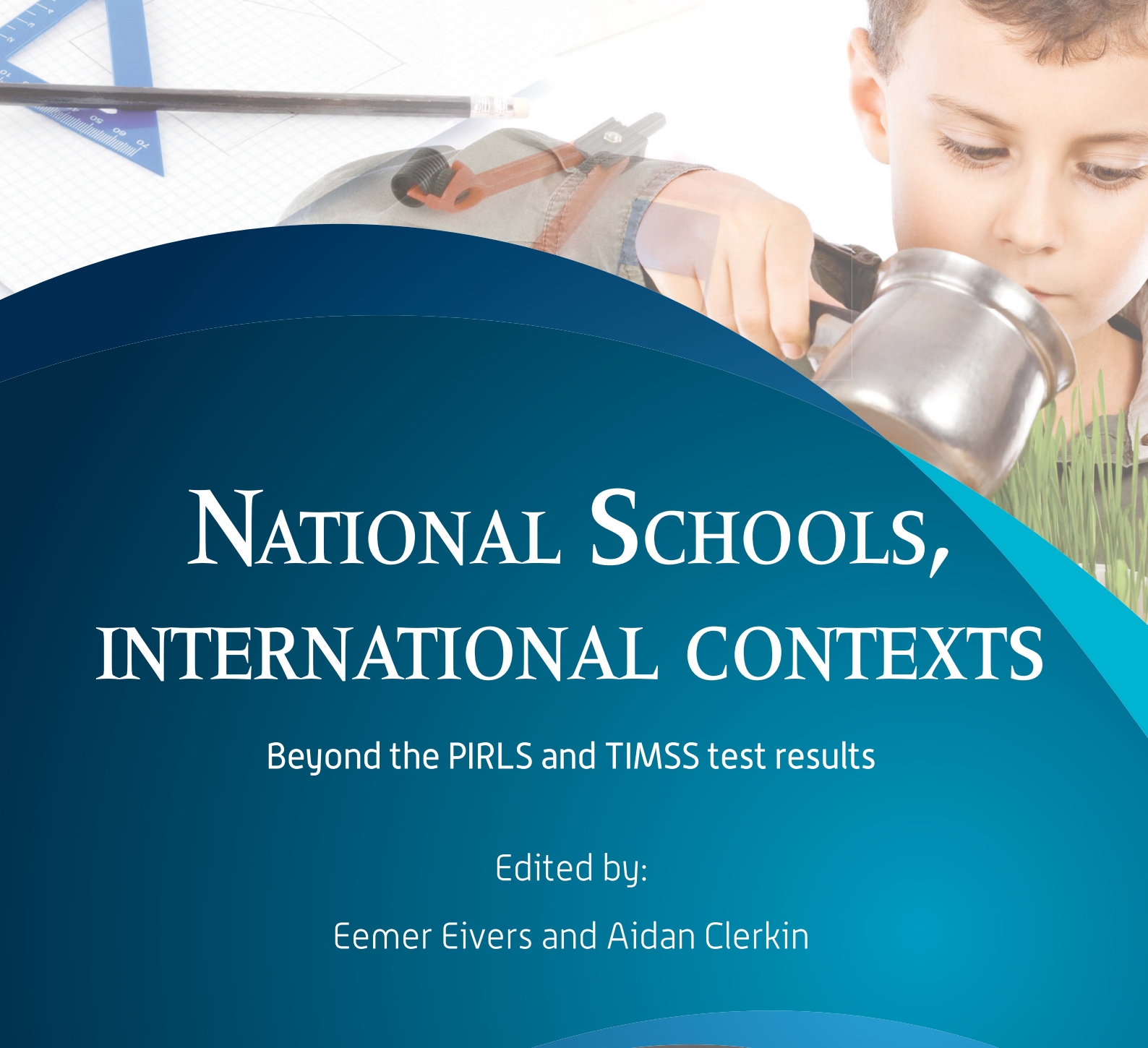

National Schools, International Contexts

Beyond the PIRLS and TIMSS test results

Edited by:

Eemer Eivers and Aidan Clerkin

Educational Research Centre

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Table of Contents

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Key acronyms

Below are some acronyms that appear in a number of chapters in this volume, with which not all readers may be familiar.

CPD Continuing Professional Development

DES Department of Education and Science / Department of Education and Skills

DEIS Delivering Equality of Opportunity in Schools

EAL English as an Additional Language

ERC Educational Research Centre

GUI Growing Up in Ireland

HSCL Home School Community Liaison

IAEP International Assessment of Educational Progress

IEA International Association for the Evaluation of Educational Achievement

INTO Irish National Teachers' Organisation

ITE Initial Teacher Education

NA National Assessments of Mathematics & English Reading

NAER National Assessment of English Reading

NAMA National Assessment of Mathematics Achievement

OECD Organisation for Economic Co-operation and Development

PIRLS Progress in International Reading Literacy Study

PISA Programme for International Student Assessment

PSEC Primary School English Curriculum

PSMC Primary School Mathematics Curriculum

PSSC Primary School Science Curriculum

PT 2011 The joint administration of PIRLS and TIMSS in 2011

TCMA Test-Curriculum Matching-Analysis

TIMSS Trends in International Maths and Science Study

Preface

This volume contains Irish analyses of the outcomes of two large international studies of achievement – Progress in International Reading Literacy Study (PIRLS) and Trends in Mathematics and Science Study (TIMSS). Both PIRLS and TIMSS are projects of the International Association for the Evaluation of Educational Achievement (IEA). They are designed to assess the reading, mathematics and science achievement of Fourth class pupils. TIMSS was first conducted in 1995 while PIRLS first took place in 2001. In 2011, Ireland took part in PIRLS for the first time, and in TIMSS for the first time since 1995.

The Irish national report (Eivers & Clerkin, 2012) outlined the main achievement-related results. The report was published at the same time as the IEA's three main reports on the three domains of reading (Mullis, Martin, Foy, & Drucker, 2012b), mathematics (Mullis, Martin, Foy, & Arora, 2012a), and science (Martin, Mullis, Foy, & Stanco, 2012).

The joint administration of PIRLS and TIMSS in 2011 (PT 2011) was Ireland's first time to take part in a comparative study of achievement at primary level since 1995. This volume draws on the considerable contextual data collected to provide a more in-depth analysis of, and an international context for, the experiences of Irish pupils, parents, teachers, and principals.

There are 10 chapters in the present volume. Chapter 1 provides a broad context for the studies and the chapters that follow. Each of the remaining nine chapters provides a thematic analysis of an aspect of the PT 2011 data, and each can be read as a standalone document. Chapter 2 examines structural characteristics of the Irish education system, while Chapter 3 provides information on pupil engagement. In Chapter 4, pupils' languages are the focus, Chapter 5 examines teachers and teaching practices, and Chapter 6 examines home-school interaction. Chapters 7 to 9 review performance on reading, mathematics and science, respectively, analysing some of the items released after the completion of the 2011 cycle. Finally, Chapter 10 describes results of multilevel models of reading, mathematics, and science achievement.

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We also acknowledge the help of the National Advisory Committee for PIRLS and TIMSS. Current members are: Caitríona Ní Bhriain (chair), Aedín Ní Thuathail, Áine Lynch, Arlene Forster, Carmel Nic Airt, Deirbhile Nic Craith, Máirín Ní Chéileachair, Mark Candon, and Mary Manley.

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Chapter 1
PIRLS and TIMSS 2011: Overview

Eemer Eivers and Aidan Clerkin

Introduction

In March and April 2011, Irish primary pupils took part in two large international studies – PIRLS (Progress in International Reading Literacy Study) and TIMSS (Trends in International Mathematics and Science Study). The main results of the studies were released in December 2012, in three separate volumes covering reading (Mullis, Martin, Foy, & Drucker, 2012), mathematics (Mullis, Martin, Foy, & Arora, 2012) and science (Martin, Mullis, Foy, & Stanco, 2012). Each reported overall achievement outcomes in participating countries, and provided detailed country-by-country relationships between reading, mathematics and science achievement and many contextual variables.

In Ireland, a national report was published at the same time as the three international reports. Eivers and Clerkin's (2012a) report described the main achievement-related outcomes only, with a particular focus on achievement in Ireland. However, achievement data represent only a small part of the information gathered for PIRLS and TIMSS in 2011. Considerable contextual information was collected at the level of pupil, school and system. Further, Ireland had not taken part in an international study of a similar scale at primary level since 1995. Consequently, comparisons with other countries on non-achievement variables are also of interest, as is a more nuanced analysis of the performance of Irish pupils on the assessments.

This introductory chapter contextualises a set of thematic analyses of the Irish data from the PIRLS and TIMSS studies. Its function is to provide background information to the studies, to aid interpretation, and reduce repetition. With the exception of this introductory chapter, the chapters in this volume are largely independent of each other and can be read in any order. Those unfamiliar with the studies should begin here, at Chapter 1, which also contains a common core set of references to some key reports, most of which are drawn upon in subsequent chapters.

The remainder of this chapter is divided into six sections:

1. The key features of PIRLS and TIMSS, including study oversight and data collected.
2. The studies' administration in Ireland, including tests and questionnaires administered, and participation and response rates.
3. The main data sources used in this volume (including other relevant studies drawn on in some of the subsequent chapters).
4. A short guide to test scores and statistical terms.
5. A summary of Irish performance relative to international performance on the three domains of reading, mathematics and science.
6. An overview of the content of the thematic analyses in later chapters.

In this and subsequent chapters, the following acronyms are used:

PIRLS	Progress in International Reading Literacy Study
TIMSS	Trends in International Mathematics and Science Study
PT 2011	The joint administration of PIRLS and TIMSS in 2011.

Key features of PIRLS and TIMSS

As noted earlier, PIRLS and TIMSS are two large international comparative studies of achievement. First conducted in 1995, TIMSS takes place every four years, assessing the mathematical and scientific skills of pupils in Fourth grade and/or Eighth grade (equivalent to Fourth class and Second Year in Ireland). PIRLS, which was first conducted in 2001, takes place every five years and assesses Fourth grade only. In 2011, the cycles of PIRLS and TIMSS coincided, and 63 countries took part in TIMSS, 49 in PIRLS, and 34 (including Ireland) assessed the same Fourth grade pupils as part of a joint PIRLS and TIMSS. Ireland did not take part in Eighth grade TIMSS. Thus, all data reported in this volume refer to Fourth class (Fourth *grade*, in an international context) and to primary school only.

PIRLS and TIMSS are projects of the International Association for the Evaluation of Educational Achievement (IEA). Governance and management of the projects on behalf of the IEA is conducted by the TIMSS and PIRLS International Study Center, based in Boston College. Within each participating country, a national research centre manages and implements the study. In some countries the same centre managed both studies in PT 2011. In others, the studies were managed entirely separately, or with some shared functions. In Ireland, both studies were managed and implemented by the Educational Research Centre on behalf of the Department of Education and Skills (DES). In Ireland, as noted earlier, the same schools and same pupils were selected to participate in both studies – this is not the case in all countries. This means that Ireland is among the subset of countries in which it is possible to compare individual pupil performance across the three domains.

What is assessed?

The PIRLS and TIMSS tests are guided by assessment frameworks. The reading framework is described in Mullis, Martin, Kennedy, Trong and Sainsbury (2009) while the mathematics and science frameworks are outlined in Mullis, Martin, Ruddock, O'Sullivan and Preuschoff (2009). This section briefly summarises some key features of the frameworks, to facilitate understanding of the subsequent chapters. It also outlines how the theoretical assessment frameworks were represented as actual assessment materials.

The TIMSS assessment is based on two organising dimensions: **content** (the subject matter to be assessed) and **cognition** (the thinking processes expected of pupils as they engage with the content). For both domains (mathematics and science), cognition is divided into three processes: Knowing, Applying, and Reasoning. Content varies by domain, as the subject matter of the assessment is domain-specific. In mathematics, the content areas are Number, Geometric Shapes and Measures, and Data Display. In science, the content areas are Life Science, Physical Science, and Earth Science.

The PIRLS assessment is also based on two organising dimensions: **purpose** (*why* readers read a text) and **comprehension processes** (*how* readers process what they read). Purpose is divided into reading either for Literary Experience or to Acquire and Use Information. There are four comprehension processes: focussing on and retrieving explicitly stated information; making straightforward inferences; interpreting and integrating ideas and information; and, examining and evaluating content, language, and textual elements. These four processes are usually referred to as Retrieve, Infer, Interpret, and Evaluate.

Both PIRLS and TIMSS assess pupils using paper-and-pencil tests, presented in booklets and using a "rotated block design". This means that there are multiple test booklets containing overlapping content. For example, a block of items (questions) might appear in the first half of one booklet, and in the second half of another. There were 13 different PIRLS and 14 different TIMSS booklets. As well as enabling broad topic coverage while keeping testing time relatively short, a rotated design helps to minimise pupil copying.

Including a short break in the middle, each PIRLS test takes about 90 minutes, divided into two 40-minute sections. Each TIMSS test takes about 85 minutes, divided into two 36-minute sections. Each half of the PIRLS test booklet contains a *test unit*, which comprises a number of questions asked about a common stimulus text. TIMSS items (questions) are primarily standalone items, although some are clustered around a common source (e.g., "Answer three questions about this chart"). In each TIMSS booklet, one half is composed of mathematics items and the other of science items. In some, science items were presented in the first half, while in others, the mathematics items were presented first. Both PIRLS and TIMSS include a mixture of multiple-choice (pupils pick one of four response options) and constructed-response items (pupils write an answer). Examples of some of the test items administered to pupils as part of the 2011 assessment are included in Chapters 7 (reading), 8 (mathematics) and 9 (science) of this volume.

Contextual information collected

PT 2011 collected considerable contextual information. The information collected fell into one of two categories: questionnaires completed by individuals, and national-level information, usually supplied by the national research centres.

Participant questionnaires

All questionnaires used in PT 2011 can be accessed in full from the TIMSS and PIRLS International Study Center's website (http://timssandpirls.bc.edu/timss2011/international-contextual-q.html). Below is a summary of the questionnaires completed by participants in the studies (pupils, teachers, principals, and parents):

- **Pupil Questionnaire:**
  Pupils answered questions about themselves and about resources in their home. Questions related to school included their experience of and attitudes to school, and attitudes to reading, mathematics and science.
- **School Questionnaire:**
  Completed by the principal or his/her designate. Topics included school size, composition and location, teacher and pupil characteristics, instruction time and school climate and resources.
- **Teacher Questionnaire:**
  Completed by the usual class teacher of each selected class group. Topics included teacher demographic characteristics, qualifications, engagement in continuing professional development, instructional time and classroom practices for reading, mathematics and science lessons.
- **Parent Questionnaire:**
  Topics included parent demographic characteristics, home resources for reading, early literacy and numeracy activities, parental educational and occupational information, and parental attitudes to reading. Administered as part of PIRLS, Parent Questionnaire data are unavailable for countries that only took part in TIMSS.

System-level information

The following system-level information was supplied to the International Study Center, either directly from each national research centre, or through sources supplied by the national centres:

- **National Curriculum Questionnaire**
  An online questionnaire summarising key characteristics of the national education system (e.g., school starting age), and domain-specific information (e.g., curriculum content areas). Data from the questionnaires were collated and used to provide system-level summary comparison information in the main international reports and in the PIRLS and TIMSS encyclopedias.
- A **national chapter** for inclusion in the **PIRLS encyclopedia**
  The encyclopedia (Mullis, Martin, Minnich, Drucker, & Ragan, 2012) provides an overview of education systems in participating countries, collated from the national curriculum questionnaires. In addition, a chapter describing their national education system, teacher education, policies, instruction, and curriculum issues specific to reading was prepared by each country, including Ireland (DES, National Council for Curriculum and Assessment, & Eivers, 2012a).
- A **national chapter** for inclusion in the **TIMSS encyclopedia**
  As with PIRLS, the TIMSS encyclopedia (Mullis, Martin, Minnich, Stanco et al., 2012) provides information about participating countries' education systems. It also includes a chapter for each country (including Ireland – DES, National Council for Curriculum and Assessment, & Eivers, 2012b) describing their national education system, with an additional focus on policies, instruction, and curriculum issues specific to mathematics and to science instruction.
- **Test-Curriculum Matching Analysis (TCMA)**
  The TCMA is an item-by-item review of whether or not a topic might be expected to have been covered by most pupils by the end of Fourth grade, based on the intended curriculum. The TCMA was conducted for TIMSS items only. In Ireland, the analysis was conducted by subject experts based in St Patrick's College (Clíona Murphy for science, and Thérèse Dooley, Dolores Corcoran and Miriam Ryan for mathematics). The outcomes of the TCMA are summarised in the main international reports on mathematics (Mullis, Martin, Foy, & Arora, 2012) and science (Martin et al., 2012).

Administration of PT 2011 in Ireland

A total of 151 schools agreed to take part in the study (a school participation rate of 98% of initially sampled schools and 100% with replacements).[1] These schools were stratified with regard to school size, DEIS status,[2] language of instruction and gender mix and then randomly selected, in order to achieve a representative sample of pupils. Within the 151 schools, 221 Fourth class groups were selected to take part in the assessments. All selected classes participated, giving a class-level participation of 100%. The 221 classes contained a

[1] Full details about Irish participation and response rates are available in Eivers and Clerkin (2012b).
[2] The term "DEIS status" is used here and in other chapters to indicate participation in the School Support Programme (SSP) as part of the Delivering Equality of Opportunity in Schools scheme (DEIS). Schools participating in the SSP receive additional supports from the DES due to having large proportions of pupils from disadvantaged backgrounds.

total of 4825 Fourth class pupils, of whom 46 (almost 1%) were excluded from both assessments. Testing for PT 2011 took place over two mornings – not necessarily on successive days. Typically, Pupil Questionnaires were completed after testing on one of the allocated test days. Choice of test dates was a matter for each school, provided that:

- both dates fell within the Irish test window of March 21st to April 8th 2011.
- tests were administered in the order pre-assigned to the school (half of schools were asked to take PIRLS first, and half TIMSS first, to minimise test order effects).
- only one test per day was administered.
- the Educational Research Centre was informed of the chosen dates (this was necessary to facilitate the visits of national and international quality monitors to a subset of schools).

In one school, administration procedures were not fully adhered to for the TIMSS assessment.[3] TIMSS test data were not accepted for this school, and the school was not included in the TIMSS dataset.

The response rate for the various tests and questionnaires ranged from 94% to almost 100%. The high levels of cooperation from pupils, parents and school staff, as reflected in the very high participation and response rates, mean that the data can be taken as representative of Fourth class pupils' achievements and experiences.

Main data sources for this volume

All of the thematic analyses in the following chapters are based on Ireland's datasets for PT 2011, with some reference to the three main international reports. Only limited use is made of the international databases. While each country had access to its own data since 2012, the full international databases were only released in February 2013, providing limited time for analysis.

Variables based on information in the Parent Questionnaire are available for PIRLS countries only, while variables from other sources can draw on *either or both* datasets. One source is generally sufficient, but both datasets are drawn on for some analyses. This is because, while the groups of countries participating in each study show considerable overlap, they are sufficiently different to warrant separate presentation in some cases. In contrast, the Irish datasets for PIRLS and TIMSS are almost identical. The notable difference is – as outlined earlier – that one school's data was excluded from TIMSS. Therefore, reporting of questionnaire data for Ireland draws from the fuller PIRLS dataset. For consistency, comparisons with selected individual countries who took part in both PIRLS and TIMSS generally make use of their PIRLS data sets, unless the analyses relate to mathematics or science achievement.

Additional data sources

As 2011 was the first time that PIRLS was conducted in Ireland, and only the second time that TIMSS was conducted, no PIRLS trend data and only limited TIMSS trend data are available for Ireland. However, five other important studies are drawn on frequently in the subsequent chapters, to provide a broader context for the PT 2011 data.

[3] Poor adherence to the administration ordering, to test timing, and difficulties over choice of test language meant that the pupils' performance on TIMSS might not be an accurate reflection of achievement.

The five are:

- National Assessment of Mathematics Achievement – **NAMA**
  (Shiel, Surgenor, Close, & Millar, 2006)
- National Assessment of English Reading – **NAER**
  (Eivers, Shiel, Perkins, & Cosgrove, 2005)
- National Assessments of Mathematics & English Reading – **NA 2009**
  (Eivers et al., 2010)
- Growing up in Ireland – **GUI**
  (Williams et al., 2009)
- Programme for International Student Assessment – **PISA**
  (Cosgrove, Shiel, Sofroniou, Zastrutzki, & Shortt, 2005; Eivers, Shiel, & Cunningham, 2008; Perkins, Cosgrove, Moran, & Shiel, 2012; Shiel, Cosgrove, Sofroniou, & Kelly, 2001)

Table 1.1 outlines some of the key features of each study. NAMA, NAER and NA 2009 are grade-based studies of mathematics and reading achievement among pupils in Irish primary schools. All were conducted by the Educational Research Centre on behalf of the Department of Education and Skills. GUI is a longitudinal study of the social, emotional and academic [mathematics and reading] development of two age-based cohorts of children (although only the 9-year-old cohort is of relevance here). It is conducted by a consortium of researchers from the Economic and Social Research Institute (ESRI) and Trinity College Dublin (TCD), overseen by the Department of Children and Youth Affairs (DCYA). PISA, which is under the aegis of the Organisation for Economic Co-operation and Development (OECD), is an international assessment of the reading, mathematics, and science achievement of 15-year-olds. It is conducted by the Educational Research Centre on behalf of the Department of Education and Skills.

Table 1.1: Summary characteristics of the main additional data sources drawn on in the thematic reports

Study	Domain(s)	Year(s)	Target group(s)	National / International	Agencies
NAMA	Maths	2004	4th class	National	ERC/DES
NAER	Reading	2004	1st and 5th classes	National	ERC/DES
NA 2009	Maths & reading	2009	2nd and 6th classes	National	ERC/DES
PISA	Reading, maths & science	2000, 2003 2006, 2009	15-year-olds	International	OECD/ ERC/DES
GUI	Maths & reading	2007-08 2011-12[4]	9-year-olds 13-year-olds	National	ESRI/TCD/ DCYA

The references section of this chapter includes the main reports based on the five studies listed in Table 1.1, the three main PIRLS and TIMSS international reports, and the PIRLS and TIMSS encyclopedias. To avoid (quite considerable) repetition, subsequent chapters will cite these studies in the text, but not repeat them in the references section.

[4] The two main "waves" of data collection for the 9-year-old cohort were as indicated in the table. As GUI is a longitudinal study, the 9- and the 13-year-olds shown are largely the same group of children.

Short guide to test scores and statistics

Most of the following chapters contain few complex statistical analyses. However, readers' understanding of some of the chapters could be enhanced if they have knowledge of some basic, but important, statistical concepts, summarised in Inset 1.1.

Inset 1.1: Key statistical concepts and terms

Test scores

PIRLS and TIMSS tests are scaled to have a mean score of 500 and a standard deviation of 100. An "average" pupil scores 500 on the test, and 68% of pupils score between 400 and 600 (i.e., a range of one standard deviation above/below 500). Because a 500:100 scale is used, a difference of a few scale points between two countries means little in practical terms.

Centrepoints

PIRLS and TIMSS always compare country performance against a scale centrepoint of 500, a point of reference that remains constant from assessment to assessment. It is the mean score from the *first* time the study was conducted. The overall reading scale centrepoint links back to 2001, and the mathematics and science overall scales link back to 1995. The average of the mean scores for participating countries changes from cycle to cycle (e.g., in 2011, the international average was below 500 for mathematics and science, and above 500 for reading). The International Study Center does not report cycle means, preferring to keep the focus on the centrepoints, which remain constant.

Population estimates and standard errors

PIRLS and TIMSS survey a sample of a population to *estimate* characteristics of the entire population. Thus, 4,500 Fourth class pupils were used to estimate the characteristics of all 62,000 Fourth class pupils in Ireland. A different sample of pupils would probably produce slightly different estimates. For this reason, some of the forthcoming chapters refer to a statistic called a *standard error*. It is an estimate of how accurately the sample mean reflects the population mean, with smaller standard errors indicating a more precise estimate.

Statistical significance

Some chapters refer to *significant* differences, meaning differences between groups that a statistical test has established is unlikely to be due to chance. A quick (and reasonably accurate) way to check if the difference between two mean scores is *significant* is to take each mean score and multiply the standard error by 2 to create two mean score bands. If one band does not overlap with another, the difference may be significant. Take, for example, means of 500 (SE=2.5) and 510 (SE=3.0). The band for the first mean is 495-505 (i.e., 500 $\pm$ 5) and for the second is 504-516. Because the bands overlap, the 10-point gap between the mean scores is not significant.

Correlation versus causation

PT 2011 was a cross-sectional (snapshot) study. Unlike some longitudinal studies, snapshot studies can show correlation between variables, but not causation. For example, liking reading and performing well on the reading test are correlated – pupils who enjoy reading tend to score above average on the reading test. However, this does not show *causation* (i.e., that liking *caused* the good test performance, or vice versa).

Weighted data

The data are weighted (statistically adjusted) to ensure that the contributions of some groups of pupils are not over- or under-represented. Two main elements are involved: a) a weight to correct for sampling bias, if any; b) a weight to correct for non-response (e.g., absenteeism).

Context Questionnaire Scales

Many context questionnaire items in PT 2011 have been combined into scales measuring a single underlying "latent" construct. Each such scale has a mean score across all participating countries of 10 and a standard deviation of 2. For example, Ireland had a mean of 10.1 on the *Students Confident in Science* scale, meaning that Irish pupils had average levels of confidence in their scientific skills.

Ireland's performance on PT 2011

Table 1.2 summarises Ireland's performance on PT 2011, showing (overall, and by gender) the national and international mean scores for reading, mathematics and science. Irish pupils performed above the international study centrepoints of 500 on all three domains. Their best performance was on reading, followed by mathematics, then science. There were no significant gender differences in Ireland (or across TIMSS as a whole) for overall performance on mathematics and science. In contrast, girls performed much better on the reading assessment, in Ireland and in almost every country that took part in PIRLS.

Table 1.2: Mean Irish and international study average scores for reading, mathematics and science, overall and by gender

		Study centrepoint	Mean scores 2011	
			Ireland	International
Reading	Overall	500	552 (2.3)	–
	Boys		544 (3.0)	504 (0.5)
	Girls		559 (2.9)	520 (0.5)
Maths	Overall	500	527 (2.6)	–
	Boys		529 (3.3)	491 (0.6)
	Girls		526 (3.7)	490 (0.5)
Science	Overall	500	516 (3.4)	–
	Boys		516 (4.6)	485 (0.6)
	Girls		516 (4.0)	487 (0.6)

Note: The main PIRLS and TIMSS international reports provide mean scores by gender for the 2011 cycle, but not overall mean scores for 2011. Country means are compared to the study centrepoint only.

For reading, Irish pupils showed a particular strength on literary-type texts. This can be attributed to Irish girls performing extremely well on literary texts, while Irish boys performed at a similar level on literary and informational texts. Irish performance on reading will be discussed in more detail by Concannon-Gibney and Shiel in Chapter 7.

For mathematics content areas, Irish pupils performed best on Number, while Geometric Shapes and Measures was a relative weakness. In contrast, Irish pupils showed a reasonably balanced performance across the three science content areas, with no major areas of strengths or weaknesses. In the cognitive domains, Reasoning was a weakness for both science and mathematics, relative to overall Irish performance on each of these domains. Irish performance on mathematics will be discussed in more detail by Close in Chapter 8, while science performance will be discussed by Murphy in Chapter 9.

Overview of the thematic analyses

This chapter serves as an overview and introduction to a series of thematic reports based on Ireland's data from PT 2011. Although they address a diverse range of topics – from the broad structure of the education system to the level of an individual test question – they share some commonalities. Generally, topics were selected for one or all of the following reasons: high policy relevance; if the data for Ireland are somewhat atypical, relative to other countries; or, if the data conflict with "received wisdom". For example, if Irish pupils or teachers scored well above or below average on a scale, or if a behaviour unexpectedly showed no relationship with achievement, then those variables would be prioritised for inclusion.

Other features that the thematic analyses have in common are:

- A consistent focus on Ireland's position relative to other countries, supported, where appropriate, by analyses of differences within Ireland.
- A focus on percentages of *pupils*, even when describing school and teacher characteristics, because the pupil is the unit of interest, not the school. For example, we might say "…16% of pupils attended schools located in heavily populated areas" rather than "…20% of schools were located in heavily populated areas".
- A common set of comparison countries, comprised of English-speaking countries and top-performing countries. In most cases, Ireland is simply compared against study averages, but where specific comparisons are made, they are usually restricted to the same set of key comparison countries as used in Eivers and Clerkin (2012a).

As noted, the chapters are largely standalone documents, and can be read in any order. Within this volume, they begin at the high, system-level, progress down to the individual item level, and end with a multi-level model of achievement that incorporates school-, class- and pupil-level data.

The first thematic chapter, written by Mary Lewis and Peter Archer, examines policy, provision, and structural characteristics of the Irish education system. They address issues such as curriculum, structure of the system, issues of the "school estate" such as size and location, and teacher certification. They also examine resources within schools, such as class libraries, and access to computers. In Chapter 3, Aidan Clerkin and Ann-Marie Creaven provide information on pupil engagement, outlining associated factors at both school and pupil level. Pupils' attitudes to school in general and to reading, mathematics and science in particular, are reviewed, as are teachers' reports of some of the difficulties they face in engaging pupils. They also examine pupils' reported experiences of bullying within school. In Chapter 4, Eemer Eivers discusses pupils for whom home and test language differed. She discusses the growth in number of such pupils and their uneven distribution within the Irish education system. The relationship between language and performance on the tests is considered, as are differences in the experiences, attitudes and home resources of "additional language" and English speaking pupils in Ireland.

In Chapter 5, Aidan Clerkin examines teachers and teaching, including teachers' qualifications and professional development, teaching practices, and collaboration with other teachers in the school. He also presents information relating to confidence in teaching, use of ICT, and teachers' working conditions. Chapter 6, by Eemer Eivers and Ann-Marie Creaven, examines home-school interaction. Issues include parental awareness about what happens in school, generally, and the extent to which schools and teachers inform parents about their own children. Parental volunteer and committee work are also considered.

After each cycle of PIRLS and TIMSS, a set of items used in the assessments are released for public review. Chapters 7 to 9 analyse some of these items in detail, drawing on context and curriculum to aid interpretation. In Chapter 7, Tara Concannon-Gibney and Gerry Shiel examine pupil performance on selected PIRLS items. They identify aspects of the items that may make them relatively easy or difficult for pupils in Ireland, and consider differences in the performance of Irish girls and boys on the selected items.

In Chapter 8, Seán Close examines, in the context of the TIMSS mathematics framework and the Irish primary school mathematics curriculum, a selection of released items where Irish pupils' performance was unusually high or low compared to overall Irish performance and international norms, or were peculiar to Ireland in terms of gender differences. In Chapter 9, Clíona Murphy reviews the released science test items, with particular reference to items for which Irish performance was notably different to the TIMSS

average. She also examines overlap between the Irish primary science curriculum and the TIMSS science framework.

In Chapter 10, Jude Cosgrove and Ann-Marie Creaven describe results of multilevel models of reading, mathematics, and science achievement. They consider the extent to which schools that took part in PT 2011 differ with respect to achievement, and then compare and contrast the results for the three domains. They examine the extent to which school characteristics are associated with achievement differences over and above pupil ones, and suggest specific areas for further research.

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Chapter 2
Features of policy and provision

Mary Lewis and Peter Archer

Introduction

The focus in this chapter is on the structural characteristics of schools, and the wider educational context within which the teaching and learning of reading, mathematics and science takes place. Before drawing on data about these characteristics from PIRLS and TIMSS 2011 (PT 2011), it may be useful to make some very general observations about the history and nature of Irish education with a view to highlighting features of the Irish system that may seem unusual from an international perspective. One such feature is the relatively recent emphasis on the role of education in economic development. A second is the development of a multilateral negotiation process between the various education stakeholders that is bound, on one side, by a largely centralised educational administration and, on another, by a written Constitution that supports both the family as the primary educator and the right of every religious denomination to manage its own schools. A third feature of Irish education that is of interest in this context is the very significant involvement of denominational bodies (particularly the Roman Catholic Church) in the ownership and patronage of schools. Another aspect of Irish education that is often commented upon by international observers is the relatively large proportion of mostly rural primary schools that have fewer than 50 pupils and which tend to be under-represented in large-scale international studies, including PT 2011.

According to an official description of the Irish education system (Department of Education and Science, 2004), "education has always been highly valued in Ireland" (p.5). The authors of this description go on to note that before the establishment of a national system of primary education in 1831, "a vast network of schools existed" and that, even in "times of great political, economic and social difficulty" (p. 5), Irish people availed of opportunities for education wherever they arose. Irish education between the foundation of the State in 1922 and the 1960s has been characterised as being concerned with religious, moral and intellectual formation rather than with the preparation of young people for productive careers in an industrial economy (Tussing, 1978). That characterisation is supported by two reports by an independent body comprising leading figures in education (Council of Education, 1954; 1962). The second of these reports described the idea of expanding second-level education in order to promote economic development as "untenable, utopian, socially and pedagogically undesirable and economically impossible" *(*quoted in Ó Buachalla, 1988, p. 68).

Some significant changes in thinking about education in Ireland occurred in the 1960s, prompted probably, at least partly, by the publication of *Investment in Education* (1965). In particular, "the state's interest in education broadened (particularly to include economic considerations), its financial contribution to education increased, and it became committed to planning" (Kellaghan, 1989, p. 192). Similar changes in thinking occurred in many other countries, but at least a few decades earlier than was the case in Ireland (Barber, 1989; Coombs, 1985). O'Sullivan (2005), commenting on what had happened in Ireland, refers to a more substantial shift in the paradigm within which educational matters may be understood – from being theocentric (where, for example, enabling students to have a relationship with a God is one of the main functions of a school) to mercantile (where, for example, the market

economy is a major influence and accountability for state funding is required in educational management).

For the next 20 years, expansion (in the sense of promoting increased participation in second- and third-level education) became a major policy objective that was pursued with considerable success. By the late 1980s, the extent to which the needs of the economy were influencing education was being raised as a concern by a growing number of commentators (e.g., Brennan, 1991; Mulcahy, 1989; O'Sullivan, 1989) and concerns of this kind became a feature of a debate that occurred between the publication of a Green Paper (1992) and a White Paper (1995). This debate resulted, according to Coolahan (1994), in a new awareness of the legitimate plurality of educational purposes that encompassed both cultural values of education as well as those of enterprise and innovation "in a balanced and harmonious way" (p. 150).

O'Sullivan (2005) is dismissive of the idea that the shift in thinking that occurred after the Green Paper was significant and he argues that the mercantile paradigm remains dominant in the Irish education system as it does in many other education systems. Nevertheless, the mission statement of the Department of Education and Science (2004) and official documents, such as its Statement of Strategy 2011-2014, refer to the contribution of education and training not only to Ireland's economic progress but also to its civic and community development as well as to the promotion of culture and heritage. Furthermore, contributors to debates about policy issues in education (e.g., those on reform of junior cycle curriculum and on school patronage) frequently argue for a balanced approach to educational aims and philosophy. This is also, of course, a feature of debates about education in other countries and appears to be taking on an international dimension in initiatives such as the work of the Commission of the European Union on a Framework of Key Competences (Saavala, 2013) and the OECD Skills Strategy (OECD, 2012b).

Governance of Irish education can be difficult to explain to international audiences. Administration of the system is largely centralised in the sense that overall responsibility for most matters rests with the Minister for Education and Skills through the Department of Education and Skills and bodies under its aegis, such as the National Council for Curriculum and Assessment (NCCA). At the same time, there is scope for involvement from many different interest groups. Education policy making has always involved participation by stakeholders – or "partners", as they tend now to be termed – including teacher unions, management bodies, churches and organisations representing parents. Up to the late 1980s and early 1990s, involvement of partners tended to be achieved through bilateral negotiations held in private. Since then, a more inclusive multilateral approach has been in place with much of the interaction between partners taking place in public. For example, a National Education Convention was held in 1993 (Coolahan, 1994). Walshe (1999) states that "the Convention attracted significant interest abroad" (p. 37). A public consultation process was also held in 2004 (Kellaghan & McGee, 2005). Examples that were more specifically focussed include a forum of early childhood education in 1998 and a forum of patronage and pluralism in 2011.

Although the State pays the salaries of teachers in almost all first- and second-level schools, over 90% of primary and a sizeable majority of post-primary schools are privately owned denominational institutions. The number of schools that are fully private, in terms of their funding sources, is very small. The origins of the seemingly paradoxical combination of centralised policymaking and administration and the relatively large number of private schools may be found in the Irish Constitution (Bunreacht na hÉireann). Article 42 of the Constitution dealing with education begins by acknowledging that "the primary and natural educator of the child is the Family" and goes on to recognise the "inalienable right and duty of parents to provide, according to their means, for the religious and moral, intellectual,

physical and social education of their children". Although the Constitution precludes the State from obliging parents to send their children to schools established or designated by the State, it does include the following provision: "The State shall, however, as guardian of the common good, require in view of actual conditions that the children receive a certain minimum education, moral, intellectual and social". The Constitution also places an obligation on the State to provide for free primary education. Elsewhere, the Constitution guarantees the right of every religious denomination to manage its own affairs and recognises that these affairs include the ownership and management of schools.

Later in this chapter, some data from PIRLS and TIMSS relating to school size will be presented. However, it is important to note here that such surveys, which are designed to be representative of the population of pupils, tend to contain relatively few small schools (those with less than 50 pupils) – something which is at least partly dealt with by weighting (see Inset 1.1 in Chapter 1). In Ireland, compared to many other countries, a relatively large proportion of primary schools (19%) have an enrolment of less than 50 pupils (Department of Education and Skills Statistical Report for 2011/2012) while less than 30% have enrolments of more than 200 pupils. On the basis of a census of primary schools, 94% of these smaller schools are located in villages or open countryside (see Archer & Sofroniou, 2008).

School size, location and ethos may be considered as elements of the wider educational landscape that impact on teaching and learning. PT 2011 yielded a considerable amount of data on these and many other structural characteristics that shape the educational environment of Fourth class pupils in Ireland. The remainder of this chapter examines system-level and school-level features of policy and provision in a context that takes account of differences and similarities between Ireland and other countries that participated in PT 2011. Findings at system and school levels, particularly in respect of Fourth class pupils, in the 151 primary schools in Ireland that took part in PT 2011 are presented with reference to the international average for the relevant variable where appropriate. Some data are also presented for a set of key comparison countries (including top-performing countries, and other English-speaking countries). The data for both studies draw on two main types of publication. PIRLS data are drawn from the PIRLS encyclopedia (Mullis, Martin, Minnich, Drucker, & Ragan, 2012, Volumes I and II) and the report on the international reading results (Mullis, Martin, Foy, & Drucker, 2012). TIMSS data are drawn from the TIMSS encyclopedia (Mullis, Martin, Minnich, Stanco, et al., 2012, Volumes I and II) and the reports on the international results in mathematics (Mullis, Martin, Foy, & Arora, 2012) and in science (Martin, Mullis, Foy, & Stanco, 2012).

System-level characteristics

In this section, the focus is on system-level national policies, including compulsory schooling, school entry age and grade promotion, provision for parental involvement, and teacher qualifications and certification. A number of features of the official or intended curriculum in reading, mathematics and science are also examined.

Compulsory schooling

Schooling in Ireland is compulsory between the ages of six and 16 years, although 16- and 17-year-olds are required to remain in school until they have completed three years of post-primary education (Education (Welfare) Act, 2000). Children must be at least four years old when they start school. In 34 of the 50 countries that took part in TIMSS, attendance at school is compulsory from the age of six upwards. In a further five countries, children are required to attend school from the age of four (Northern Ireland) or five (England, Malta, the Netherlands, United Arab Emirates) while in Finland, Lithuania, Poland, Thailand and

Sweden compulsory schooling begins at seven years. Five countries had no national policy on school attendance age, while in the United States the policy varies by state.

In many countries that took part in TIMSS, the minimum school-leaving age is lower (16/50) or higher (12/50) than that in Ireland. In some, it is possible to leave school at 13 (Croatia), 14 (Korea, Turkey), or 15 years of age (e.g., Austria, Chinese Taipei, Hong Kong SAR, Slovenia and Thailand) but, in others, the minimum school-leaving age is 17 or even 18 years of age (e.g., Belgium, Germany, the Netherlands, Poland).

There are few differences between PIRLS and TIMSS participants with regard to policies on compulsory schooling. In 26 of the 45 countries that took part in PIRLS, compulsory schooling begins at six years of age while, in a further six countries, children must attend school from when they are seven years old. In the remaining eight countries for which information is available, children are required to attend school from the age of four (Northern Ireland) or five (e.g., England, the Netherlands). The minimum school-leaving age is 16 years in 21 of the countries that took part in PIRLS, but, as with TIMSS, ranges from 13 to 18 years.

Ireland is one of only six countries (along with England, Malta, Northern Ireland, New Zealand, and Trinidad and Tobago) that took part in PIRLS 2011 in which more than 90% of Fourth class pupils started school aged five years or younger. Of the Fourth grade pupils in all countries that took part in PIRLS, one-quarter (25%) began attending primary school when they were five years or younger, nearly half (48%) did so at six, while the remainder were seven years of age (26%) or older (1%).

Primary schools in Ireland are unusual in that they enrol large numbers of pupils who are younger than the compulsory age of attendance at six years. In effect, this means that nearly half of four-year-olds and almost all five-year-olds are enrolled in the Infant classes of primary schools. There is often confusion about whether pupils in Infant classes in Ireland should be classified as pre-primary (ISCED 0) or primary (ISCED 1)[1]. The Department of Education and Skills frequently uses the latter classification and most Irish people would consider pupils in Infants classes as attending primary school. However, in international contexts such as PIRLS and TIMSS, Infant classes are often classified as pre-primary. The manual for ISCED (OECD, 1999) partly adds to the confusion, as the table for Ireland includes eight grades under primary/ISCED 1, but also notes that "Programme is divided into two ISCED levels in the UOE [UNESCO/OECD/EUROSTAT] data collection. For UOE reporting, ISCED level 0 comprises the first two years of this programme" (p. 92). The main basis for the distinction is the length of the school day, which is shorter for Infants classes.

Grade promotion

Most countries taking part in PT 2011 had national or regional policies on grade promotion and retention. In Ireland, primary school pupils are automatically promoted from one grade to the next and are only allowed to repeat a year for educational reasons and in exceptional circumstances. A similar approach is found in the Nordic countries (Denmark, Finland, Norway, and Sweden) and in eight other countries including Australia, Chinese Taipei, Malta, and New Zealand. Elsewhere, grade promotion is determined by academic performance (e.g., France, Italy, the Netherlands, Czech Republic, Korea) or more commonly, by some

[1] ISCED, or the International Standard Classification of Education, is a multidimensional framework designed to facilitate international comparisons of educational statistics and to reflect educational pathways in the OECD indicators (OECD, 1999).

combination of automatic promotion in the early grades and academic performance in subsequent grades (e.g., Germany, Portugal, Russian Federation, Singapore). England, Japan and Lithuania are unusual in that they have no national policy on grade retention and promotion, while in Canada and the United States the policy varies across states.

The nature of parental involvement

This section relies on submissions from participating countries regarding their national policies to involve parents in school management. The submissions varied considerably and covered one or more of various strands reflecting different roles (e.g., participants in management, recipients of information about their own children's progress, providers of support for the work of the school, contributors to policy making). Such variation makes meaningful comparisons difficult, although some general points may be made.

Formal policies to involve parents in the education of their children and in the achievement of school objectives had been introduced in most countries that took part in PT 2011. In about half of countries across both studies, school governing bodies were mandated to include parents. Ireland did not explicitly include this in its submission, although parents are represented on boards of management in accordance with legislation. Additionally, in common with many other countries, parents are encouraged to form Parents' Associations or Parent Teacher Associations, the objective of which is to support schools by promoting parental involvement, organising and supervising events for students out of school, and engaging in fundraising activities. In Ireland's case, the Education Act (1998) requires schools to support the establishment of such associations and to give them a role in determining school policy. Most of Ireland's comparison countries, as identified in Chapter 1 of this volume (Eivers & Clerkin, 2013), have parent representatives on school boards of management – this is the case in Australia, England, New Zealand, Northern Ireland, Hong Kong SAR and the Russian Federation. In Finland, schools are required by law to communicate frequently with parents about pupil progress and behaviour. This practice was included also in the submissions of a number of other countries including Australia, Ireland, Denmark, New Zealand, Northern Ireland, Slovenia, the Slovak Republic and Sweden. In the United States, the emphasis is more on encouraging parent involvement, and while there is support in many federal programmes for parents to participate in the education of their children, these programmes "do not apply to all schools and students" (Mullis, Martin, Minnich & Drucker, 2012, p. 22).

Ireland is one of very few countries that mentioned enhanced parental involvement through an initiative such as the Home/School/Community Liaison scheme as part of its strategy to combat educational disadvantage. However, given the centrality of parent involvement in successful initiatives to address disadvantage (e.g., Slavin & Madden, 2003), it is likely that many countries have a similar approach (Archer & Weir, 2005; Henderson, 2002).

Teacher qualification and certification

In Ireland, initial teacher education is undergoing change. At the time that PT 2011 was being administered, qualification as a primary teacher was through one of two possible routes:

- Concurrent model: Completion of a three-year B. Ed. programme, or
- Consecutive model: Those who have already completed a basic degree complete an eighteen-month post-graduate diploma in education.

Since September 2012, the concurrent model has changed to a four-year degree programme, while post-graduate programmes will be extended to two years with effect from September 2014.

Although the precise nature of teacher qualification (e.g., degree or diploma) was not specified for a few participating countries, it is clear that for the majority, a three-year or four-year degree through a university or teacher college was the most common teacher preparation route. In PIRLS, at least 33 countries indicated that such a qualification was the main teacher preparation route, with a further five countries (Finland, Croatia, Czech Republic, Slovak Republic and France) reporting that a masters' degree was required. In TIMSS, 40 countries required a degree and four of the five just listed – France did not participate in TIMSS – required completion of a masters' degree. High-performing Singapore was one of the few countries not to require prospective primary teachers to hold a degree – routes to teaching include two- and four-year diploma courses, and courses that attract mid-career professionals to teaching. Those examples aside, the majority of Singaporean teachers are university graduates.

As well as a basic degree, many countries had additional certification requirements for newly-qualified teachers, as summarised in Table 2.1. For example, Irish teachers are required to undertake a supervised practicum, pass a qualifying examination and complete a probationary period in order to be certified as a primary teacher. Since 2012, all newly-qualified teachers in Ireland must also participate in the National Induction Programme for Teachers. However, at the time of participation in PT 2011, Ireland was one of slightly more than half of countries where mentoring/induction programmes were *not* a compulsory feature of teacher qualification (Table 2.1).

A large majority of countries that took part in PIRLS and/or TIMSS required newly-qualified teachers to undertake a supervised practicum, while passing a qualifying examination to become a teacher was a requirement in most PIRLS and TIMSS countries. However, 28% of TIMSS participants (or 14 countries) – including Australia, Finland, and New Zealand – did not require new teachers to pass a qualifying examination. A probationary period was a requirement in Ireland and in approximately half of countries in each of the PIRLS and TIMSS studies.

Table 2.1: Qualification and certification requirements for primary teachers, Ireland and all PIRLS and TIMSS countries

	Supervised practicum	Qualifying exam	Probationary period	Mentoring / induction
Ireland	Yes	Yes	Yes	No*
% of all countries requiring				
PIRLS (N=45)	91	80	49	42
TIMSS (N=50)	88	72	52	46

* Participation in an induction programme was not a requirement at the time PT 2011 was administered.

The relationship between the national requirements for teacher certification and performance on PIRLS and TIMSS is not straightforward. Some of the highest performing countries (e.g., Singapore and Japan) required teachers to complete all four components shown in the table while other high-performing countries (Finland, Chinese Taipei and Hong Kong SAR) required no more than two of the four. Overall, slightly less than half of countries reported that a mentoring or induction programme was mandatory. This requirement was part of the teacher qualification route in a number of top-performing countries, however. Three of the top five performers in reading (Russian Federation, Singapore, and Northern Ireland) and in mathematics (Singapore, Korea and Japan) had a

mentoring programme, in addition to four of the top five performers in science (Korea, Singapore, Japan and Russian Federation).

Curriculum

Ireland is one of a large majority of countries taking part in PT 2011 that reported having a nationally defined curriculum for both pre-primary and primary education. Pre-primary education was available in all participating countries, but mandatory in only ten countries across the two studies (Austria, Bulgaria, Colombia, Denmark, Hungary, Israel, Kazakhstan, the Netherlands, Poland, and Serbia). Among PIRLS participants, 30 of the 45 participating countries had a national pre-primary curriculum while three had regional (state/provincial) curricula. Of the countries with a national curriculum, 25 included language, reading and writing skills in the curriculum. For TIMSS, 35 of 50 countries had a nationally defined pre-primary curriculum, while two had regional curricula. Amongst those 35 countries, only one (Poland) did not have both science and mathematics included in the national pre-primary curriculum.

Almost every country that took part in PT 2011 had a national primary curriculum covering, among other topics, reading, mathematics and science. Partial exceptions included Qatar (in the case of reading) and Iran (mathematics), where ministry guidelines rather than a national curriculum informed instruction. Also, some countries (e.g., Denmark, Germany and the United States) had regional or federal curricula, but these "local" curricula were typically linked to national standards.

The primary curriculum in Ireland was published in 1999 and introduced to schools on a phased basis over a number of years, beginning with English in 2000. For each of reading, mathematics and science, more than half of countries reported that the curriculum in their country was currently under revision. In Ireland, the reading curriculum is currently under revision, while the mathematics and science curricula are not. This is despite the fact that most countries introduced their reading, mathematics and science curricula more recently than in Ireland. For example, only eight PIRLS countries had a national reading curriculum that pre-dates Ireland's. Among Ireland's comparison countries, only England's reading and mathematics curricula pre-date those in Ireland, while only England and Hong Kong have science curricula that pre-date the science curriculum in Ireland (Table 2.2).

Table 2.2: Reading, mathematics and science curricula by year of introduction, Ireland and comparison countries

	Reading	Mathematics	Science
Australia	varies by state	varies by state	varies by state
England	1999*	1999*	1999*
Finland	2004	2004	2004
Hong Kong SAR	2004	2002	2002
Ireland	2000*	2002	2003
Korea, Rep.**	–	2007*	2007*
New Zealand	2010	2010	2010
Northern Ireland	2008	2007	2007
Russian Federation	2004*	2004*	2004*
Singapore	2003*	2007*	2008*
United States	varies by state	varies by state	varies by state

*under revision.

** Korea did not participate in PIRLS.

There is a written curriculum for Fourth grade reading in all PIRLS countries and for Fourth grade mathematics and science in all countries that took part in TIMSS. In at least two-thirds of countries in each of the studies, but not in Ireland, the curriculum is accompanied by Ministry notes and directives (Table 2.3). A mathematics and science instructional guide is available in about the same proportion of TIMSS countries, while a reading instructional guide is available in just 60% of the countries that took part in PIRLS. Mandated textbooks had been introduced in slightly more than half of countries across both studies, but are not a feature of reading, mathematics and science curricula in English-speaking countries with the exception of the United States. Top-performing Korea, Hong Kong and Singapore all have mandated textbooks and, in addition, recommend specifically developed instructional activities as part of their curricula in each of the measured domains. Recommended instructional activities are also common in English-speaking countries, but have not been introduced in Ireland or Northern Ireland.

Table 2.3: Format in which reading, mathematics and science curricula are made available in Ireland, and percentage of PIRLS and TIMSS countries indicating format is available

	Reading		Mathematics		Science	
	IRL	PIRLS (N=45)	IRL	TIMSS (N=50)	IRL	TIMSS (N=50)
Ministry notes and directives	No	71%	No	68%	No	66%
Instructional guide	Yes	60%	Yes	70%	Yes	66%
Mandated textbooks	No	51%	No	56%	No	54%
Recommended activities	No	42%	No	48%	No	50%

In all countries that took part in PT 2011, curricular goals and objectives for reading, mathematics and science were specified for Fourth grade pupils. Additionally, in Ireland, there are prescribed methods of instruction and assessment standards for reading, mathematics and science. Both these aspects of instruction were prescribed for mathematics and science in more than half of TIMSS countries (56%). For reading, just over half of PIRLS participants (51%) had prescribed methods of instruction while a greater majority (64%) had prescribed assessment standards. Fewer countries (one-third of countries for reading, and about four-in-ten for mathematics and science) had prescribed instructional materials.

Among Ireland's comparison countries, only Korea, Hong Kong and Singapore had prescribed instructional materials. In Northern Ireland and in New Zealand, none of these aspects of instruction were prescribed while in Australia, England and the United States only the reading curriculum had prescribed assessment standards. Finland (also with prescribed assessment standards only for reading) and the Russian Federation (which does not prescribe any of these aspects of instruction) are similar to the English-speaking comparison countries in this regard. Their approach is very different from that of the highly prescriptive curriculum that is characteristic of Korea, Hong Kong and Singapore, and of Ireland to a lesser extent.

Curriculum: Official time allocation

Primary schools in Ireland are open for 183 days each year, and provide about 4.7 hours of daily instruction (i.e., excluding time for breaks and roll call). Irish Fourth class pupils receive, on average, 854 instructional hours per year – over 40 hours less than the international PIRLS and TIMSS averages (905 hours and 897 hours, respectively). However, there is not a clear relationship between total instruction time and performance on PIRLS and TIMSS. Among high-performing countries, for example in Singapore and Hong Kong,

pupils receive over 1000 hours instruction time per annum, while pupils in Korea and Finland receive less than 800 hours.

Ireland is among more than two-thirds of PIRLS participants (69%) and three-quarters of TIMSS participants (76%) that had national policies allocating instructional time to Fourth grade reading, mathematics and science. Most reported allocating more time to language and/or reading (20-40%) than to mathematics (13-22%) or science (7-13%). In Ireland, the percentage of time that is officially allocated to these aspects of the curriculum, though consistent with the trend described, is relatively low. However, Irish primary schools also have two hours per week of "discretionary curriculum time", some of which may be allocated to reading, mathematics or science.

Reading, on which Ireland performed very well on the PIRLS assessment (only five countries did significantly better), is allocated nearly one-fifth (18%) of instructional time. The share of time that is officially allocated to mathematics is 13%. Fourth class pupils in Ireland were significantly outperformed by their peers in 13 countries in mathematics, while in science, which is allocated only 4% of time, they were significantly outperformed by pupils in 17 countries. As shown in Table 2.4, most of the comparison countries have policies that either vary by state (Australia and United States) or that do not specify the amount of time to be allocated to reading, mathematics and science (Northern Ireland, England, New Zealand and Finland). In respect of those top-performing countries that do officially allocate time, it is clear that all three of the assessed curriculum domains attract a considerably greater share of available instructional time than is allocated in Ireland. This pattern is also evident in the data for nearly all participating countries in PIRLS and TIMSS. For example, only Austria, at 2-3%, officially allocated less time to science instruction than Ireland.

The OECD's annual publication, Education at a Glance, contains data on intended instruction time per subject as a percentage of total compulsory instruction time, for all OECD countries (OECD, 2012a). The data for the 9-11-year-olds (i.e., the same age group as in PT 2011) show that the official time allocations for reading, mathematics and science are similar to those found in PT 2011. Ireland is also very close to the OECD and EU averages for time allocated to social studies and to arts. However, Ireland allocated 10% of compulsory instruction time to religion, considerably higher than the OECD average of 4%, and exceeded only by Israel. In contrast, Ireland allocated 4% of compulsory time to physical education, less than half the OECD average of 9%, and lower than in any other country.

Table 2.4: Percentage of curricular time intended for reading, mathematics and science instruction, Ireland and comparison countries (official allocation)

	Reading	Mathematics	Science
Australia	Varies by state	Varies by state	Varies by state
England	Not specified	Not specified	Not specified
Finland	Not specified	Not specified	Not specified
Hong Kong SAR	18	12-15	12-15
Ireland	18	13	4
Korea, Rep. *	–	14	10
New Zealand	Not specified	Not specified	Not specified
Northern Ireland	Not specified	Not specified	Not specified
Russian Fed.	36	16	6
Singapore	33	22	8
United States	Varies by state	Varies by state	Varies by state

* Korea did not participate in PIRLS.

School-level characteristics

In this section, school-level features of provision are considered. There are three main focus points: implementation of the curriculum, some demographic characteristics of schools, and availability of key instructional resources.

Curriculum: Instructional time

The amount of time devoted to various aspects of the curriculum in the classroom may be different from that which is prescribed in national policies. Data from PT 2011 allows some exploration of the relationship between curriculum practice and policy in relation to reading, mathematics and science.

The amount of instructional time devoted to a subject is a function of the total amount of instructional time and the percentage of that total time devoted to a particular subject. Class teachers were asked how much time per week they spent on each of reading, mathematics and science. This, multiplied by the number of weeks in the school year, was used to calculate national total instructional hours per year for each of the three domains. The information supplied by class teachers indicates that Irish pupils spent slightly more time than the PIRLS average in reading lessons, slightly less than the TIMSS average in mathematics lessons, and considerably less time than the TIMSS average in science lessons (Table 2.5).

Table 2.5: Hours of instructional time per year spent on reading, mathematics and science, Ireland and comparison countries (teacher reports)

	Reading (cross-curricular)	Mathematics	Science
Australia	197	230	65
England	123	188	76
Finland	99	139	98
Hong Kong SAR	102	158	88
Ireland	159	150	63
Korea, Rep.*	–	121	92
New Zealand	220	168	52
Northern Ireland	155	232	72
Russian Federation	130	104	49
Singapore	127	208	96
United States	246	206	105
PIRLS	146	–	–
TIMSS	–	162	85

* Korea did not participate in PIRLS.

Irish Fourth class pupils have 150 hours of mathematics instruction per annum, (TIMSS average: 162 hours) and an average of 63 hours per year of science lessons (TIMSS average: 85 hours). Only for cross-curricular reading instruction does the amount of time in Ireland (159 hours) exceed the study average (146 hours). Expressed as percentages of the international averages, cross-curricular reading in Ireland is given 109% of the PIRLS average time, mathematics receives 93% of the TIMSS average time, and the time given to science teaching in Ireland is only 74% of the TIMSS average.

Among Ireland's comparison countries, only three (United States, New Zealand and Australia) allocated more time to reading instruction in practice. Only three countries spend less time on mathematics instruction (Finland, Korea and Russian Federation) while only two

spend less time than Ireland on science (New Zealand and Russian Federation). At 232 hours per annum, Northern Ireland spends most time on mathematics instruction – 82 hours more per annum than is spent on mathematics in Ireland, and 143% of the TIMSS average. For science, there is less variation between countries in the amount of instructional time allocated, with most countries spending far less time on science than on mathematics. The United States spends most time at science (105 hours annually) followed closely by the three top performers in this domain, Korea (92 hours), Singapore (96 hours), and Finland (98 hours). Japan, in fourth place, devotes 91 hours per annum to science.

The position of Ireland, in terms of the percentage of instructional hours per year allocated to reading, mathematics, and science in the classroom, relative to the comparison countries, is clearly shown in Table 2.6. Very broadly, the data highlight the relatively greater share of instructional time that is devoted to reading in Ireland. The table also shows that science is allocated relatively little time, as in most of Ireland's comparison countries. The share of time allocated to mathematics in Ireland is average, both by international standards and relative to the selected comparison countries. (Where Ireland's position relative to other countries differs slightly in Tables 2.5 and 2.6, this is because absolute values [number of hours] are shown in Table 2.5, while Table 2.6 is based on percentages of total hours).

Table 2.6: Percentage of instructional hours per year spent on reading, mathematics and science, Ireland and comparison countries (teacher reports)

	Reading (cross-curricular)	Mathematics	Science
Australia	20	23	6
England	12	19	8
Finland	13	18	13
Hong Kong SAR	10	15	8
Ireland	19	18	7
Korea, Rep.*	–	15	12
New Zealand	24	18	6
Northern Ireland	16	24	7
Russian Fed.	20	16	7
Singapore	13	21	10
United States	23	19	10
PIRLS	16	–	–
TIMSS	–	18	10

* Korea did not participate in PIRLS.

A comparison of the percentage of curriculum time that is officially allocated to reading, mathematics and science with the actual number of hours devoted to each of these domains by class teachers shows some discrepancy between the two. In particular, the trend described in the previous section in relation to official policies, whereby proportionately more time is reported to be allocated to reading than to mathematics or science, is not supported by the teacher reports described in this section[2]. As shown in Table 2.5, the average annual instructional hours devoted to mathematics in the classroom internationally

[2] Some of the discrepancy may be attributable to differently phrased questions. The National Curriculum Questionnaire asked about "language/reading instruction" while the Teacher Questionnaire asked about "English [or test language] instruction and/or activities".

(among all TIMSS countries) exceeds the number of hours given to reading (among all PIRLS countries). In several of Ireland's comparison countries (Australia, England, Finland, Hong Kong, Northern Ireland and Singapore), teachers reported spending more time on mathematics than on reading.

Evaluating curriculum implementation

Visits by inspectors, research programmes, school self-evaluation and national or regional assessments are all methods used by PIRLS and TIMSS participating countries to evaluate implementation of Fourth grade reading, mathematics and science curricula. School self-evaluation was the most commonly used method in all three curriculum domains (Table 2.7). More than 80% of countries reported using this method for reading, mathematics, and science. Inspector visits (particularly for mathematics and science) and national or regional assessments (more so for reading and mathematics) were also widely used. Research programmes, used to a lesser extent, were, nonetheless, part of curriculum evaluation in more than half of countries across both studies.

Table 2.7: Methods used to evaluate curriculum implementation, Ireland and all PIRLS and TIMSS countries

	Reading		Mathematics		Science	
	IRL	PIRLS (N=45)	IRL	TIMSS (N=50)	IRL	TIMSS (N=50)
Inspector visits	Yes	69%	Yes	78%	Yes	78%
Research programmes	Yes	56%	Yes	58%	No	54%
School self-evaluation	Yes	84%	Yes	82%	No	82%
National/ regional assessments	Yes	78%	Yes	76%	No	56%

Of the 45 countries that took part in PIRLS, 10 (including Ireland, Northern Ireland, United States, Hong Kong and the Russian Federation) reported using all four methods to evaluate implementation of the reading curriculum. Twelve TIMSS countries (including our comparison countries of Northern Ireland, United States, Korea and the Russian Federation) used all four methods to evaluate mathematics and science curricula. Ireland reported using all four methods to evaluate mathematics, but relied on inspector visits only for evaluation of the science curriculum.

Population, school size, and size of Fourth grade classes

At 65 people per square kilometre, Ireland has a lower population density than many of the countries that took part in PT 2011. Only 15 other countries in PIRLS, and 16 in TIMSS, had lower population densities. The variation that exists among countries in this regard is shown in Table 2.8, where the population density values per square kilometre for Ireland's comparison countries range from as low as three in Australia to as high as 7,125 in Singapore.

The population distribution in Ireland is also different to that in most other participating countries. According to data obtained from principals, nearly twice as many Fourth grade pupils in Ireland (36%) as internationally (19%) were living in areas with 3,000 people or fewer. Using a textual definition that classified school locations on an urban-rural continuum, a sizeable percentage of Irish Fourth class pupils (18%) was categorised as attending schools in "remote rural" areas, compared to international averages of 9% for PIRLS and 10% for TIMSS. While, internationally, pupils attending schools in more populated urban centres had higher average achievement in reading, mathematics and science

than their counterparts in schools located in smaller rural areas, the opposite is true for Ireland.

Table 2.8: Average school size, population density, class size and school-level PTR, Ireland and comparison countries

	Mean school size	Pop. density (per sq. km)	PTR*	Mean class size#
Australia	488	3	–	26
England	340	398	23	27
Finland	295	18	14	21
Hong Kong SAR	773	6,721	16	33
Ireland	279	65	16	26
Korea, Rep.	1,002	503	24	30
New Zealand	354	16	15	27
Northern Ireland	288	133	20	24
Russian Fed.	630	9	17	22
Singapore	1,645	7,125	19	37
United States	555	34	14	24
PIRLS	529	–	–	24
TIMSS	583	–	–	25

*PTR is the number of pupils enrolled in primary school divided by the number of primary school teachers, nationally.
Class size is the average class size (reported by teachers) for Fourth grade pupils who took part in PT 2011.

Across all countries participating in PIRLS and TIMSS, average school size varied from 177 in Austria to 1,645 in Singapore. The average size of primary schools in Ireland was 279 pupils, much smaller than the PIRLS (529) and TIMSS (583) international averages. Contributing to the relatively small average school size in Ireland is the fact that almost one-fifth of primary schools here have less than 50 pupils which, as noted in the introduction, is a relative rarity by international standards. Broadly, average school size tends to be larger in countries with high population densities. However, as shown in Table 2.8, all six of Ireland's comparison countries with lower population densities had a larger average school size than Ireland.

In PT 2011, a measure of pupil-teacher ratio (PTR) was used that is based not on the numbers of pupils in classrooms, as is usually the case, but on the total number of primary school pupils in a country divided by the total number of primary school teachers. A PTR of 16:1 was calculated for Ireland. This is in the average range for participants in both studies (minimum and maximum values are 9 and 29 for PIRLS, and 9 and 27 for TIMSS) and is somewhat lower than the PTR in Northern Ireland (20:1) and England (23:1), as shown in Table 2.8.

Fourth classes in Ireland contained, on average, 26 pupils, similar to both the PIRLS international average (24) and the TIMSS international average (25). There are some differences in class size among the top performers in reading, mathematics, and science. Compared to Ireland, the average number of pupils in Fourth grade classes is smaller in Finland (21) and the Russian Federation (22), but larger in Korea (30) and Hong Kong (33). Singapore has an average class size of 37 for its Fourth grade pupils, the largest among PIRLS participants. Among TIMSS participants, Singapore is second only to Yemen, which has an average of 48 pupils in Fourth grade classes. Azerbaijan, with a reported class size of 18, has, on average, the smallest number of pupils in Fourth grade classes among participants across both studies.

Computer and science laboratory availability

There is considerable variation among the countries that took part in PT 2011 in the extent to which Fourth grade pupils were reported as having computers for instructional purposes in their schools (Table 2.9). Ireland, with 35% of Fourth class pupils in schools with one computer for every 1-2 pupils, is somewhat below both the PIRLS international average (41%), and the TIMSS international average (38%). Ireland is poorly placed also relative to most of its comparison countries, including Northern Ireland, where a very high proportion of Fourth grade pupils (77%) were in schools with one computer for every l-2 pupils.

Of all participants in both TIMSS and PIRLS, England had the best computer-to-pupil ratio (90% of Fourth grade pupils were in schools with one computer for every 1-2 pupils), followed by the Slovak Republic with 81% of pupils in such schools. Among countries that participated in TIMSS, the poorest ratios were reported for Iran, Tunisia, and Yemen, with 7% of pupils or fewer in schools with this level of computer availability. Among PIRLS countries, Austria, Croatia and Morocco had the lowest computer-to-pupil ratios with 11-12% of pupils in schools with a computer for every 1-2 pupils. A relatively small proportion of Fourth grade pupils were in schools that had no computers for instruction (8% for TIMSS, and 7% for PIRLS). For those pupils, compared to all other groups of pupils in schools with varying computer-to-pupil ratios, there was a notably lower level of average achievement.

Countries participating in TIMSS also varied greatly in the extent to which Fourth grade pupils had access to a science laboratory. On average, internationally, more than one-third of Fourth grade pupils (36%) attended schools with a science laboratory. Provision was best in Korea, Kuwait, Singapore and Japan, with practically all Fourth grade pupils in these countries attending schools that had a science laboratory. In most European countries, however, fewer than one-in-five pupils had access to a science library, a situation that may reflect school size as well as variations in practice. Only in three countries (Ireland, Northern Ireland and Lithuania) did no pupils have access to a science laboratory in their schools. As shown in Table 2.9, provision was also somewhat limited in Ireland's comparison countries, apart from Singapore, Korea and, to a lesser extent, Hong Kong. Broadly, pupils in countries where school size was larger than average were more likely to have a computer laboratory in their school. For example, eight of the 10 countries with best provision had school sizes above the TIMSS average size. Pupils in schools that had a science laboratory had slightly higher average achievement in science than those attending schools without a science laboratory.

Table 2.9: Percentages of Fourth grade pupils having access to computers and science laboratory, Ireland and comparison countries

	One computer per 1-2 pupils	Science laboratory
Australia	65	13
England	90	9
Finland	55	16
Hong Kong SAR	56	37
Ireland	35	0
Korea, Rep.	22	100
New Zealand	70	5
Northern Ireland	77	0
Russian Fed.	28	23
Singapore	51	100
United States	65	25

Library resources

School and class libraries can provide an additional source of reading material to support the efforts of teachers and enhance pupils' learning experiences. Among the countries that participated in PT 2011, just 13% of Fourth grade pupils, on average, attended schools that had no school library. The countries with the highest percentages of Fourth grade pupils in schools without a school library were, for PIRLS, Morocco (67%), Ireland (48%) and Colombia (36%). For TIMSS, the highest percentages were found in Yemen (77%), Morocco (70%), and Flemish-speaking Belgium (60%). Among Ireland's comparison countries (Table 2.10), those with the smallest average school size – Ireland, Northern Ireland and Finland – also had the highest percentages of Fourth grade pupils attending schools that had no school library. In all other comparison countries, a school library was available to practically all Fourth grade pupils.

On average, nearly one-third (32%) of Fourth grade pupils in TIMSS attended schools that had school libraries with more than 5000 book titles. The corresponding PIRLS international average was slightly smaller, at 27% (Table 2.10). Apart from England, Finland, Ireland, and Northern Ireland, all of the countries shown in Table 2.10 exceeded both international averages by a considerable amount. The countries with the largest average school size (Singapore and Hong Kong) had the highest percentages of pupils with access to school libraries with more than 5000 books. Data for TIMSS show that the same is true of Korea, in which 92% of pupils were in schools that had a well-resourced school library. Average achievement in reading, mathematics, and science was positively associated with size of school library, with pupils in schools with well-resourced libraries having the highest achievement.

Table 2.10: Percentages of Fourth grade pupils having access to school and class libraries, Ireland and comparison countries [#]

	School-level			Class-level		
	Mean school size	No school library	5000+ books	Mean class size	No class library	50+ books
Australia	488	1	54	26	9	48
England	340	7	10	27	13	70
Finland	295	21	4	21	49	22
Hong Kong SAR	773	0	79	33	5	75
Ireland	279	48	7	26	2	87
Korea, Rep.*	1,002	1	92	30	–	–
New Zealand	354	0	45	27	1	29
Northern Ireland	288	31	3	24	3	89
Russian Fed.	630	1	63	22	23	36
Singapore	1,645	0	77	37	8	44
United States	555	1	62	24	1	92
PIRLS	529	13	27	24	28	32

[#]Only PIRLS data are presented since there is little difference between values for PIRLS and TIMSS at school level, and no class-level data are available for TIMSS.

*Korea did not participate in PIRLS; school-level data are sourced from TIMSS.

Information was provided also on the existence and size of classroom libraries. Internationally, 28% of Fourth grade pupils had no classroom library, and their average reading achievement was slightly below that of pupils who had a classroom library. Morocco (70%), Colombia (63%), and Denmark (62%) had the highest percentages of Fourth grade

pupils in schools with no classroom library. In nearly half (47%) of PIRLS countries, less than 25% of pupils had no classroom library.

Among Ireland's comparison countries (Table 2.10), there is considerable variation with practically all Fourth grade pupils in the United States, New Zealand and Northern Ireland – as well as Ireland itself – having a classroom library, and a relatively large percentage of pupils in Finland (49%) not having one. In the United States, England, Australia, New Zealand, Singapore and Hong Kong, large percentages of pupils had access to both classroom and school libraries. In Ireland and Northern Ireland, classroom libraries are much more common than school libraries and in the Russian Federation there is greater availability of school libraries than classroom libraries.

On average, nearly one-third (32%) of Fourth grade pupils internationally attended schools with classroom libraries that had more than 50 book titles. The percentage of pupils with access to at least 50 books was nearly three times greater than the international average in the United States (92%), Northern Ireland (89%) and Ireland (87%). Finland and the Russian Federation, with the smallest average class sizes, also had the smallest percentages of pupils with access to more than 50 books in a classroom library. Overall, however, there was no clear relationship between average class size and size of classroom library.

Conclusion

Features of the educational system that shape and define the learning and teaching environment of Fourth class pupils in Ireland have been the main theme of this chapter. Historically-important influences were discussed in the introduction, which drew attention to the relatively late shift in the dominant educational ideology towards an awareness of the role of education in economic development, the mainly centralised educational administration that is both informed and constrained by a diversity of stakeholders and interest groups, and the disproportionately large number of small rural schools that evolved in a country of low population density. National policies in education were then reviewed, drawing on data obtained in PT 2011. Implementation of some of these policies at school level was examined subsequently, as well as aspects of the school environment relevant to the experiences of Fourth class pupils. The overall purpose of these analyses was to compare policy and practice in Ireland with that of other countries participating in PIRLS and TIMSS, and with reference to the achievements of Fourth class pupils in reading, mathematics, and science.

Ireland's experience was broadly similar to that of the majority of PIRLS and TIMSS participants regarding national policy requirements for compulsory schooling, teacher qualifications, and parental involvement. Some differences worth highlighting in this brief summary relate to curriculum policy. There are two main observations. The first is that the reading curriculum in Ireland, though currently under revision, is older than the reading curriculum in all but eight of the countries that took part in PIRLS. Further, the reading, mathematics and science curricula in Ireland pre-date those in almost all of Ireland's comparison countries – yet, unlike many of the newer curricula in our comparison countries, the curricula in Ireland have not been reviewed since their introduction. A second point of difference is the extent to which aspects of the curriculum are prescribed. Although presented in the format of a written document with an instructional guide, the curriculum in Ireland is issued without lists of mandated textbooks, recommended activities, or accompanying official notes and directives. In many other countries, across both studies, including top-performing Korea, Hong Kong, and Singapore, official curricular information or guidance is made available in a more diverse range of formats. In other respects, however, the curriculum in Ireland could be described as highly prescriptive. Both methods of instruction and assessment standards are prescribed for each of the three curriculum

domains assessed in PT 2011 – a practice that also exists in Korea, Hong Kong and Singapore, but is not much used in any of Ireland's other comparison countries.

A comparison of national policy with implementation of policy at school level revealed interesting discrepancies with regard to allocation of instructional time (perhaps partly attributable to a slight difference in the questions asked of teachers and in the National Curriculum Questionnaire). Officially, the majority of countries, including Ireland, reported allocating more time to reading/language instruction than to mathematics or science. In the classroom, however, more time is spent on average on mathematics (amongst all TIMSS countries) than on reading (amongst all PIRLS countries). This trend is observed also in most of our comparison countries, although not in Ireland. In fact, compared to these key countries, and to Northern Ireland and Australia in particular, the number of hours per year spent on mathematics instruction in Ireland is relatively low.

The amount of time devoted to science in Ireland is limited when compared with the experiences of other countries, both in terms of the official and the implemented curriculum. Other indications from PT 2011 also suggest that, compared to reading and mathematics and relative to other countries, science, for Fourth class pupils in Ireland, is not prioritised. For reading and mathematics, several different methods (inspector visits, research programmes, school self-evaluation and national/ regional assessments) are used to evaluate curriculum implementation, but, for science, the only method of evaluation reported was inspector visits. Though provision of a science laboratory for Fourth grade pupils is not widespread in countries that took part in TIMSS (apart from some notable exceptions including Singapore, Korea, and Japan), Ireland, was one of only three countries in which no Fourth grade pupils have access to a school science laboratory. Further, as described in more detail in Chapter 5 (Clerkin, 2013), Irish teachers were less likely than the PIRLS or TIMSS study averages to have a specialisation in science, to feel confident teaching science, to engage in science-related Continuing Professional Development, or to assign science-related homework.

Ireland's Fourth class pupils also have limited access to computers in school, with only one in three attending schools that have one computer for every 1-2 pupils. This is somewhat fewer than the international average for both PIRLS and TIMSS. Further, Ireland is poorly placed relative to most of its comparison countries, including Northern Ireland, where a high proportion of Fourth grade pupils were in schools with one computer for every 1-2 pupils.

Countries differed with regard to provision of library facilities, with some investing more in school libraries and others (such as Ireland) tending to favour classroom libraries. Nearly half of Fourth class pupils in Ireland had no school library, compared to a PIRLS average of just 13%. Provision of class libraries was much better, with most Fourth class pupils in Ireland having a classroom library with more than 50 books, compared to only 32%, internationally.

The demographic context within which Fourth class pupils in Ireland attend school has some unusual features. Ireland has a relatively low population density among countries that took part in PT 2011 and a considerably higher proportion of pupils in Ireland than in other participating countries live in "remote rural" locations. At 279, the average size of primary schools in Ireland is approximately half that of the PIRLS and TIMSS international averages. With nearly one-fifth of primary schools in Ireland having fewer than 50 pupils, small schools in areas of low population density are not uncommon. For pupils in other countries with sparsely populated regions, however, this feature of school enrolment is not typical. On the contrary, in all of the comparison countries that had lower population densities than Ireland, average school size was generally much larger. Patterns of population distribution are relevant also to achievement outcomes. Fourth class pupils in Ireland living

in smaller rural areas did better on average in reading, mathematics, and science than those attending schools in more populated urban centres, whereas the opposite is true internationally.

On other aspects of school, Fourth class pupils in Ireland had similar experiences to their peers in many other countries. Average Fourth class size in Ireland was 26, slightly above the PIRLS (24) and TIMSS (25) international averages, although considerably below those of top-performing Singapore (37), Hong Kong (33), and Korea (30). The primary school pupil-teacher ratio, at 16:1 for Fourth class pupils in Ireland, was also in the average range for pupils in both studies.

Additional references

This section does not repeat the core references already listed in Chapter 1. These include the three international reports and the Irish national report on PT 2011, and those related to other key studies such as National Assessments and PISA.

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Chapter 3
Pupil engagement

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Introduction

The concept of *pupil engagement* with school has been the subject of a large body of research, with much of that demonstrating its association with a range of social, behavioural, and academic outcomes. The term encompasses emotional, behavioural and cognitive elements (Fredericks, Blumenfeld, & Paris, 2004; Jimerson, Campos & Greif, 2003):

- affective/emotional engagement – positive or negative feelings towards the school, teachers, and peers.
- behavioural engagement – such as active participation in class, and completing homework.
- cognitive engagement – willingness to invest intellectual effort in, for example, understanding a new idea or mastering a skill.

Research with primary school-aged children shows that pupils who like their teachers and classmates, and whose teachers have high expectations for them, tend to be more motivated to put sustained effort into their schoolwork and are more likely to attend school regularly, come to class prepared, and complete their homework (Furrer & Skinner, 2003; Li, Lerner, & Lerner, 2010). These engaged pupils, who feel like they belong and are comfortable in the school, tend to show better academic performance than less engaged peers (Fredericks et al., 2004). Among older students, strong feelings of attachment to the school and involvement in school life are associated with greater self-esteem and lower levels of antisocial behaviour and substance abuse, as well as superior academic performance (Maddox & Prinz, 2003).

Disengagement from school – characterised by, for example, a weak or negative emotional attachment and/or lack of participation in school activities – is a gradual process. Poor relationships with peers and negative experiences in school have been associated with lower engagement several years later (Buhs, Ladd, & Herald, 2006; Jimerson, Egeland, Sroufe, & Carlson, 2000; Perdue, Manzeske, & Estell, 2009). Such disengagement is seen as the beginning of a progression that sometimes culminates in early school leaving (Finn, 1989; Furlong & Christenson, 2008). Early school leaving, in turn, is strongly associated with a host of further social, health-related, and economic costs (Alliance for Excellent Education, 2009; Byrne & Smyth, 2010; Cutler & Lleras-Muney, 2006; Joint Oireachtas Committee on Education and Skills, 2010; Kortering & Braziel, 2008; Levin, 2009).

In Ireland, approximately 14-15% of post-primary students leave school without completing the Leaving Certificate (Byrne & Smyth, 2010; Joint Oireachtas Committee on Education and Skills, 2010). Estimates of the number of children who leave primary school without entering post-primary education at all are less certain, largely due to the absence of a database that would allow pupils' progress from primary to second-level to be tracked. The proposed development of a primary pupil database may address this issue in the future (Quinn, 2013). However, the latest annual figures from the Department of Education and Skills' Statistical Report (2012) show that fewer than 400 pupils, excluding those known to have emigrated, left their primary school without going to another primary, post-primary, or

special school within the State. In addition, more than 1100 pupils left primary school with no further information available.

The Primary School Curriculum (DES/NCCA, 1999) is quite explicit in recognising the importance of good teacher-pupil relationships to pupils' engagement, happiness in school, and academic development, stating that:

> the quality of the relationship that the teacher establishes with the child is of paramount importance in the learning process. The teacher's concern for the well-being and the successful development of the child is the basis for the creation of a supportive environment that can facilitate the child's learning. A relationship of trust between teacher and child creates an environment in which the child is happy in school and motivated to learn. (p. 20)

A study of early school leavers in Ireland (Eivers, Ryan & Brinkley, 2000) found that, when compared to a matched comparison group of students who remained in education, early school leavers were more likely to report that their favourite thing about school was that it was fun or had lots of activities. When asked to nominate their *least* favourite aspect of primary school, not liking some or all of the teachers, and not understanding things or not being good at schoolwork were identified by early school leavers. None of the matched comparison group mentioned any of these early signs of disengagement as a negative aspect of their primary school experience. Although the sample of young people interviewed was very small, it provides support, in an Irish setting, for the assertion that "inadequate relations with a teacher may lead to dislike and fear of school and over time may lead to feelings of alienation and disengagement" (Jennings & Greenberg, 2009, p. 501). This is particularly relevant in the context of formative experiences of schooling among younger pupils (Finn, 1989).

Although some primary level studies (e.g., National Assessments, Growing Up in Ireland) have collected information on the extent to which pupils enjoy their school experience, much of the literature on school engagement refers to post-primary students (McCoy, Smyth, & Banks, 2012). Thus, the data from PIRLS and TIMSS (PT 2011) presented in this chapter provide an opportunity to examine the attitudes of Irish primary pupils towards school generally, and alongside those of similar-aged pupils in other countries.

As well as comparisons between engagement among pupils in Ireland and those in other PT 2011 countries, Irish pupils' attitudes towards school will be examined with particular reference to some key demographic variables that have been shown by previous research to be related to engagement in school or to early school leaving. Particular attention is paid to two key variables – gender and socioeconomic status (SES). Higher rates of disengagement are consistently found among males and among pupils from low-SES backgrounds (Eivers et al., 2000; Jimerson et al., 2000; Joint Oireachtas Committee on Education and Skills, 2010; McCoy et al., 2012).

The remainder of this chapter is structured as follows: first, some characteristics relating to the participating pupils are presented. Next, Fourth class pupils' self-reported attitudes to school and to the assessed domains (reading, mathematics and science) are presented. Third, pupils' relationships with their classmates, in terms of experiencing bullying, are examined. Fourth, teachers' reports of some of the difficulties that they experience in engaging pupils in their classrooms are outlined. Finally, the issue of engagement in Irish schools is discussed more broadly, drawing on these data, and key findings are summarised. This chapter focuses on a subset of the data from PT 2011. Readers who would like more background information on PIRLS and TIMSS, or about Ireland's participation in the studies are referred to Chapter 1 of this volume (Eivers & Clerkin, 2013).

The pupils in PT 2011

Table 3.1 summarises some basic general characteristics of the pupils who took part in PT 2011. Participating pupils were relatively evenly split by gender, both in Ireland and internationally. Irish Fourth class pupils were just over 10 years old on average, very similar to the PIRLS (10.2 years) and TIMSS (10.3 years) averages. More than four-fifths (84%) of Fourth class pupils in Ireland *always* spoke English at home, with about 2% of pupils reporting that they *never* spoke English at home. By comparison, a lower percentage of pupils internationally (72-73%) *always* spoke the language of the PIRLS or TIMSS tests at home, and 5-6% of pupils *never* spoke the language of the test at home.

Table 3.1: Summary characteristics of pupils who took part in PT 2011, Ireland, PIRLS and TIMSS

		Ireland	PIRLS	TIMSS
Gender (%)	Girl	49	49	49
	Boy	51	51	51
Age (years)	Mean	10.3	10.2	10.3
	Range	8-12	8-13	8-13
Frequency of speaking language of test at home (%)	Always	84	73	72
	Sometimes	13	22	22
	Never	2	5	6

As outlined in Chapter 2 (Lewis & Archer, 2013), Irish pupils were more likely than the average to be enrolled in small schools, or to attend schools in rural areas. Mean school size in Ireland was 279 pupils, roughly half the school average size across PIRLS and TIMSS, and 36% of Irish pupils, but only 19% internationally, lived in areas with a population of 3,000 people or fewer.

Specific to Ireland, 81% of pupils were in non-DEIS schools. Of those pupils in DEIS schools, 8% of the overall sample attended Urban Band 1 schools, and 7% are in Urban Band 2 schools. Slightly less than 5% of pupils attended DEIS schools in rural areas. Just under three-quarters (73%) of the PT 2011 pupils attended mixed-gender schools, while 14% were in all-girls schools and 12% were in all-boys schools.

Pupils' attitudes to school and subjects

This section is divided into two parts. The first describes pupils' affective engagement with school. The second part reports pupils' attitudes to the subject domains examined in PT 2011 – reading, mathematics and science – and their cognitive engagement in reading, mathematics and science lessons at school. Findings are first presented with reference to our comparison countries and the PIRLS and TIMSS international averages, and then followed by further detail on differences between pupils' attitudes within Ireland (e.g., by pupil gender).

Attitudes to school

Three-quarters (74%) of Irish pupils *agreed a lot* or *a little* that they liked being in school, a lower percentage than the international averages (Table 3.2). Among our selected comparison countries, almost 90% of pupils in Singapore and the Russian Federation like being in school, and all except Hong Kong and Northern Ireland had greater percentages of pupils giving positive responses to the statement than in Ireland. Although not shown in Table 3.2 because the *a lot* and *a little* response options are combined, of particular note is the high percentage of Irish pupils (13%) who *disagreed a lot* with the statement "I like being in

school". This is double the corresponding international average (6% among TIMSS countries, and 7% among PIRLS countries). Only Croatia (15%) and Northern Ireland (14%) had higher percentages of pupils *disagreeing a lot* that they like school.

In a similar fashion, relatively fewer Irish pupils reported a strong sense of belonging at their school. Across all countries, about 88% of pupils *agreed* that they belong at their school, compared to 82% in Ireland. The 18% of pupils in Ireland who *disagreed* (*a lot* or *a little*) that they felt they belonged in their school is similar to the percentages in England, Australia, and Singapore, but markedly higher than in the Russian Federation and Finland (Table 3.2).

Table 3.2: Percentages of pupils who agreed/disagreed they liked or belonged in school, Ireland, comparison countries and study averages

	I like being in school		I feel like I belong at this school	
	Agree (a lot or a little)	Disagree (a lot or a little)	Agree (a lot or a little)	Disagree (a lot or a little)
Australia	81	19	82	18
England	80	20	82	18
Finland	79	21	90	10
Hong Kong SAR	74	26	78	22
Ireland	74	26	82	18
Korea, Rep.	86	14	86	14
New Zealand	86	14	84	16
Northern Ireland	73	27	85	15
Russian Fed.	89	11	96	4
Singapore	90	10	83	17
United States	79	21	81	19
PIRLS	85	15	88	12
TIMSS	86	14	87	13

More positively, 91% of Fourth class pupils said that they feel safe when at school, higher than in Hong Kong, Korea, Singapore, the Russian Federation and the US (Table 3.3). Among our key comparison countries, only Northern Ireland has a marginally higher percentage (92%) of pupils who feel safe at school. Pupils' relative perceptions of safety broadly correspond with principals' reports of school discipline and safety. The 83% of pupils in Ireland (and 85% in Northern Ireland) who attended schools described by principals as having *hardly any* [discipline] *problems*, was much higher than the corresponding PIRLS (58%) and TIMSS (61%) averages.[1]

Among the comparison countries shown in Table 3.3, only Hong Kong had greater percentages of pupils in schools with hardly any problems. By contrast, Sweden, Austria and Germany (not shown here) were among 16 countries taking part in one or both studies where fewer than half of the Fourth grade pupils were in schools with *hardly any problems*.

[1] The *School Discipline and Safety* scale was based on principal responses to frequency with which 10 behaviours were a problem among Fourth grade pupils in their school: vandalism; theft; physical fights among pupils; arriving late at school; absenteeism; classroom disturbance; cheating; profanity; intimidation or verbal abuse among pupils (including texting, emailing, etc.); and intimidation or verbal abuse of teachers or staff (including texting, emailing, etc.).

Table 3.3: Percentages of pupils who feel safe at school, and in schools with different degrees of discipline/safety problems, Ireland, comparison countries and study averages

	Pupil: I feel safe in this school		Principal: discipline/safety problems		
	Agree (a lot or a little)	Disagree (a lot or a little)	Hardly any problems	Minor problems	Moderate problems
Australia	88	12	64	34	2
England	90	10	75	24	1
Finland	91	9	64	34	2
Hong Kong SAR	84	16	87	12	1
Ireland	91	9	83	16	1
Korea, Rep.	78	22	76	18	6
New Zealand	90	10	68	32	<1
Northern Ireland	92	8	85	15	0
Russian Fed.	85	15	65	35	<1
Singapore	85	15	67	33	0
United States	87	13	63	35	2
PIRLS	89	11	58	31	11
TIMSS	89	11	61	29	11

Consistent with previous research (e.g., Eivers et al., 2010; McCoy et al., 2012), boys expressed much more negative views than girls about school (Table 3.4). In Ireland, 37% of boys reported *not liking* (*a lot* or *a little*) being in school. This was not only considerably higher than the 16% of girls in Ireland who did not like school, but also much higher than the averages for boys (20%) and girls (10%) across all PIRLS and TIMSS countries.

Similarly, lower percentages of boys than girls agreed that they belonged at their school and that they felt safe there. This is the case both in Ireland and internationally. Overall, pupils in Ireland were somewhat less likely to report a feeling of belonging at their school in Ireland than pupils internationally, but were slightly more likely to report feeling safe.

Table 3.4: Percentages of girls and boys endorsing various statements about their attitudes to school, Ireland, and PIRLS average

			Agree (a lot or a little)	Disagree (a lot or a little)
I like being in school	Ireland	Girls	84	16
		Boys	63	37
	PIRLS	Girls	90	10
		Boys	80	20
I feel like I belong at this school	Ireland	Girls	87	13
		Boys	78	22
	PIRLS	Girls	90	10
		Boys	85	15
I feel safe when I am at school	Ireland	Girls	95	5
		Boys	87	13
	PIRLS	Girls	91	9
		Boys	86	14

As the PIRLS and TIMSS means on these measures were almost identical, only PIRLS is shown.

Within Ireland, some variations in pupils' affective engagement with school were evident when examined by school DEIS status (Table 3.5). Pupils attending non-DEIS schools, Rural DEIS and DEIS Urban Band 1 schools provided similar responses when asked about their liking of, belonging to, and feelings of safety at school. Pupils in Urban Band 1 schools (i.e., those identified as having the highest concentrations of socioeconomically-disadvantaged pupils, and in receipt of the greatest additional support) were most likely to *agree a lot* that they like being in school.

In contrast, pupils attending Urban Band 2 schools were most likely to *disagree* (*a little* or *a lot*) that they liked being in school (36%), that they felt they belong at their school (25%), and that they felt safe at their school (17%). This is in contrast to recent analyses of Growing Up in Ireland (GUI) data, which found little variation in nine-year-olds' liking of school by DEIS status, either between DEIS and non-DEIS schools or between Urban Band 1 and Band 2 schools (McCoy et al., 2012).

Table 3.5: Percentages of pupils in Ireland endorsing various statements about their attitudes to school, by school DEIS status

			DEIS Urban 1	DEIS Urban 2	DEIS Rural	Non-DEIS
I like being in school	Agree	(a lot or a little)	79	64	77	74
	Disagree	(a lot or a little)	21	36	22	26
I feel like I belong at this school	Agree	(a lot or a little)	79	75	85	83
	Disagree	(a lot or a little)	21	25	15	17
I feel safe when I am at school	Agree	(a lot or a little)	93	83	92	92
	Disagree	(a lot or a little)	7	17	8	8

Attitudes to reading, mathematics and science

Participating pupils were asked a number of questions about their enjoyment of reading (as part of PIRLS) and mathematics and science (as part of TIMSS). Their responses were combined to create three overall measures of the extent to which pupils like reading, like learning mathematics, and like learning science (Table 3.6).[2] Overall, Irish Fourth class pupils held much more positive attitudes towards reading and slightly more positive views towards science than their peers in other countries, but were less favourably disposed towards mathematics.

In Ireland, 37% of pupils *liked reading*, compared to the international average of 28%. The percentage of pupils who *do not like reading* in Ireland, at 14%, is similar to the international average (15%). Across PIRLS as a whole, Portugal and Georgia were the only countries with a greater percentage of pupils who *liked reading* than Ireland, at 46% and 42%, respectively.

While the 41% of Irish pupils who indicated that they *like learning maths* is higher than the comparable percentage for reading, it is below the corresponding international average of 48%. Countries where similar percentages of pupils to Ireland reported liking mathematics included Germany, Czech Republic, Austria, and England. Korea, Japan, Finland and Northern Ireland are among the countries whose pupils held more negative attitudes to mathematics. Almost one-quarter of Irish pupils reported that they *do not like learning maths*.

[2] See the international reports (Martin, Mullis, Foy, & Stanco, 2012; Mullis, Martin, Foy, & Arora, 2012; Mullis, Martin, Foy, & Drucker, 2012) for the components of the combined scales.

Table 3.6: Attitudes to reading, mathematics, and science, Ireland, comparison countries and study averages

	Reading		Maths		Science	
	Like	Do not like	Like	Do not like	Like	Do not like
Australia	30	19	45	22	55	14
England	26	20	44	19	44	21
Finland	26	21	34	31	36	25
Hong Kong SAR	21	16	47	17	52	14
Ireland	37	14	41	23	59	12
Korea, Rep.	–	–	23	29	39	16
New Zealand	32	14	47	18	55	13
Northern Ireland	29	20	36	26	51	13
Russian Fed.	26	13	58	8	62	7
Singapore	22	15	48	19	57	12
United States	27	22	45	22	56	15
PIRLS	28	15	–	–	–	–
TIMSS	–	–	48	16	53	12

To facilitate comparison across all three domains, the middle category ("somewhat like") is not shown in the Table.

In contrast to reading and mathematics, a majority of Irish pupils (59%) reported that they *like learning science*, slightly above the international average (53%). Similar percentages of Fourth graders in Germany, Singapore, and Chinese Taipei fell into this category, while pupils in Finland, England, and Korea were among those expressing the least positive attitudes. Turkish and Tunisian pupils were the most positive about science, with 72-73% reporting that they *like learning science*. More than one-tenth (12%) of Fourth class pupils in Ireland said that they *did not like learning science*.

The association between pupils' liking of a particular subject and achievement in that domain is not uniform (Table 3.7). In Ireland, the achievement gap between pupils who *like* and *don't like* a domain is highest for reading, at more than three-fifths of a standard deviation (65 scale points), and larger than the PIRLS average of 57 points. For science, the gap is two-fifths of a standard deviation (39 points), similar to the TIMSS average gap of 43 points. For mathematics, the gap is relatively small, at one-fifth of a standard deviation (18 points), and considerably smaller than the corresponding TIMSS average difference of 42 points. While Irish pupils who *don't like* reading and mathematics achieved mean scores above the international scale centrepoint, those who *don't like* science scored below the centrepoint.

Table 3.7: Mean achievement scores in each domain by pupil liking of that domain, Ireland and study averages

		Like		Somewhat like		Do not like		Gap (Like – Do not like)
		%	Mean	%	Mean	%	Mean	
Reading	Ireland	37	580	49	543	14	514	65
	PIRLS	28	542	57	506	15	485	57
Maths	Ireland	41	535	36	529	23	517	18
	TIMSS	48	509	36	478	16	466	42
Science	Ireland	59	529	29	506	12	490	39
	TIMSS	53	504	35	469	12	461	44

In addition to questions about their liking of each subject, pupils were asked to respond to several statements about the extent to which they could follow and were engaged

in their lessons, such as "I know what my teacher expects me to do" and "I think of things not related to the lesson".[3] The responses to these statements were combined to create an overall indicator of classroom engagement for each of the three subjects, with pupils categorised as being *engaged*, *somewhat engaged*, or *not engaged*, depending on their responses.

Children in Fourth class in Ireland were found to be generally interested in their lessons, with most pupils classified as being *engaged* or *somewhat engaged* (Table 3.8). The percentage of pupils in Ireland who were *engaged* or *somewhat engaged* was similar to the corresponding international averages for each of the three domains. Eight percent of pupils were described as being *not engaged* in each of the three subject domains, both in Ireland and at the international averages. The percentage of *not engaged* pupils across individual countries ranged from 2-20% for reading, 3-33% for mathematics, and 2-34% for science. Surprisingly, perhaps, some of the best-performing countries in PT 2011 had large percentages of *not engaged* pupils.

In PIRLS, countries with high percentages of pupils classified as *not engaged* with their reading lessons included Finland (20%), Hong Kong (18%), and Singapore (13%). *Engaged* pupils in these countries achieved a mean score about 14-21 points higher than *not engaged* pupils on the reading assessment, similar to the 16-point difference in Ireland but less than the 30-point difference at the PIRLS average. Relatively high percentages of *not engaged* pupils were also found in Denmark (14%) and the Netherlands (15%), both of which achieved a similar overall score to Ireland on the assessment.

Table 3.8: Mean achievement scores in each domain by pupil engagement with that domain, Ireland and study averages

		Engaged		Somewhat engaged		Not engaged		Gap (Engaged – Not Engaged)
		%	Mean	%	Mean	%	Mean	
Reading	Ireland	43	557	49	550	8	541	16
	PIRLS	42	519	50	510	8	489	30
Maths	Ireland	45	538	47	522	8	516	22
	TIMSS	42	507	49	482	8	464	43
Science	Ireland	51	529	41	506	8	503	26
	TIMSS	45	504	47	476	8	458	46

A similar pattern was evident with regard to mathematics and science. Here, Japan (23% for mathematics; 34% for science), Korea (29%; 23%) and Finland (31%; 20%) had large percentages of *not engaged* pupils, but performed better overall on the assessments than almost every other participating country. These somewhat counter-intuitive patterns underline the need for caution when comparing attitudinal variables across (rather than within) countries, particularly where a wide range of cultures are represented, as is the case with TIMSS and PIRLS.

Comparing Tables 3.7 and 3.8 reveals that, in Ireland, reading achievement has a stronger relationship with *liking* reading than with *engagement* with reading. For science, the

[3] The statements in the text above were two of five common to all three domains. The remaining three were: "My teacher is easy to understand", "I am interested in what my teacher says", and "My teacher gives me interesting things to do". Two additional statements were included for reading engagement: "I like what I read about in school", and "My teacher gives me interesting things to read".

relationship between achievement and engagement is also weaker than between achievement and liking. However, for mathematics achievement, engagement shows a slightly stronger relationship than liking. At the international level, self-reported liking of and engagement in mathematics and science produce similar differences in achievement between the positive and negative extremes of the scale. Like Ireland, the largest gap is found between those who *like* and who *don't like* reading.

For all three domains, the difference in Ireland between *engaged* and *not engaged* pupils is slightly less than half the corresponding difference for the studies overall. In fact, pupils in Ireland who reported not being engaged with their reading lessons still performed well on the assessment, with an average score of 541 points – higher than the overall average achievement for most participating countries. As noted above, the difference in achievement between these pupils and those who reported being *engaged* was only 16 points, considerably smaller than the 65-point difference between pupils who *like* and *don't like* reading shown in Table 3.7.

Within Ireland, gender differences are evident in pupils' liking of the three domains (Table 3.9). Girls are about 1.6 times as likely as boys to *like* reading, and boys are almost twice as likely as girls are to say that they *don't like* reading. These proportions are similar to, but marginally less pronounced than the corresponding PIRLS averages.

In contrast, boys in Ireland are slightly more likely than girls to *like* science, and more girls than boys *don't like* science in Ireland, while these patterns are reversed at the TIMSS average. However, in general, the majority of both boys and girls report positive views towards science, both in Ireland and internationally.

In Ireland, 21% of girls and 25% of boys indicated that they *don't like* mathematics, more than for reading or science, and more than the corresponding international averages for mathematics. That said, it is notable that more Irish boys *like* mathematics than *like* reading.

Table 3.9: Mean achievement scores in each domain by gender and pupil liking of that domain, Ireland and study averages

			Like		Somewhat like		Do not like		Gap (Like – Do not like)
			%	Mean	%	Mean	%	Mean	
Reading	Ireland	Girls	45	583	46	544	10	524	56
		Boys	29	574	52	541	19	509	65
	PIRLS	Girls	35	544	55	511	10	490	54
		Boys	21	538	58	501	21	483	55
Maths	Ireland	Girls	42	530	37	529	21	514	16
		Boys	40	539	35	530	25	519	20
	TIMSS	Girls	47	505	36	480	17	470	35
		Boys	48	512	35	477	16	464	48
Science	Ireland	Girls	57	529	30	506	13	487	42
		Boys	62	529	28	506	10	493	36
	TIMSS	Girls	55	502	34	471	11	465	37
		Boys	52	507	35	467	13	457	49

Some differences in liking scores were also apparent by DEIS status. Pupils in DEIS Rural schools were particularly positive about learning science (with 71% reporting that they *like* science and only 7% *not liking* science). For mathematics, pupils in Urban Band 2 schools were the least positive. Only 42% *liked* mathematics and 30% *did not like* mathematics. In

contrast, pupils' ratings for liking reading varied little by school DEIS status, with about half of pupils in each school category *somewhat liking* reading and around one-third (between 32% and 38%) *liking* reading.

Experience of bullying

The questionnaire completed by pupils in PT 2011 included six questions related to experiences of bullying. In Ireland, and internationally, being bullied was related to lower achievement in reading, mathematics, and science. Across all participating countries and across all three domains, there was an average difference of approximately one-third of a standard deviation in the achievement of pupils who were categorised as being *almost never* bullied, and those who were bullied *about weekly* (Martin et al., 2012; Mullis, Martin, Foy, & Arora, 2012; Mullis, Martin, Foy, & Drucker, 2012). The association for Irish pupils between being bullied and achievement in particular is considered in more detail in Chapter 10 of this volume (Cosgrove & Creaven, 2013). In this section, we examine general school and pupil characteristics associated with bullying, both in Ireland and internationally, and look at differences within the Irish population.

Prevalence

Pupils were asked how often they had experienced each of six different bullying behaviours at school during the course of the year, with responses combined to create a single overall indicator of bullying; the "*Students Bullied at School*" scale.

Compared to other countries, Irish pupils reported relatively little bullying at school (Table 3.10). In Ireland, 64% of pupils were categorised as *almost never* experiencing bullying, compared with an international average of 47% for PIRLS, and 48% for TIMSS. Only in four countries (Azerbaijan, Sweden, Georgia, and Denmark), did pupils experience bullying on a less frequent basis than in Ireland. Nonetheless, 25% of Irish pupils were bullied *about monthly* and 12% were bullied *about weekly*. By comparison, 20% of pupils in both PIRLS and TIMSS were described as being bullied *about weekly*.

Table 3.10: Percentages of pupils reporting various frequencies of experiencing bullying in school, Ireland, comparison countries and study averages

	About weekly	About monthly	Almost never
Australia	25	38	37
England	20	35	45
Finland	9	30	61
Hong Kong SAR	17	33	51
Ireland	12	25	64
Korea, Rep.	15	32	53
New Zealand	30	37	33
Northern Ireland	14	29	57
Russian Fed.	19	35	45
Singapore	23	38	39
United States	18	30	52
PIRLS	20	33	47
TIMSS	20	32	48

Table 3.11 provides the detail from which the summary measure shown in Table 3.10 was developed. Pupils were asked to indicate how frequently, if at all they experienced each of six specific types of bullying behaviours while at school. Generally, Irish pupils were less

likely than were pupils internationally to experience a particular type of bullying, while nonetheless showing the same broad pattern of *relative* frequency. Thus, in Ireland and internationally, verbal bullying was the most common form reported, followed by physical bullying and bullying by exclusion. This broadly corresponds to Williams et al.'s (2009) finding that for the 9-year-old cohort in GUI, verbal bullying was the most common form of bullying experienced, followed by being bullied by exclusion, and then by being physically bullied. Cyberbullying – which GUI data suggest is a far less common form of bullying – was not explicitly assessed in PIRLS and TIMSS, although may have been considered an aspect of some of the categories shown in Table 3.11.

In Ireland, 24% of pupils were made fun of or called names at school *a few times a year* while 11% experienced such bullying *at least once a week* (Table 3.11). While high, the incidence is considerably lower than the study averages for both PIRLS and TIMSS (21% of pupils reported weekly experience of name-calling or being made fun of). Eight percent of Irish pupils reported being left out of games or activities at least weekly, and 8% reported being hit or hurt by another pupil on a weekly basis. Pupils in Ireland, and internationally, were least likely to be made do things against their will or to have something stolen from them at school.

Table 3.11: Percentages of pupils reporting various frequencies of experiencing specific bullying behaviours, Ireland and study averages

During this year, how often…		At least once a week	Once or twice a month	A few times a year	Never
…have you been made fun of or called names at school?	IRL	11	9	24	56
	PIRLS	21	13	22	43
	TIMSS	21	13	21	45
…have you been left out of games or activities by other students at school?	IRL	8	9	21	61
	PIRLS	16	13	17	54
	TIMSS	16	13	17	54
…has someone spread lies about you at school?	IRL	7	9	19	65
	PIRLS	15	13	20	52
	TIMSS	15	13	20	53
…has something been stolen from you at school?	IRL	5	7	21	67
	PIRLS	9	8	18	66
	TIMSS	9	8	17	66
…have you been hit or hurt by other student(s) at school?	IRL	8	9	22	62
	PIRLS	13	12	22	52
	TIMSS	13	12	21	54
…have you been made to do things you didn't want to do by other students at school?	IRL	4	5	12	80
	PIRLS	7	6	11	76
	TIMSS	7	6	11	75

Pupil characteristics

In Ireland, boys, and pupils who *sometimes* or *never* spoke English at home[4] were most likely to have experienced bullying.

Pupil gender

Fourteen percent of boys were bullied *almost weekly*, compared to 10% of girls. Similar gender differences were reflected across the studies as a whole (e.g., across PIRLS, 24% of boys experienced bullying *almost weekly* compared to 17% of girls). As well as differences in overall prevalence, there was some variation in the types of bullying experienced by girls and boys, as shown in Table 3.12. For example, girls in Ireland were less likely to report being hit or hurt by another pupil (70% of girls reported they had *never* been hit compared to 54% of boys).

Table 3.12: Percentages of pupils, by gender, reporting various frequencies of experiencing specific bullying behaviours, Ireland and PIRLS averages

During this year, how often…			At least once a week	Once or twice a month	A few times a year	Never
…have you been made fun of or called names at school?	Ireland	Girls	8	7	22	63
		Boys	14	10	26	50
	PIRLS	Girls	18	12	22	47
		Boys	24	14	22	39
…have you been left out of games or activities by other students at school?	Ireland	Girls	7	10	23	60
		Boys	9	9	19	63
	PIRLS	Girls	14	12	18	56
		Boys	18	14	17	51
…has someone spread lies about you at school?	Ireland	Girls	6	8	20	67
		Boys	8	10	19	62
	PIRLS	Girls	13	12	21	54
		Boys	16	13	19	51
…has something been stolen from you at school?	Ireland	Girls	4	7	21	68
		Boys	7	6	21	66
	PIRLS	Girls	8	7	17	68
		Boys	10	8	18	63
…have you been hit or hurt by other student(s) at school?	Ireland	Girls	6	7	18	70
		Boys	10	11	25	54
	PIRLS	Girls	11	11	21	57
		Boys	16	14	24	47
…have you been made to do things you didn't want to do by other students at school?	Ireland	Girls	4	4	13	79
		Boys	4	5	10	81
	PIRLS	Girls	6	6	11	77
		Boys	8	7	11	75

As PIRLS and TIMSS data on these measures are very similar, only PIRLS is shown.

[4] Hereafter described as EAL (English as an Additional Language) pupils. See also Chapter 4 in this volume (Eivers, 2013) for more detail on some of the issues related to EAL pupils generally, and to EAL pupils and bullying, in particular.

The gender differences outlined in Table 3.12 are broadly in line with gender differences found in the GUI study and in a recent Irish study examining bullying in primary and post-primary schools (Minton, 2010; Williams et al., 2009). However, unlike both these studies, PT 2011 data did not show that girls were more likely to experience bullying by exclusion. In Ireland 7% of girls and 9% of boys experienced bullying by exclusion weekly. The comparable study averages were 14% of girls and 18% of boys.

Pupil language

Pupils who *always* spoke English at home were less likely to be bullied than were pupils who *sometimes* or *never* spoke English at home (Table 3.13). For example, almost one in five EAL pupils were bullied *about weekly*, compared to one in ten non-EAL pupils.

Table 3.13: Percentages of pupils in Ireland who reported various frequencies of being bullied, by how often they spoke English at home

Frequency of speaking English at home	Frequency of being bullied		
	About weekly	About monthly	Almost never
Always	10	23	67
Sometimes / Never	19	32	49

Note. As few pupils never spoke the test language at home, the *sometimes* and *never* categories are collapsed. Pupils for whom the language of instruction is Irish are excluded.

EAL pupils experienced each of the six bullying behaviours more frequently than their non-EAL counterparts, as shown in Table 3.14. In particular, EAL pupils were more likely to be excluded from games and activities on an at least monthly basis (25% for EAL pupils, and 15% for non-EAL pupils). Half of EAL pupils had been made fun of or called names, and had been left out of games at least a few times in the school year, while just over one-quarter had been made to do things they didn't want to do by other students at school.

Table 3.14: Percentages of pupils in Ireland who reported various frequencies of experiencing specific bullying behaviours, by how often they spoke English at home

During this year, how often … at school?	How often do you speak English at home?	At least once a week	Once or twice a month	A few times a year	Never
…have you been made fun of or called names?	Always	10	8	23	58
	Sometimes / Never	16	11	23	49
…have you been left out of games or activities by other students?	Always	7	8	21	64
	Sometimes / Never	14	12	26	48
…has someone spread lies about you?	Always	6	8	18	68
	Sometimes / Never	11	13	24	52
…has something been stolen from you?	Always	4	6	21	69
	Sometimes / Never	12	7	20	61
…have you been hit or hurt by other students?	Always	7	8	20	65
	Sometimes / Never	11	13	25	51
…have you been made to do things you didn't want to do by other students?	Always	4	4	11	81
	Sometimes / Never	7	7	13	73

School characteristics: Ireland

The prevalence of bullying varied according to some school characteristics (Table 3.15). Pupils in DEIS Urban Band 1 and Band 2 schools were twice as likely to experience bullying as pupils in DEIS Rural and non-DEIS schools. Mirroring this contrast between DEIS Urban and Rural schools, pupils in urban schools generally (including non-DEIS schools) were twice as likely to be categorised as experiencing *about weekly* bullying as were pupils in small towns or remote rural areas. Pupils in smaller schools were also slightly less likely to experience bullying than were those in larger schools.

As many rural schools are also categorised as small schools, urban/rural differences in bullying may be a function of school size, or *vice versa*. Although school size has been found to be more strongly associated than location with some aspects of school climate (e.g., school connectedness; Thompson, Iachan, Overpeck, Ross, & Gross, 2006), the relationship between school size or urbanicity and bullying is unclear (Klein & Cornell, 2010; Nansel et al., 2001; Ma, 2002; Wolke, Woods, Stanford & Schulz, 2001). Moreover, Irish schools tend to be considerably smaller than in many countries. Many "large" Irish schools would be classified as small or medium in other countries, making it difficult to draw conclusions about school size solely from international research.

In terms of school gender composition, almost one-fifth of pupils in all-boys schools experienced bullying on an *about weekly* basis, compared with only approximately one-tenth of those in mixed and in all-girls schools. However, no notable differences in frequency of bullying were evident by school ethos or language of instruction.

Table 3.15: Percentages of pupils in Ireland reporting various frequencies of experiencing bullying, by selected school characteristics

		About weekly	About monthly	Almost never
DEIS	DEIS Urban 1	20	27	53
	DEIS Urban 2	23	29	48
	DEIS Rural	7	23	71
	Non-DEIS	10	24	66
Location	Urban	20	23	57
	Suburban	13	25	62
	Large town	13	27	60
	Small town	8	23	69
	Remote rural	9	25	66
School size	Small	9	24	67
	Medium	11	24	64
	Large	14	26	60
Gender composition	Mixed	11	25	65
	Girls	11	23	66
	Boys	19	26	55

Pupil reports of bullying were aggregated to the school level to create a measure of bullying prevalence for each school. There was considerable variation between schools, with 3% of pupils enrolled in schools where all pupils were classified as *almost never* being bullied. At the other extreme, 7% of pupils were in schools where more than one quarter of pupils experienced bullying *about weekly*.

Bullying and attitudes to school

Pupils who were *almost never* bullied were more likely to express positive attitudes to school than those who were bullied *about weekly* (Table 3.16). In particular, those who were *almost never* bullied were more likely to agree that they belonged in the school than were those bullied *about weekly* (87% and 68%, respectively).

Table 3.16: Percentages of Irish pupils indicating whether they agreed that they liked being in school, belonged in school, and felt safe there, by frequency of being bullied

		About weekly	About monthly	Almost never
I like being in school	Agree	66	70	76
	Disagree	34	30	24
I feel safe when I am at school	Agree	81	89	94
	Disagree	19	11	6
I feel like I belong in school	Agree	68	78	87
	Disagree	32	22	13

In terms of engagement in lessons, those who were *almost never* bullied were more likely to be classified as "engaged" in reading, mathematics and science than those who were bullied either *about monthly* or *about weekly* (Table 3.17), a pattern reflected in other PIRLS and TIMSS countries. Similar but weaker associations were observed between bullying and "liking" these subjects (Table 3.17).

Table 3.17: Percentages of pupils in Ireland reporting various frequencies with which they were bullied, by engagement in, and liking of, each of reading, mathematics, and science

		Frequency of being bullied		
		About weekly	About monthly	Almost never
Reading lessons	Engaged	35	34	48
	Somewhat engaged	51	56	46
	Not engaged	14	10	7
Mathematics lessons	Engaged	31	40	50
	Somewhat engaged	54	50	44
	Not engaged	15	10	6
Science lessons	Engaged	37	47	56
	Somewhat engaged	51	43	38
	Not engaged	12	10	6
Likes reading	Like	33	36	38
	Somewhat like	50	49	48
	Do not like	17	15	14
Likes mathematics	Like	34	42	42
	Somewhat like	36	34	37
	Do not like	30	25	21
Likes science	Like	53	56	62
	Somewhat like	33	30	28
	Do not like	14	14	10

Difficulties in engaging pupils

The preceding sections have examined pupil interest and engagement from the pupil perspective. In this section, we use teacher reports to examine some problems that could be symptomatic of, or contributory factors to, a lack of pupil engagement in the classroom. Teachers were asked about a range of problems that they faced in teaching their classes, and the extent to which these problems limited their teaching.

Disruptive behaviour in the classroom was reported as being *a lot* of a problem for the teachers of 10% of pupils in Ireland and 12% of pupils across all PIRLS countries (Table 3.18). The countries where this figure was notably low (less than or equal to 3%) were Azerbaijan, Chinese Taipei, Georgia, Indonesia, and Romania. Conversely, countries where a notably high percentage of pupils (at least 20%) are taught by teachers who reported that disruptive behaviour limited their teaching *a lot* include Belgium (French), France, Italy, Lithuania, and Slovenia. For the majority of pupils in Ireland, their teachers said that disruptive behaviour is a problem *to some extent* (43%; compared to PIRLS average, 53%) or *not at all* (47%; compared to PIRLS average, 35%).

The teachers of 4% of Irish pupils indicated that uninterested pupils limited teaching *a lot*, well below the international average of 10%. Other countries where very few pupils' teachers indicated that uninterested pupils were a major problem included England, Finland, Germany, the Netherlands, New Zealand, and Northern Ireland. Uninterested pupils were reported to be *not at all* a problem for the teachers of 39% of Irish pupils, higher than the percentages (30% for PIRLS countries, 31% for TIMSS countries) reported internationally.

Table 3.18: Percentages of pupils whose teachers indicated the extent to which various factors limited their teaching, Ireland, TIMSS and PIRLS averages

		A lot	To some extent	Not at all
Disruptive pupils	Ireland	10	43	47
	PIRLS	12	53	35
	TIMSS	13	51	37
Uninterested pupils	Ireland	4	57	39
	PIRLS	10	60	30
	TIMSS	11	58	31
Pupils lacking prerequisite knowledge or skills	Ireland	8	56	37
	PIRLS	11	61	28
	TIMSS	12	61	27
Pupils with special needs (e.g., physical disabilities, mental or emotional/psychological impairment)	Ireland	4	53	43
	PIRLS	8	46	46
	TIMSS	8	44	49
Pupils suffering from not enough sleep	Ireland	6	56	38
	PIRLS	5	43	51
	TIMSS	5	42	53
Pupils suffering from lack of basic nutrition	Ireland	4	18	78
	PIRLS	4	23	73
	TIMSS	5	24	71

That lack of interest among pupils is a relatively small problem for teachers may be considered in light of reports from principals that the majority of Irish pupils are in schools that are characterised as having high levels of teacher and parental support, both of which

might be expected to support pupils' engagement (Blumenfeld & Meece, 1988; Fredericks et al., 2004; Jimerson et al., 2000). For example, about 95% of Fourth class pupils in Ireland are in schools where the teachers are reported to have *high* or *very high* expectations for their achievement, compared to 69% and 74% of pupils at the TIMSS and PIRLS (respectively) averages. More on the attitudes and practices of Irish teachers can be found in Chapter 5 (Clerkin, 2013) of this volume. Furthermore, as will be discussed in Chapter 6 (Eivers & Creaven, 2013), principals' ratings of general levels of parental support for pupils' achievement were also far more positive in Ireland than for either the PIRLS or TIMSS average.

Two common issues identified by teachers as limiting their teaching relate directly to the home environment (Table 3.18). The first is that of pupils coming to class without being sufficiently well-rested. In Ireland, almost two-thirds of pupils (62%) were taught by teachers who said that their teaching was limited *to some extent* or *a lot* because pupils were not getting enough sleep. This is well above the PIRLS (48%) and TIMSS (47%) averages. In some countries – including Australia (68%) and the US (76%) – lack of sleep was reported to be an even greater problem than in Ireland. In others, such as high-performing Singapore (40%), Korea (29%) and Japan (20%), pupils' lack of sleep was much less of an issue than in Ireland.

Two features that may be worth noting in this regard are that 54% of the Fourth class pupils in Ireland reported that they had a TV in their bedroom, while 19% had a computer in their bedroom. Pupils attending DEIS schools were much more likely to report having a television in their bedrooms. A large majority of pupils in both Urban Band 1 (78%) and Band 2 schools (74%), and a smaller majority of pupils in DEIS Rural schools (63%) reported having a TV in their bedroom, compared to 49% of pupils in non-DEIS schools.[5] Nationally, Fourth class boys (58%) were somewhat more likely than girls (49%) to have a TV in their bedroom.

Lack of basic nutrition was also identified as a problem by the teachers of 22% of Irish pupils, of whom 4% say that poor nutrition among pupils limits their teaching *a lot*. These figures are broadly in line with the international averages. However, pupils coming to class lacking proper nutrition was a more common problem in Ireland than in some of our comparison countries, including Northern Ireland (where no pupils were taught by teachers whose teaching was limited *a lot* by pupils' lack of nutrition, and 20% were in classes where teaching was limited *to some extent*), Singapore (1% of pupils in classes where teaching is limited *a lot*, and a further 13% limited *to some extent*), and Finland (less than half a percent of pupils in classes where teaching is limited *a lot*, and only 9% in classes where teaching is limited *to some extent*).

Discussion

Although most pupils in Ireland liked their school, Irish pupils were nonetheless twice as likely as the TIMSS and PIRLS international averages to *disagree a lot* that they liked being in school. Irish pupils were also slightly less likely than the average to express a feeling of belongingness at their schools, although the difference between Ireland and our comparison countries on this measure is less marked. Given the substantial portion of their time that pupils spend in school, and the fact that lower liking of school is linked to higher rates of absenteeism even among primary-aged pupils (Thornton, Darmody, & McCoy, in press), our

[5] As questions about a TV or computer in the bedroom were Irish national additions, no international comparative data are available.

findings suggest that efforts are needed to foster and maintain engagement and enthusiasm among pupils who do not perceive the school environment as a positive one.

Consistent with previous research (Eivers et al., 2010; Williams et al., 2009), boys reported much more negative views of school than girls. In PT 2011, the percentages of boys who either *strongly agreed* or *strongly disagreed* that they liked school (26% and 21%, respectively) were reasonably comparable. In contrast, girls were seven times more likely to *strongly agree* than to *strongly disagree* that they liked school (42% and 6%). Pupils in DEIS Urban Band 2 (but not Band 1) schools consistently reported lower affective engagement with school than pupils in other DEIS categories or pupils in non-DEIS schools. However, multilevel analyses of the GUI dataset revealed no association between 9-year-olds' liking of school and schools' DEIS status (McCoy et al., 2012). This suggests that secondary analyses of the PT 2011 data might explore the relationship between engagement and socioeconomic disadvantage in greater detail, incorporating information provided by the pupils' parents.

PT 2011 revealed that the experience of being bullied is less frequent in Irish classrooms than in most other countries, with two-thirds of Irish pupils almost never experiencing bullying at school. Ireland ranked best among our key comparison countries on this measure. Overall, pupils in only four countries from among all PIRLS and TIMSS participants reported lower rates of bullying than that reported by Irish pupils. This, in conjunction with principals' ratings of school safety and discipline suggests that Irish schools provide a safe environment for pupils, safer than those found in most other countries.

Although the overall prevalence of bullying was relatively low in Ireland, bullying remains a significant problem for some groups of pupils. For example, EAL pupils were more likely to experience each of the six types of bullying listed than were non-EAL pupils. In addition, the proportion of pupils being bullied weekly was twice as high in DEIS Urban schools as in non-DEIS and DEIS Rural schools. The findings suggest that teachers of EAL pupils, and teachers in DEIS Urban schools in particular, may need additional support to tackle bullying in their classrooms.

The *Students Bullied at School Scale* does not explicitly assess cyberbullying, and may thus underestimate the frequency of bullying. However, as face-to-face bullying has been found to be more common than bullying online (O'Neill, Grehan, & Ólafsson, 2011), the measure probably captures much of the bullying experienced by Fourth grade pupils. As well as being associated with lower achievement in reading, mathematics, and science, being bullied appears to be associated with lower engagement in lessons across all three domains, and to a lesser extent, with *liking* these subjects. Being bullied was also associated with lower endorsement of statements about liking of, feeling safe at, and belonging in school. Thus the PT 2011 data underscore findings from previous research showing that bullying can have profound effects on children's well-being as well as academic achievement. As noted earlier, the association between bullying and achievement on the measures of reading, mathematics and science is explored in more detail in Chapter 10 (Cosgrove & Creaven, 2013).

In general, attitudes to reading and to science were positive. Proportionally more pupils in Ireland expressed a liking of each subject than did their Fourth grade peers internationally, particularly so in the case of reading. Such pupils also achieved higher scores than their classmates who did not like the subjects. Relatively more girls than boys in Ireland liked reading, and one-fifth of boys reported that they *do not like* reading – twice the corresponding percentage of girls. Boys, on the other hand, were marginally more likely than girls to report liking science.

In contrast to the relatively positive attitudes towards reading and science, fewer pupils in Ireland than in most other countries liked mathematics, and more expressed a dislike of mathematics. The gap in mathematics achievement between pupils who *like* and *do*

not like the subject is smaller than for reading or science. Gender differences in liking of mathematics were less apparent than in the other two domains, but the high proportion of Fourth class pupils (one in five girls and one in four boys) who report that they don't like mathematics at this early stage in their education (see also McCoy et al., 2012) is a concern.

Teacher reports suggested that, in a significant minority of Irish classrooms, teaching practices were constrained by pupils not receiving adequate nutrition.[6] Concerns have been expressed previously about a lack of connection between Irish pupils' understanding of healthy and unhealthy foods, and their relative consumption of each type and general eating patterns (Broderick & Shiel, 2000). Pupils' ability or motivation to pay attention and work in class may be impaired as a result of poor nutrition (Cooper, Bandelow, & Nevill, 2011), which is more likely to be found among girls and children from low-SES families. For example, in an Irish context, a World Health Organisation study found that 11-year-old girls were slightly more likely than boys to skip breakfast in the mornings, and that children from lower-SES families were much less likely to eat breakfast on a school day (Currie et al., 2012).

Some limited funding is available for schools to organise breakfast clubs for their pupils,[7] and supporting information and resources are also available from websites such as www.healthyfoodforall.com (see, e.g., Foley, 2011). Many schools avail of these resources. However, a small number of teachers in Ireland nonetheless report that insufficient nutrition among their pupils limits their classroom participation *a lot*. Also, lack of basic nutrition remains a problem at least *to some extent* for more than one-fifth of children in Fourth class. These figures compare poorly with some of our comparison countries, including Northern Ireland, Singapore and Finland, and are similar to the international averages, perhaps surprisingly given Ireland's status as an economically-developed nation.

Lack of sleep appeared to be a widespread problem in Ireland, with almost two-thirds of Irish pupils taught by teachers who said it was limiting their instruction. This is a finding of particular concern. Insufficient rest can impair pupils' concentration and attention in class (Meijer, 2008). It has also been associated with lower enjoyment of school (Garmy, Nyberg, & Jakobsson, 2012) and with elevated risk of obesity (Chen, Beydoun, & Wang, 2008).

It may be the case that some parents are unaware that their children are not getting enough sleep. For example, while most may consider about eight hours of sleep per night to be typical for adults, it is less well known that a 10-year-old typically needs about 10 hours (Chen et al., 2008). However, inadequate sleep may also be related to the widespread availability of TVs in Irish children's bedrooms, and, for a substantial minority, a computer too. Garmy et al. (2012) reported that a TV in the bedroom and prolonged computer use were both associated with sleep deprivation in school-aged children, while Eivers et al. (2010) found that pupils with a TV in their bedroom tended to have fewer (or no) books at home and achieved lower reading and mathematics scores than pupils without their own TV.

Combined, lack of sleep and lack of basic nutrition can represent significant barriers for pupils' engagement with school, and the evidence would suggest that the combination is most common among children from less affluent families. Indeed, within Ireland, problems with children not getting enough sleep and receiving poor or inadequate nutrition have been implicated as factors that "militate against school completion", particularly in socioeconomically-disadvantaged areas (Downes, Maunsell, & Ivers, 2006; Downes &

[6] As the question asked about "lack of basic nutrition", teacher responses are likely to encompass both lack of food (e.g., pupils coming to school hungry) and lack of appropriate food (e.g., pupils with an unhealthy diet).
[7] http://www.welfare.ie/en/Pages/School-Meals-Programme.aspx (last verified, 7th May, 2013).

Maunsell, 2007). Efforts to ensure that children receive appropriate rest and nutrition might therefore be expected to have a positive impact on pupils' liking of and engagement with school, on attendance rates, academic performance, health, and wellbeing.

Additional references

This section does not repeat the core references already listed in Chapter 1. These include the three international reports and the Irish national report on PT 2011, and those related to other key studies such as National Assessments and PISA.

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Chapter 4
Pupils' languages

Eemer Eivers

Introduction

Globalisation and changes in migration patterns have contributed to rapid socio-cultural changes in societies. However, while labour markets and broader society adapt to more diverse populations, education systems have generally been slower to address diversity. Children of migrant parents are often seen as a challenge to the education systems in their new country – "the successful integration of immigrant students into the education system presents a central concern to many countries worldwide" (OECD, 2006, p. 7). Within the microcosm of the school, migrant children are perceived to be at risk of poorer educational outcomes (early dropout, poorer exam performance), of limited participation in school life, and are sometimes characterised as a drain on scarce resources. Schools can be left the task of integrating migrant children and their families not only into a new education system, but also into new social and cultural norms.

In Ireland mass immigration is a relatively recent phenomenon. As a result, there are many data gaps related to the experiences of migrant children in Irish schools. It is against this changing cultural backdrop that the data from the PIRLS and TIMSS 2011 (PT 2011) studies can be interpreted. The PT 2011 data build on the relatively limited information available on the "non-traditional-Irish" pupil in the classroom, and, for the first time, allow for comparisons with other countries. Information on pupils' home background was gathered from pupils and parents in PT 2011. As noted in Chapter 1 (Eivers & Clerkin, 2013), countries that took part only in TIMSS did not survey parents. Thus, most analyses in this chapter are based on the PIRLS dataset.

The remainder of this chapter is presented in five main sections, the first of which provides a broad introduction to changes in the Irish population generally, and changes in schools in particular. The second section outlines why the focus in this paper is on language spoken (rather than, for example, migrant status). Section three outlines some of the languages spoken in PT 2011, and country-by-country differences in the percentages of pupils who mainly spoke a language other than the language in which they were tested. Achievement differences, by language, are also outlined. The fourth section focuses on Ireland. It examines the distribution of second language and additional language speaking pupils within Ireland and summarises selected home and school characteristics of those pupils. Finally, the main findings are discussed and some conclusions are drawn. Readers should note that this chapter examines only a subset of the PT 2011 data. Those who would like more general information about PT 2011 are referred to Chapter 1 of this volume.

Changes in the population and education system

Until the 1990s, Irish primary school classrooms were largely mono-cultural, mono-ethnic, and featured only two languages (English and Irish). However, the net immigration that characterised the period from the mid-1990s until 2007 has led to major changes in the

composition of Ireland's population. Census data from the period 1996 to 2011 show that the percentage of the population born in the Republic of Ireland gradually dropped, from 93% (1996) to 90% (2002), to 85% (2006), and currently is at 83%.[1] Until very recently, the percentages of the population born outside Ireland probably suggested a more diverse population than was the case. If those born in Northern Ireland, Scotland, England and Wales are excluded (i.e., English-speaking and sharing many cultural characteristics) the percentage of Ireland's residents born "elsewhere" in 1996 was a mere 1.7% – few of whom were children. This rose to 9.2% by 2006 and in the 2011 Census was 10.6% – a more than six-fold increase in just 15 years.

Changes in the population have been reflected in classroom composition, albeit in a slightly delayed manner. Between the 2006 and 2011 censuses, there was a 50% increase in the number of "non-Irish national" children, much higher than the increase in the adult non-Irish national population (Central Statistics Office [CSO], 2012b). This suggests that Irish classrooms are starting to reflect the diversity found in the adult population. Unfortunately, very little school-based data are available beyond the past few years. For example, Ireland has carried out periodic National Assessments of reading and/or mathematics achievement among primary school pupils since the early 1970s. The studies have always collected a large amount of contextual data, yet 2004 was the first time that information was sought on country of birth or language of the home. Then, depending on grade level, between 8-10% of pupils were born outside Ireland, but less than 3% spoke a language other than English or Irish with their parents (Eivers, Shiel, Perkins, & Cosgrove, 2005).

In the 2009 National Assessments, 14-15% of pupils were born outside Ireland and 6-10% normally spoke a language other than English or Irish with their parents (Eivers et al., 2010). Thus, even within the short time between 2004 and 2009, differences are apparent. Data from Census 2011 revealed that 11% of Irish residents spoke a language other than Irish or English at home (CSO, 2012a). Although slightly higher than the percentage reported in the most recent National Assessments, it is broadly comparable because the census did not ask which language was *normally* spoken, and will therefore include languages spoken only on an occasional basis.

The Irish education system's initial response to population changes was based on an asylum-seeking model but gradually changed to recognise that most people who migrated to Ireland did so for economic reasons. Thus, the (then) Department of Education and Science (DES) set up the Refugee Language Support Unit in 1999, but the unit was subsequently reconstituted in 2001 as Integrate Ireland Language and Training (IILT). The first significant departmental publication related to the needs of non-Irish pupils was entitled "Information booklet for schools on asylum seekers" (DES, 2000). Much of the content related to explanations of government policy on asylum seekers, and issues related to their legal status and accommodation. Content specific to education largely focussed on human rights and anti-racism education. Relatively little attention was directed at language.

IILT's 2003 publication "Integrating non-English speaking pupils into the school and curriculum" was indicative of changing perceptions of migrant pupils. While it also outlined issues related to the legal status of such children, its primary focus was cultural integration and language support. The next significant DES document – Circular 53/07: Meeting the needs of pupils for whom English is a second language – completed the change. Asylum-seekers were no longer the focus, and the issues addressed were not socio-emotional and

[1] Data were retrieved from the Central Statistics Office interactive database, http://www.cso.ie/en/census/ on February 21, 2013.

cultural issues, but specific to language difficulties. Circular 53/07 defined three proficiency levels in English, and specified at which levels additional resources should be directed.

From an almost non-existent budget prior to 2000, educational spending on children for whom English was an additional or a second language (EAL/ESL) grew in an exponential and somewhat poorly planned manner. The recently published Value for Money review of provision for migrant pupils across the period 2001-2009 found that expenditure increased from approximately €10 million in 2001/02 to approximately €140 million in 2008/09, while related teaching posts (primary and post-primary) rose from 260 to over 2,100 during the same period (DES, 2011). However, the review also found a lack of strategic planning for delivery of services to migrant children, suggesting that the original ad hoc solution for small numbers of pupils had been inappropriately applied as a system-level solution for large numbers of pupils, making it neither efficient nor effective. In particular, the review criticised the lack of initial or continuing professional development (CPD) for EAL posts. For example, almost all EAL funding was consumed by teacher salaries, with only 0.7% spent on CPD, despite the fact that EAL support had not featured in most teachers' initial teacher education.[2]

Since the review, provision of additional support for EAL pupils has been re-structured. In 2012, the General Allocation Model of support was altered to combine general allocation and language support into a single allocation of "additional support" for all primary schools (DES, Circular 007/12). Specific additional support for EAL is currently provided only for schools with high concentrations of EAL pupils. Thus, over a relatively short period, educational provision for "non-traditional Irish" children has changed from non-existent, to limited provision targeted at problematised asylum-seekers, to large-scale, ad hoc provision based on limited English proficiency, and is now broadly subsumed under a general umbrella of children in need of additional educational support.

Why focus on language?

It is important to define the group of pupils that are the target of the rest of this chapter. The classification of non-native-born children (or children of migrant parents) in any population can be quite complex, as reflected in the variety of terms used in schools, the media, and in research. For example, in addition to migrants, pupils are sometimes referred to as non-native Irish, second-generation, newcomer, non-English speaker, ESL or EAL. Classification can be based on one or more of the following, often overlapping, criteria: country of birth, parental country of birth, parental language(s), length of time living in Ireland. An additional consideration is ethnic minority status, which may be assigned based on factors such as nationality, skin colour, religious beliefs, or culture (as in the case of members of the Traveller community).

As part of PT 2011, the relevant data collected related to language(s) spoken in the home, teacher reports about pupils who experienced difficulty speaking the language of the test, and principal teacher reports on the percentages of school enrolments for whom the language of the test was a second language. Consequently, the focus of the paper is "additional language" pupils. In an Irish context, these are EAL pupils, operationally defined as those for whom *English* is not the exclusive language spoken at home. In Ireland, PIRLS was considered to be a test of English reading, and therefore was administered in English

[2] Although issues related to EAL and second language learning now feature in initial teacher education, Irish teachers remain more likely than the norm not to have studied it as part of their formal training (teachers of 62% of Irish pupils, compared to a PIRLS average of 43%).

only. In contrast, Irish-medium schools could choose their preferred test language for TIMSS. This meant that some pupils might be considered to have two "languages of the test". As the number of pupils taking the test in Irish was small, and to avoid Fourth class pupils answering a quite complex question about language, the item in the Pupil Questionnaire that asked pupils how often they spoke the language of the test at home referred to English only. Data about speaking Irish were therefore collected from the Parent Questionnaire only.

Within the group of EAL pupils, there may be further possible distinctions. For example, some might always have spoken English and another language at home, others might have spoken *only* another language prior to starting school (i.e., ESL pupils), and others may now speak only English, despite having a parent whose first language is not English.

As neither ethnicity nor place of birth were part of the TIMSS or PIRLS questionnaires, they will not be examined in this chapter. Moreover, from a pedagogic point of view, the issues associated with teaching pupils with limited proficiency in the language of instruction are quite different to those associated with differences in nationality or ethnicity, and merit separate treatment.

Irish research data on the educational achievement and experiences of EAL children (as distinct from migrant children more generally) are relatively sparse, especially in the case of data from larger, quantitative studies. Table 4.1 summarises some achievement data from the 2009 cycles of the National Assessments (NA 2009) (Eivers et al., 2010) and Programme for International Student Assessment (PISA) (Perkins, Cosgrove, Moran, & Shiel, 2012). As can be seen, the percentage normally speaking a language other than English or Irish at home drops as age increases. Thus, while 9% of Second class pupils reported usually speaking another language at home, only 5% of Sixth class pupils and less than 4% of 15-year-olds did so. Whether this reflects different cohorts of children, the gradually anglicising effects of attending school in Ireland, or a mixture of the two is unclear.

Among Second class pupils, those who normally spoke "another" language obtained mean scores that were significantly lower than those obtained by English speakers on both the reading and mathematics assessments. (The comparison is restricted to English speakers and "other" language speakers, as the number of pupils who normally spoke Irish at home was quite small.) At Sixth class, the gap between the two groups for mathematics was much smaller (.22 of a standard deviation) and not statistically significant. In contrast, the gap on the reading assessment was very large (.83 of a standard deviation), and significant. However, the Irish data from PISA 2009 show a significant gap between native and "other" language speakers across each of reading, mathematics and science, with a gap of almost two-thirds of a standard deviation on reading achievement.

Table 4.1: Percentages from NA 2009 and PISA 2009 reporting a usual home language other than English or Irish, and relationship with achievement (expressed as a proportion of a standard deviation)

Study	Target group	"Other" language speakers	Gap between English & "Other" (proportion of SD)		
			Reading	Maths	Science
NA 2009*	2nd class	8.6%	**.62**	**.44**	–
	6th class	5.4%	**.83**	.22	–
PISA 2009**	15-yr-olds	3.6%	**.62**	**.40**	**.44**

Bold denotes a significant difference between English and "other" language speakers.

* Source: Eivers et al., 2010. What language do you speak at home most often? (English/Irish/Other)

** Source: Perkins et al., 2012. What language do you speak at home most of the time? (English/Irish/Other)

Similar data to those in Table 4.1 were collected as part of the 2004 National Assessments and in earlier cycles of PISA. However, until 2009, the numbers of EAL pupils involved were very small (from less than 1% in PISA 2000 and 2003 to just over 2% in NA 2004). This made it difficult to draw any firm conclusions about achievement differences, although, with the exception of PISA 2000, all show the same general relationship (native speakers tend to do better on tests than EAL pupils). Unusually, the Irish data from PISA 2000 showed a very small and non-significant advantage on the reading assessment for "other language" students, a finding probably attributable to the unusually high socioeconomic status of that particular group (Cosgrove, Shiel, Archer, & Perkins, 2010).

Oddities such as PISA 2000 aside, it is a common finding in international educational research that native speakers tend to outperform non-native speakers on assessments of academic achievement (e.g., Martin, Mullis, Foy, & Stanco, 2012; Mullis, Martin, Foy, & Arora, 2012; Mullis, Martin, Foy, & Drucker, 2012; OECD, 2012). Language spoken appears to be more relevant to achievement than immigrant status. For example, the OECD's publication "Where Immigrants Succeed" found that while language spoken in the home accounted for much of the achievement differences between immigrant and native students, the gap remained significant in most countries (OECD, 2006). Broadly similar findings were reported in the 2004 and 2009 National Assessments (Eivers et al., 2005; Eivers et al., 2010). Further, immigrants, even well-educated ones, tend to be clustered in socio-economically disadvantaged areas, and immigrant children tend to be overrepresented in "disadvantaged" schools (OECD, 2012).

Given the reported achievement gaps, it is perhaps not surprising that a deficit model is often applied to additional language pupils (Arzubiaga, Noguerón, & Sullivan, 2009). Not only are the children perceived to be "deficient" in their English proficiency, but the system is perceived to be deficient in how it prepares teachers to deal with their deficiencies (during both initial teacher education and CPD) (Lyons & Little, 2009). Similarly, EAL pupils are often described in terms of "challenges" to be faced. For example, when asked to list their three most serious challenges to the teaching of English, dealing with pupils from non-English-speaking families was one of those most frequently cited by principals in NA 2009. Specific issues reported by teachers include fears that communication with EAL pupils' homes can be of lower quality in cases where the pupils' parents do not speak English themselves, a lack of knowledge about the pupils' competency in their native language, and a need for pupils to learn not only the formal language of instruction but also the informal social customs of their new school (Kitching, 2006; Wallen & Kelly-Holmes, 2006).

The view of EAL pupils as problematic is pervasive. As most readers are probably aware, the reading and mathematics performance of Irish 15-year-olds on PISA 2009 was considerably poorer than in previous cycles. One consequence was an attempt in some quarters to blame much of the decline on the increase in EAL and migrant children in Irish classrooms. While PISA 2009 data do show that children born outside of Ireland generally obtained lower scores on the assessments than did their native-born counterparts, they also show that the numbers of students involved is smaller in Ireland than in most countries, and that most non-Irish-born students spoke English. Indeed, if only "native Irish" students are considered, the drop in reading performance between 2000 and 2009 reduces to 26 points, slightly less than the overall drop of 31 points, but still the largest decline among participating countries (Perkins et al., 2012).

However, many teachers have also identified positive aspects of having EAL pupils in their classrooms, including satisfaction with the rapid progress of motivated, appreciative learners, satisfaction with their own contribution to (often) accelerated pupil success, and the stimulation of working with pupils from different cultures (Devine, 2011; Kelly, 2010; Wallen & Kelly-Holmes, 2006).

Pupil language in PT 2011

Ireland is by no means unique in having a multilingual pupil population or in having two official languages of instruction. While a majority of countries that took part in PT 2011 tested in only one language, a sizeable minority did not. For example, of the 50 countries that took part in TIMSS Fourth grade, 16 tested in at least two languages. Most PT 2011 countries were like England, having a single language of instruction and a single language for the test materials. However, other countries such as Canada and the Slovak Republic are similar to Ireland in that different schools may have different languages of instruction. In these countries, test and questionnaire materials were translated into the languages of instruction.

Other participating countries have an official language of instruction that differs from the national language or the language(s) most commonly spoken in homes in that country. For example, in Singapore, there are four official languages (Malay, English, Mandarin and Tamil) of which Malay is the national language, yet English is the language of instruction in all schools and all pupils were tested in English (Ang et al., 2012). Another language model applies in countries such as Malta, where the two official languages (Maltese and English) are also the two languages of instruction, in an education system based on bilingualism, yet where the tests were administered in English only (Firman & Camilleri, 2012).

This illustrates the difficulty in assigning a uniform meaning to *language of instruction* or *language of the test*. It may be mother tongue, it may be one of two mother tongues, or it may be a different language entirely. It also illustrates that not every pupil whose home and school language differ are from a migrant family background. Bearing in mind those caveats, the focus in this section is on "additional language pupils" as defined by the match between the pupil's language and the language of the PT 2011 test in his or her school. Thus, a French-speaking Canadian pupil might be considered an additional language pupil if he or she were in a school in British Columbia, but not in a school in Quebec. In the rest of this section, two main sources are drawn on to examine the achievement of additional language pupils – pupils' self-reports, and the language that parents reported children as speaking prior to starting school.

Pupil language: self-report

There was considerable variation between countries in the percentages of pupils reporting that they *always*, *sometimes* or *never* spoke the test language at home. The international study averages for pupils who *always* spoke the language of the test was 72% (TIMSS) and 73% (PIRLS). Thus, at 84%, Ireland had considerably fewer additional language pupils than most countries. Tables 4.2, 4.3 and 4.4 contain information about home language and reading, mathematics and science achievement, respectively. As can be seen, even within the subset of key comparison countries, the percentage of pupils *always* speaking the language of the test at home ranged from 32% in Singapore to 91% in Northern Ireland. Across PT 2011 as a whole, Hungary, Northern Ireland, Poland and Serbia had the highest percentages of pupils (all over 90%) indicating that they always spoke the language of the test at home. In contrast, the most multilingual systems were in Tunisia, Malta, Morocco and Singapore, where no more than one-third of pupils always spoke the language of the test at home.

Tables 4.2 to 4.4 also show that, within country, there are generally very large differences between the mean achievement of those in the *always* and *never* columns. However, as relatively few pupils *never* spoke the language of the test at home, the last column in the Tables shows the gap between the more reliable data for the *always* and *sometimes* groups of pupils. The international average gap between the *always* and the *sometimes*

group is smallest for mathematics (9 points) and is largest for science (17). In Ireland, the gaps for all three domains were slightly larger than the study averages.

Among Ireland's comparison countries, Finland, New Zealand, and the United States show the largest achievement gaps between those who *always* and who *sometimes* spoke the test language at home – at least 25 points on each of the three domains. In contrast the Russian Federation had relatively small differences in the mean scores of pupils – only a 9-point gap for reading, and a 4-point gap for science, while those who *sometimes* spoke the language of the test at home outperformed those who *always* spoke it by 8 points for mathematics.

Table 4.2: Percentages of pupils reporting the frequency with which they speak the language of the test at home, by PIRLS mean achievement scores, Ireland and comparison countries

	%			Mean **Reading** score			Sometimes
	Always	Sometimes	Never	Always	Sometimes	Never	– Always
Australia	79	19	1	531	515	472	–16
England	79	20	1	556	540	503	–16
Finland	89	10	1	571	544	527	–27
Hong Kong SAR	68	28	4	574	572	544	–2
Ireland	84	13	2	556	540	481	–16
New Zealand	74	24	2	543	501	482	–42
N. Ireland	91	8	1	561	552	455	–8
Russian Fed.	85	13	2	571	562	540	–9
Singapore	32	62	6	588	562	518	–26
United States	86	12	2	562	523	511	–39
PIRLS	73	22	5	517	504	466	–13

Note. Differences between *always* and *sometimes* are calculated before rounding, and may differ slightly from calculations on rounded data presented in the table.

Table 4.3: Percentages of pupils reporting the frequency with which they speak the language of the test at home, by mean **mathematics** achievement scores, Ireland and comparison countries

	%			Mean **Maths** score			Sometimes
	Always	Sometimes	Never	Always	Sometimes	Never	– Always
Australia	80	19	1	520	509	460	–11
England	81	17	2	546	529	496	–18
Finland	89	10	1	548	525	518	–23
Hong Kong SAR	66	29	4	607	597	568	–10
Ireland	84	13	2	531	518	495	–13
Korea, Rep.	75	25	<1	602	616	531	+14
New Zealand	74	24	2	494	469	458	–25
N. Ireland	91	8	1	565	556	465	–10
Russian Fed.	85	13	2	541	549	534	+8
Singapore	33	62	6	620	603	572	–18
United States	86	12	2	546	515	488	–30
TIMSS	72	22	6	494	484	453	–9

Note. Differences between *always* and *sometimes* are calculated before rounding, and may differ slightly from calculations on rounded data presented in the table.

Northern Ireland showed relatively small gaps between the *always* and *sometimes* groups of pupils on all three domains (as little as 6 points for science), yet also had among

the largest gaps when those who *never* spoke the test language at home were examined – over 100 points below pupils in the *always* group on each of the three domains. Generally, countries with very few children speaking a different language at home tended to have the largest gap in achievement between the *always* and *never* groups. For example, in Hungary almost all children (97%) *always* spoke the test language, and the achievement gaps between the *always* and *never* groups ranged from 120 to 176 points, depending on domain.

Table 4.4: Percentages of pupils reporting the frequency with which they speak the language of the test at home, by mean **science** achievement scores, Ireland and comparison countries

	%			Mean **Science** score			Sometimes – Always
	Always	Sometimes	Never	Always	Sometimes	Never	
Australia	80	19	1	522	500	463	–22
England	81	17	2	535	503	481	–33
Finland	89	10	1	574	541	492	–34
Hong Kong SAR	66	29	4	542	530	490	–12
Ireland	84	13	2	521	501	458	–20
Korea, Rep.	75	25	<1	584	596	504	+12
New Zealand	74	24	2	508	471	438	–37
N. Ireland	91	8	1	519	513	415	–6
Russian Fed.	85	13	2	554	549	533	–4
Singapore	33	62	6	608	576	532	–32
United States	86	12	2	551	504	475	–48
TIMSS	72	22	6	492	475	438	–17

Note. Differences between *always* and *sometimes* are calculated before rounding, and may differ slightly from calculations on rounded data presented in the table.

Korea did not participate in PIRLS. However, Korean performance on both the mathematics and science assessment in TIMSS is unusual in two regards. First, roughly one-quarter of pupils report that they only *sometimes* speak the language of the test at home, and second, these pupils obtain a higher mean score than those who *always* speak the language of the test at home. This is unexpected, not only because of the higher score for pupils in the *sometimes* group, but also because Korea only has one national language, and very few immigrants. A likely explanation lies with Korea's many private kindergartens. A sizeable proportion are English-medium, and they tend to be popular with wealthier and highly-educated parents. It may be that some parents are speaking English at home to reinforce what is learned in the three years of kindergarten (S. Kim, Korean NRC for TIMSS, personal communication, April 11, 2013).

In Ireland, pupils who reported that they *sometimes* spoke English at home scored above the study centrepoint of 500 for reading (540) and slightly above for mathematics (518), but for science obtained a mean score of only 501. Looking at the 2% of pupils who *never* spoke English at home, their score was well below the centrepoint for science (458), below for reading (481), but almost at the centrepoint for mathematics (495). This suggests that while Irish performance in general is weakest on science, science is particularly problematic for EAL pupils in the Irish education system.

Pupil language: parent-report

Parents were also asked whether their child spoke the language of the test prior to starting school. As parents were provided with dichotomous (*yes/no*) response options, their answers provide a slightly less nuanced view of language of the home than the reports from pupils. However, their answers are highly relevant, as they provide an indicator of pupils'

preparedness for the demands of primary school – that is, at a very basic level, being able to understand the language of instruction. Data are unavailable for England and the United States, as, in common with countries who took part in TIMSS only, the Parent Questionnaire was not administered in either country.

As with pupil reports, there is considerable variation between countries in the percentage of pupils who did not speak the test language (Table 4.5). While almost all pupils in Finland and Northern Ireland spoke the language of the test prior to starting school, this was true of only 82% in Singapore. With almost 7% of pupils not speaking the test language, Ireland was close to the PIRLS international average (8%). Thus, parent reports broadly support data from the Pupil Questionnaires, suggesting that Irish schools have an average to below average proportion of additional language pupils.

Table 4.5: Percentages of pupils described by parents as speaking the language of the test prior to starting school, and related achievement scores*

	Spoke test language, pre-school		Mean gap (No-Yes)		
	% Yes	% No	Reading	Maths	Science
Australia	95	5	–4	+4	–11
Finland	99	1	~	~	~
Hong Kong SAR	97	3	–3	7	–6
Ireland	93	7	–39	–29	–42
New Zealand	94	6	–52	–	–
Northern Ireland	98	2	~	~	~
Russian Fed.	96	4	–31	–6	–20
Singapore	82	18	–33	–24	–36
PIRLS	92	8	–37	–34	–40

Parent questionnaire unavailable for TIMSS-only countries and for England and the United States.
*TIMSS data available only for countries that administered both PIRLS and TIMSS to the same pupils.
A tilde (~) indicates insufficient numbers to generate reliable data.

Comparing pupil and parent reports (equating *never* with *no*), two points are of note. First, at home, pupils were less likely to speak the test language before they began school than at the time of testing. Thus, it is likely that some children who learn the test language in their school bring that language into their home. Second, the overall achievement gaps between those who did or did not speak the language of the test is considerably smaller if parent reports are used. For example, the PIRLS study average gap, based on parent reports of pre-school language, is 37 points, whereas for pupil reports of current language, it is 51 points. In Ireland, the gap on reading achievement based on reported pre-school language spoken is 39 points, compared to 75 for pupils who currently do not speak the language of the test at home. This may reflect differences in how pupils and parents interpret the questions asked. However, it may also be indicative of elevated risk of academic problems for children whose families do not incorporate the language of the school into their home.

EAL pupils in Ireland

The previous section provided a context for the extent of additional language speakers across PT 2011. This section compares EAL pupils with native-speaking pupils in Ireland. Topics covered include the other languages typically spoken, the distribution of EAL pupils within the Irish primary school system (e.g., by DEIS status, school location), educational attainment and employment status of parents, and home and school experiences. As noted earlier, information on whether pupils spoke Irish or not was gathered as part of the Parent Questionnaire only.

Languages spoken

As part of the Parent Questionnaire, parents in Ireland were presented with a list of languages (English, Irish, Polish, Romanian, French, and Other [3]) and asked to indicate which language(s) their child had spoken prior to starting primary school. In addition, parents were asked which language they and their spouse or partner spoke most frequently.

As might be expected, parents indicated that the vast majority of pupils (93%) spoke English before they started school, and English was the language most commonly spoken by mothers (92%) and fathers (91%) (Table 4.6). Five percent of pupils spoke Irish, considerably higher than the less than half a percent of parents. This may reflect attendance at naíonraí or a small number of bilingual households. Among other listed languages, Polish was by far the most commonly spoken (just over 2% of pupils, mothers and fathers). Over 7% of pupils and almost 5% of parents spoke a language other than the five listed. Further information on what these languages were is not available (although Census 2011 data would suggest that Lithuanian is prominent among them [CSO, 2012b]).

Table 4.6: Parental reports of language(s) spoken by pupils prior to starting primary school, and language currently spoken *most often* by parents

Language	% pupil	% mother	% father
English	93.4	92.1	90.8
Irish	5.2	0.4	0.3
Polish	2.2	2.3	2.0
Romanian	0.9	0.3	0.3
French	0.9	0.5	0.5
Other	7.4	4.3	4.6
Not applicable	–	0.1	1.5

Data for pupils include multiple responses and sum to more than 100%. Parent data refer to single language only.

Where do EAL pupils attend schools?

There is some research evidence to support the popular perception that EAL children tend to be unevenly distributed across primary schools. For example, Smyth, Darmody, McGinnity and Byrne (2009) found that, at primary level, so-called newcomer pupils were more likely to be found in those schools that are urban, "disadvantaged", large, had English as the medium of instruction, and a non-Catholic ethos. In a similar vein, Curry, Gilligan and Ward's (2011) analyses of data from the Growing Up in Ireland (GUI) study suggest that what they referred to as "non-traditional Irish" children (children where no parent is Irish-born or from any part of the UK) were slightly over-represented in urban DEIS schools. For example, 23% of "non-traditional Irish" pupils were enrolled in DEIS Urban Band 1 or 2 schools, compared to 14% of "old Irish" pupils. Data from PT 2011 offer some support for these findings.

Parental responses were combined into a family language measure. Pupils were split into those with and those without at least one English-speaking parent. These data were then related to school characteristics – specifically, to school DEIS status, urban/rural location, and to principals' reports on the percentage of their enrolment who spoke English as their first language. In addition, teachers were asked how many pupils in their class

[3] As Census 2011 data had not been released when PT 2011 questionnaires were developed, the languages were chosen based on unpublished NA 2009 data about the languages pupils most frequently reported as spoken in their home.

experience difficulties with spoken English. Nearly two-thirds (62%) of pupils were in classrooms where *no* pupil had difficulty with English, but differences were evident by school location and DEIS status.

DEIS status

EAL pupils were unevenly distributed across schools by DEIS status (Table 4.7). While 82% of pupils who said that they *always* spoke English at home were enrolled in non-DEIS schools, this fell to 65% among the admittedly quite small number of pupils who *never* spoke English at home. The pupils in the *never* group who were enrolled in DEIS schools tended to be urban-based, with less than 5% in DEIS Rural schools. As the number of pupils who *never* speak English at home is very small, Table 4.7 shows data for a combined *sometimes/never* category of pupils. Unlike the very small *never* group of pupils, the combined category is unlikely to be skewed by a small number of atypical pupils.

Table 4.7: Percentage of pupils enrolled in various categories of DEIS status schools, by frequency with which the pupil spoke English at home

Frequency	Urban Band 1	Urban Band 2	Rural	Not in DEIS
Always	8	6	4	82
Sometimes	10	12	5	73
Never	11	19	5	65
Sometimes/Never	*10*	*13*	*5*	*72*
Overall (IRL)	8	7	4	80

Teacher reports largely support the data collected from the pupils. Approximately half of pupils in DEIS Urban Band 1 (48%) and Band 2 (52%) schools were in classes where their teacher indicated that no pupils had difficulty with spoken English, a good deal lower than the percentage in DEIS Rural schools and non-DEIS schools (65% in both cases). Indeed, no DEIS Rural school had more than one pupil per class who had difficulty with spoken English. In contrast, 32% of pupils in DEIS Urban Band 1 schools and 48% in Urban Band 2 schools had more than one such pupil in their class. Thus, the data suggest that DEIS Urban schools have higher concentrations of pupils likely to be in need of EAL assistance.

Location, size and gender composition

In addition to a relative overrepresentation in DEIS Urban schools, EAL pupils were more likely to be concentrated in urban areas, generally (Table 4.8). Nationally, 18% of pupils attended schools in remote rural areas, compared to only 9% of pupils who indicated that they *sometimes/never* spoke English at home.

Table 4.8: Percentage of pupils enrolled in schools in various locations, by frequency with which the pupil spoke English at home

Frequency	Urban	Suburban	Small city/ large town	Small town	Remote rural
Always	11	17	23	30	20
Sometimes	15	20	32	24	9
Never	18	16	37	22	7
Sometimes/Never	*16*	*19*	*33*	*23*	*9*
Overall (IRL)	11	17	24	29	18

Teacher reports also suggest differences in the distribution of EAL pupils by school size and location. Almost 80% of pupils in small schools had no pupils with spoken language difficulty in their classroom, compared to approximately 60% of pupils in medium-sized schools, and only half of those in large schools. Likewise, almost 80% of pupils in small town or remote rural schools were in classrooms where teachers reported that no pupils had spoken language difficulty. This dropped to 57% for pupils in medium size cities, 44% in suburban areas, and 32% in urban schools. Half (50%) of pupils in urban schools were in classrooms where more than one pupil had difficulty with the spoken language of the test.

Three-quarters (75%) of pupils who *always* spoke English at home were enrolled in mixed-sex schools, compared to 69% of those who *sometimes* and 52% of those who *never* spoke English at home. Teacher reports also suggest differences by school gender composition. Over two-thirds (68%) of pupils in mixed schools had no pupils with spoken language difficulty in their classroom, compared to 60% of pupils in all-girls schools, and only 34% of pupils in all-boys schools. In a related vein, pupils in all-boys schools were much more likely to be in a class where more than one pupil had language difficulties (58% compared to 31% in all-girls schools), with pupils in mixed schools being least likely to be in such a classroom (16%). The data for mixed sex schools may be a reflection of location – most rural schools tend to be mixed. However, reasons for the higher incidence of difficulties with spoken English in all-boys schools are less apparent. They may perhaps be attributable to a greater propensity for boys to have language difficulties (e.g., Hammer, Farkas, & Maczuga, 2010; Shriberg, Tomlin, & McSweeny, 1999), and for slightly fewer boys than girls to speak English at home (as will be described later).

Patronage and language of instruction

Of the relatively few pupils in PT 2011 enrolled in schools where the patron/ethos was other than Roman Catholic, most were enrolled in schools with a Church of Ireland ethos. Thus, Table 4.9 presents data for Catholic and Church of Ireland schools separately, but combines data for other types of schools to preserve anonymity. The data partly reflect Smyth et al.'s (2009) finding that schools with a non-Catholic ethos tended to have slightly higher percentages of pupils for whom English was an additional language. At 89%, Church of Ireland schools had the highest percentage of pupils who reported *always* speaking English at home. In contrast, only 73% of pupils in schools with an "other" ethos or patronage model did so. Again, a cautionary note is needed, due to the very small numbers of "other" ethos schools. A larger sample of such schools would be needed to establish if a more diverse enrolment is a consistent feature or limited to new schools in newly built areas, most of which tend to not assume a Catholic patronage.

Table 4.9: Percentage of pupils enrolled in schools of different patronages, by frequency with which the pupil spoke English at home

Frequency	Catholic	Church of IRL	Other
Always	85	89	73
Sometimes	13	11	26
Never	2	0	1
Sometimes/Never	*15*	*11*	*27*
Overall (IRL)	93	4	3

In the case of Irish-medium schools, data from the Parent Questionnaire about the languages pupils spoke prior to starting school were substituted for the Pupil Questionnaire data used elsewhere. This was done to distinguish between pupils in Irish-medium schools

who spoke English *and* Irish at home (and who were not considered to be EAL pupils), and pupils who spoke "another" language at home. As can be seen from Table 4.10, Irish-medium schools are almost entirely devoid of EAL pupils. Just under half a percent of the enrolment of Irish-medium schools did not speak English prior to starting school, compared to 7% of pupils in English-medium schools. Parent reports are supported by data from teachers. Teachers in Irish-medium schools reported that none of their pupils had difficulty with spoken English.

Table 4.10: Percentage of pupils enrolled in English- and Irish-medium schools, by parental reports of whether the pupil spoke English or not prior to starting school

	English	Irish
Yes	93	100
No	7	<1

EAL pupils: perceptions of clustering

This section compares principals' perceptions of the percentage of their school's enrolment that are EAL pupils with a percentage derived from parent and pupil reports. Pupils with *at least one* parent who reported that English was the language they spoke most frequently were considered to have English as their first language. Given the combination of at least one English-speaking parent and living in an anglophone country, it seems reasonable to classify such pupils as native English speakers or bilingual, as distinct from speaking English as an *additional* language. Where data from the Parent Questionnaire were missing, Pupil Questionnaire responses were used (those who *sometimes* or *never* spoke English at home were considered to be EAL pupils).

For each school, the percent of Fourth class pupils who were EAL pupils was calculated and used as a proxy for the percent of EAL pupils within their school as a whole. This was compared against principals' estimates of the percentage of their school's pupils for whom English was not their first language. This provided another measure of the extent of clustering of EAL pupils within certain schools, and allowed for a comparison of principal estimates versus parental reports.

There are slight differences between parental reports of home language and principals' perceptions of same (Table 4.11). Both principal and parent reports suggest that roughly 60% of pupils attending English-medium schools were in schools where almost all pupils (i.e., more than 90%) spoke English as their first language. However, while parent reports suggest that only 9% of pupils attended schools where fewer than three-quarters have English as their first language, principal estimates suggest that 19% of pupils are enrolled in such schools.

Table 4.11: Principal estimates and parental reports (aggregated to school level) of the percentages of pupils within a school whose first language is English

% native speaking pupils in the school	Source	
	Principal	Parent
More than 90%	61%	59%
76% to 90%	20%	32%
51% to 75%	15%	7%
26% to 50%	3%	2%
25% or less	1%	0%

Data are based on a common set of 134 schools. Schools excluded are those teaching through Irish and those for which the School Questionnaire was not returned (i.e., no principal estimates are available).

The parental data relate to the Fourth class sample only, whereas principal estimates refer to the school unit. However, it is unlikely that the overall composition of Fourth class is systematically different from the composition of the school enrolment as a whole. Also, some pupils were excluded due to limited English proficiency, and their parents did not complete a Parent Questionnaire. Again though, this does not explain the disparity as only 18 pupils (0.4%) were excluded for this reason. In a related vein, differential response rates to the Parent Questionnaire by English- versus non-English-speaking parents cannot account for the different data. First, parental response rates were high, irrespective of language of the home (for example, there was a 96% completion rate for pupils who *always* spoke English at home versus 94% for those who *sometimes* or *never* did so). Second, in the small number of cases where parental information was missing, pupil data were substituted.

Parent reports are based on a description of their own personal characteristics, while principal reports are an estimate of a school-level characteristic. On balance, it seems likely that parent reports are more accurate. It may be that principals have included in their estimates any child for whom only one parent is not an English language speaker, even if the other parent normally speaks English. Another possible explanation is that the view of EAL pupils as a "challenge" leads to a slight over-estimation of such pupils.

Background characteristics of EAL pupils

There is little doubt that the home environment experienced by children – in terms of wealth, of support for academic achievement, and in the "social capital" provided – is strongly related to academic achievement (e.g., Davis-Kean, 2005; Dupéré, Leventhal, Crosnoe, & Dion, 2010). However, there is relatively little Irish research examining how the home environments of EAL pupils differ from those of native speakers. What does exist tends to examine immigrants in general, is typically based on teacher perception rather than parent or pupil reports, and tends to be qualitative and/or related to a discrete location (e.g., Devine, 2005; Smyth et al., 2009).

An exception is Curry et al.'s (2011) use of GUI data. Using data from 9-year-old cohort, they suggest that "non-traditional Irish" children tended to have fewer books in their homes, but to make greater use of school and public libraries. They also found that such pupils had higher absenteeism rates, and were marginally more likely to have experienced bullying in school but were more positive about school, generally, and about mathematics in particular, than their "traditional Irish" counterparts. Parents of non-traditional Irish pupils provided homework assistance less frequently, and typically were well educated but not well paid. Thornton, Darmody and McCoy (in press) – using the same GUI dataset – also found that 9-year-olds whose mother was not a native English or Irish speaker were nine times more likely to have a poor attendance record, whereas children whose mothers were "immigrants" (defined as born outside of Ireland) had few attendance problems.

Although largely focused on psychological well-being, Fanning, Haase and O'Boyle's (2011) study is also relevant, as they speculated that the relatively high levels of well-being among a sample of immigrant children in Dublin was attributable to the comparatively high levels of parental education (and associated additional cultural and social capital). More generally, they noted the atypical pattern, whereby "Ireland is in a somewhat extreme position in that immigrant educational advantage over the native population is quite large" (p. 174). This concurs with Curry et al.'s findings, and suggests that research from other countries on the home and educational experiences of migrant children might not apply so well here. As such, the (albeit quite limited) data from PT 2011 are particularly welcome.

EAL pupils' parents

A small amount of information about the characteristics of parents of EAL pupils can be gleaned from the Parent Questionnaire. Both mothers and fathers of EAL pupils tend to be well educated (Table 4.12). For example, 30% of mothers and 28% of fathers have been educated to at least degree level, slightly higher than the 23% of mothers and 22% of fathers of native-speaking pupils. However, at the other end of the spectrum, a slightly higher percentage of parents of EAL pupils than of native speakers had no educational qualifications.

Table 4.12: Paternal and maternal educational attainment, by whether pupil is classified as EAL or native* speaker

Highest level completed	Father		Mother	
	% Native	% EAL	% Native	% EAL
None	<1	<1	<1	1
Some primary/post-primary	9	14	5	11
Junior Cert. or equivalent	20	7	13	5
Leaving Cert. or equivalent	19	19	19	18
PLC or equivalent	12	10	14	11
Third-level cert. or diploma	17	19	25	21
Degree	13	15	15	20
Postgraduate degree	9	13	8	10
N/A	2	4	<1	3

"Native" defined as at least one English- or Irish-speaking parent, or, if parent data are missing, by "always" speak language of test at home.

EAL pupils were slightly less likely to have a parent in employment than were native speaking pupils (Table 4.13). While the fathers of 73% of native speakers were in full-time employment, this was true of only 59% of EAL pupils' fathers. Maternal full-time employment rates were reasonably similar (29% for mothers of native speaking pupils, versus 33% for mothers of EAL pupils), but a larger percentage of mothers of native speakers were in part-time employment (32% versus 20%, respectively).

Table 4.13: Paternal and maternal employment status, by whether pupil is classified as EAL or native* speaker

	Father		Mother	
	% Native	% EAL	% Native	% EAL
Full-time	73	59	29	33
Part-time	6	12	32	20
No paid work	7	9	18	20
Other	9	12	12	17
N/A	5	7	9	11

"Native" defined as at least one English- or Irish-speaking parent, or, if parent data are missing, by "always" speak language of test at home.

The Parent Questionnaire asked parents a series of questions about their child's school, and their views on inclusivity, safety and pastoral care. Parental responses in general are discussed in more detail in Chapter 6 (Eivers & Creaven, 2013). In the context of the present chapter, some positive findings emerged. As shown in Table 4.14, there was little difference between parents of EAL and of English-speaking pupils on how they rated their

child's school on inclusivity, safety and pastoral care. Almost all parents either *agreed a lot* or *agreed a little* that their child's school included them in their child's education, provided a safe environment, and cared about their child's progress in school.

Table 4.14: Percentage of pupils whose parents *agreed a lot* or *agreed a little* that the school included them, was a safe environment, and cared about their child's progress, by frequency with which the pupil spoke English at home

	School includes me	School is a safe environment	School cares about progress
Always	92	98	99
Sometimes	92	97	97
Never	88	97	97
Sometimes/Never	*91*	*97*	*97*
Overall (IRL)	92	98	98

Similar to the findings of Curry et al.'s (2011) analyses of GUI data, parents of EAL pupils were slightly less likely to help their children with schoolwork (Table 4.15). For example, only slightly more than half of pupils who *sometimes* or *never* spoke English at home received daily or near daily help with either reading or maths. In contrast, among pupils who *always* spoke English at home, 59% received almost daily help with reading and 58% received daily or almost daily help with mathematics. Pupils who *sometimes* or *never* spoke English at home received general help with homework less regularly than those who *always* spoke English at home, with the difference most pronounced for the small number of pupils in the *never* group (less than half received daily or near daily help). While almost all parents reported ensuring time was set aside for homework, it was slightly less common among parents whose child *sometimes* or *never* spoke English at home (89% versus 96% among those who *always* spoke English).

Table 4.15: Percentages of pupils whose parents engage in various homework-related activities with them on a daily or near daily basis, by frequency with which the pupil spoke English at home

	Help practise reading	Help practise maths skills	Help with homework	Ensure time for homework
Always	59	58	70	96
Sometimes	53	54	62	90
Never	40	38	46	80
Sometimes/Never	*51*	*52*	*60*	*89*
Overall (IRL)	58	57	69	95

However, two broader patterns are worth noting. First, in most countries in PT 2011, parents of additional language pupils tended to be slightly less involved in homework than parents of native-speaking pupils. Second, as discussed in Chapter 6 (Eivers & Creaven, 2013), parents in Ireland generally displayed higher levels of involvement in their child's homework than did parents in other countries. Thus, even though only 60% of EAL pupils in Ireland received almost daily help with homework, this was higher than the overall international average of 55% (i.e., including native and additional language pupils) across all PIRLS countries.

EAL pupil characteristics

The small numbers of pupils who *never* spoke English at home were older than other pupils (10.6 years of age versus an overall Irish average of 10.3 years) (Table 4.16). Although one might expect equal numbers of boys and girls among EAL pupils, in Ireland, slightly more boys (3%) than girls (only 1.6%) reported *never* speaking English at home. [4] Most pupils had attended pre-school, but attendance was less common among the *sometimes/never* group of pupils than among those who *always* spoke English at home (77% versus 90%, respectively). In addition to lower likelihood of pre-school attendance, EAL pupils tended not to enrol in school at as early an age as native speaking pupils. Whereas almost all (98%) of pupils in the *always* group had started school no later than age 5, only 77% of those in the *sometimes/never* group (and only 54% of pupils who *never* spoke English at home) had done so.

Table 4.16: Pupil age, sex and early educational experiences, by frequency with which the pupil spoke English at home

	Current age	% Girls	% Boys	% Attended pre-school	% Started school at 5 or younger
Always	10.3 yrs	85%	84%	90%	98%
Sometimes	10.3 yrs	13%	13%	79%	80%
Never	10.6 yrs	2%	3%	65%	54%
Sometimes/Never	*10.4 yrs*	*15%*	*16%*	*77%*	*77%*
Overall (IRL)	10.3 yrs	49%	51%	88%	95%

In terms of resources – educational and otherwise – found in the home, EAL and English-speaking pupils were quite similar. Almost all pupils (96%) had a computer in their home, while a sizeable minority – especially among EAL pupils – had a computer in their bedroom (Table 4.17). Just over half of pupils in each category had a TV in their bedroom (ranging only from 53% of pupils in the *always* category to 56% of pupils in the *never* category). However, only 75% of pupils who *always* spoke English at home reported that they had a study desk or table, compared to 81% of pupils who *sometimes/never* spoke English at home. Of all the resources listed, pupils were least likely to own an iPhone (13%), but ownership was higher among pupils in the *sometimes/never* group (18%) and highest in the *never* group (28%).

Table 4.17: Percentages of pupils reporting which of a variety of resources they had in their own home, by frequency with which the pupil spoke English at home

	% Computer	% Study desk	% TV in bedroom	% Computer in bedroom	% iPhone
Always	96	75	53	18	12
Sometimes	96	81	55	28	17
Never	91	86	56	31	28
Sometimes/Never	*95*	*81*	*55*	*28*	*18*
Overall (IRL)	96	76	54	19	13

[4] Similar slight gender differences were apparent also in the PIRLS and TIMSS study averages. For example, in PIRLS, 4% of girls and 6% of boys in all participating countries reported *never* speaking the language of the test at home.

As outlined in Chapter 3 (Clerkin & Creaven, 2013), pupils were asked a number of questions about their enjoyment of reading, mathematics, and science, and their responses were combined to create three overall "liking" scales (with pupils divided into the categories of *like*, *somewhat like* and *don't like*). While Irish pupils generally held more positive attitudes towards reading than their peers in other countries, the (small number of) pupils who *never* spoke English at home were not so positive (Table 4.18). Only 21% were categorised as liking reading, compared to an Irish average of 37%. However, for mathematics and science, roughly similar percentages of EAL and English-speaking pupils were categorised as *liking* the subjects.

Table 4.18: Percentages of pupils categorised as liking reading, mathematics and science, by frequency with which the pupil spoke English at home

	Reading	Maths	Science
Always	37	40	59
Sometimes	38	45	64
Never	21	42	52
Sometimes/Never	*35*	*45*	*62*
Overall (IRL)	37	41	59

As well as attitudes to the three academic domains, pupils were asked how they felt about school, more generally (Table 4.19). Nationally, 74% agreed that they liked school, but only 65% of pupils in the *never* group did, somewhat counterbalancing the 81% agreement from those who *sometimes* spoke English at home. Pupils in the *never* category were also less likely to indicate that they felt they belonged in school (only 65% agreed). However, it is worth remembering again that the number of pupils in the *never* group is very small. The combined *sometimes/never* category is considerably larger and more reliable. Taking this group of pupils into consideration, 79% agreed that they felt they belonged in school, just below the 83% of pupils who *always* spoke English. A large majority of pupils (ranging from 79% of the *never* group to 91% of the *always* and *sometimes* groups) agreed that they felt safe in school.

Table 4.19: Percentages of pupils who agreed *a little* or *a lot* that they liked school, felt safe there, and felt they belonged there, by frequency with which the pupil spoke English at home

	I like being in school	I feel safe at school	I belong at school
Always	73	91	83
Sometimes	81	91	82
Never	65	79	65
Sometimes/Never	*78*	*89*	*79*
Overall (IRL)	74	91	82

Pupils were asked how frequently (if at all) they experienced each of six types of bullying behaviour while in school. Behaviours listed included being made fun of or being forced to do something. Bullying is dealt with comprehensively in Chapter 3 of this volume (Clerkin & Creaven, 2013). However, some of their main findings relating to EAL pupils are also worth noting here. Pupils who *always* spoke English at home were less likely to be bullied than those who *sometimes* or *never* did so. EAL pupils experienced each of the six bullying behaviours more frequently than their non-EAL counterparts. In particular, EAL pupils were about twice as likely as native speakers to experience regular exclusion from games and or to have something stolen from them.

Discussion

PT 2011 revealed some interesting information about children who are not fluent in the language of instruction in their primary school classroom. One key finding is that Irish classrooms contain fewer such children than classrooms in most other participating countries. While there was a rapid increase in the number of EAL pupils in Irish schools over a relatively short time period, our classrooms remain less linguistically diverse than classrooms in most countries. This is perhaps in contrast to popular perception. There is also a slight divergence between principals' perceptions of the percentage of EAL pupils in their own school and what parents tell us. Information from principals suggest that in a sizeable number of our schools, English speakers comprise no more than three-quarters of the enrolment, while parent reports suggest this is true only of a smaller number of schools.

Pupils whose home and school languages differed performed less well on the reading, mathematics and science assessments. In Ireland, although EAL pupils were outperformed by native speakers on all three domains, pupils who *sometimes* spoke English at home scored well above the study centrepoint of 500 for reading and mathematics. However, while the science assessment was – in general – the area on which Irish pupils displayed the weakest performance, performance was particularly poor for EAL pupils.

In countries where relatively few pupils spoke a language that differed from the language of the test, achievement gaps tended to be very large. That aside, in some countries, pupils who spoke a language that differed from the language of the test obtained mean scores that were not only well above the centrepoint of 500 but also above national means for many other countries. For example, pupils in Singapore and the Russian Federation who *never* spoke the language of the test at home achieved higher scores on the mathematics and science assessments than Ireland's overall national mean.

In Ireland, as in most countries, the achievement gap is larger if current language spoken, rather than language spoken prior to starting school, is examined. It may be that pupils who do not "bring home" the language of the school, and whose home language environment is unrelated to their school language environment are at an elevated risk of academic difficulties. The elevated risk may be compounded by the lower likelihood of parental assistance with homework in EAL households. This may be partly attributable to some EAL parents feeling that they lack the requisite skills, but may also be cultural. As discussed in Chapter 6 (Eivers & Creaven, 2013), homework is an almost universal feature of school life in Ireland, and parents in Ireland were above average in the frequency with which they monitor and support homework. However, in some countries, homework is not so frequently given, nor is it accorded such importance. Thus, it may be useful to draw teachers' attention to cultural differences in attitudes to homework, and to note that some otherwise enthusiastic parents may not engage with homework in the manner expected.

In Ireland, the data revealed evidence of clustering of EAL pupils in certain types of school. Specifically, EAL pupils were more likely to be found in schools with a non-Catholic /Church of Ireland ethos, in urban schools generally, and in DEIS Urban schools in particular. This may be because immigrant families tend to settle in less affluent urban areas, or because some school admission policies can inadvertently exclude recent arrivals to an area. While this chapter was being written, Minister Quinn announced changes to admission policies in Irish schools (Quinn, 2013). One of his stated aims was to stop children who come to Ireland from other countries from being excluded from more popular or over-subscribed schools. When enacted, it will be interesting to see what effects the changes have on how EAL pupils are clustered in primary schools.

The data revealed many positive findings about EAL pupils in Ireland. First, their parents almost universally agreed that their child's school provided a safe environment and

cared about their child's progress. Second, the pupils themselves tended to have a positive attitude to learning, and were broadly similar to their English-speaking counterparts in the extent to which they liked reading, mathematics and science. However, the (admittedly very small number of) pupils who *never* spoke English at home were less likely than the average to agree that they liked being in school, felt safe there or felt they belonged there. Further, EAL pupils were more likely than English-speaking pupils to have experienced bullying in school. These data suggest that while most schools have successfully included EAL pupils and their parents in the broad school community, some problems remain, particularly regarding pupils' interaction with each other.

The information presented in this chapter represents only a broad description of some of the characteristics and experiences of EAL pupils in Ireland. The PT 2011 data are useful in that they allow for comparison with many other countries, but the breadth of the studies militates against depth. Questions addressed here are those applicable in all countries, rather than those directed at the particular (and many) gaps that exist in Irish data on EAL pupils. It would be of interest to follow up on some of the results reported here, but with a wider variety of schools and with much more information collected from the pupils and their teachers.

Additional references

This section does not repeat the core references already listed in Chapter 1. These include the three international reports on PT 2011 and the Irish national report and those related to other key studies such as National Assessments and PISA.

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Chapter 5
Teachers and teaching practices

Aidan Clerkin

Introduction

Primary teachers are responsible not only for interpreting and implementing the Primary School Curriculum but also for supporting pupils' academic and social development and wellbeing on a day-to-day basis. The importance of this role is reflected in the generally positive public perception of the teaching profession (Teaching Council, 2010). It is also acknowledged quite clearly in Curriculum documentation, where the introduction notes that "the quality of teaching more than anything else determines the success of the child's learning and development in school" (DES/NCCA, 1999, p. 20). This recognition is accompanied by a reminder of the teacher's responsibility to create a rich learning environment through:

- varied methods of classroom organisation
- wide use of strategies and resources (including parents, colleagues, and available information and communication technologies [ICT])
- an awareness of developments in educational theory and best practice
- and a commitment to continuing professional reflection and development (DES/NCCA, 1999, p. 21).

Much research has been directed at the teacher behaviours and classroom teaching practices that might lead to high achievement outcomes for pupils (see, e.g., Conway & Murphy, 2013; Darling-Hammond, 2000; Gorard, 2013; Teodorović, 2011). This chapter draws on the data collected in PIRLS and TIMSS 2011 (PT 2011) to examine some of these issues. However, it is also worth taking a step back, to consider what characteristics make a "good teacher", how one person flourishes in the role while another suffers from burnout, and, more broadly, some general demographic characteristics of the profession.

In Ireland, as in many other countries, a majority of classroom teachers are female. The most recent figures show, for the 2011/12 school year, that 86% of primary teachers in Ireland were women (DES, 2012b). A similar pattern is evident in most other developed countries (Drudy, Martin, Woods, & O'Flynn, 2005; European Commission/EACEA/ Eurydice, 2013). In contrast, women tend to be underrepresented at school management level globally (Drudy et al., 2005) and in Ireland (INTO, 2004; OECD, 2007). Despite the relative scarcity of male teachers, the evidence suggests little or no association between teacher gender, or teacher-pupil gender match, and pupil achievement (Drudy, 2008; Neugebauer, Helbig, & Landmann, 2011).

Many primary teachers in Ireland are relatively young, and are still in the early stages of their careers. Eivers et al. (2010) found that 16% of Second class pupils (but only 5% of those in Sixth class) were taught by a teacher in the first two years of their teaching career. Similarly, data from Growing Up in Ireland (GUI) showed that almost two-fifths of nine-year-old children were taught by teachers aged 29 or under, and a further one-fifth taught by teachers aged between 30-39 (Williams et al., 2009). The relatively youthful profile of Irish primary teachers has some implications for classroom practice, as outlined next.

A consistent finding of recent studies is that the use of ICTs (computers, interactive whiteboards, and even calculators) in Irish primary school classrooms is uneven, and substantial percentages of pupils never or very rarely use ICT in school (Eivers et al., 2010; Gilleece, Shiel, Clerkin, & Millar, 2012; McCoy, Quail & Smyth, 2012). The limited availability of resources – and associated infrastructural considerations such as access to a high-speed broadband connection – is one often-cited reason for high reliance on more traditional resources such as textbooks and curriculum documents. However, Cosgrove and Marshall (2008) found that teachers under 30 were more likely to use ICT in the classroom, suggesting that access is by no means the only inhibiting factor. Further, many of the teachers surveyed by Eivers et al. (2010) rated the use and integration of technology in the classroom as a priority topic for continuing professional development (CPD). Thus, it seems that teacher confidence in using ICT in the classroom is at least as important as quality access to ICT, and that younger teachers may feel slightly more confident than older teachers in this regard.

The 2009 National Assessments (Eivers et al., 2010) showed that Irish classrooms at Second and Sixth class levels are predominantly characterised by whole-class teaching and by pupils working by themselves (rather than in pairs or in small groups), as well as by the use of textbooks, reading schemes, and workbooks. These findings suggest that constructivist teaching approaches in the classroom remain relatively rare compared to more "traditional" methods of instruction. Devine, Fahie and McGillicuddy (2013) reported a similar finding based on direct classroom observations, and noted teachers' concerns – particularly among teachers in DEIS schools – that frequent use of active learning methods could have a negative impact on classroom discipline. That aside, more "active" or constructivist teaching methods, such as encouraging pupils to ask each other questions in class and providing pupils with opportunities to engage in hands-on activities, are also more common among less experienced – usually younger – teachers (Devine et al., 2013; McCoy, Smyth, & Banks, 2012). Differences in approach by teaching experience may reflect changes in Initial Teacher Education programmes in recent years, or it may be a function of teaching experience itself.

As noted in the introductory paragraph, the Curriculum places a responsibility on teachers to engage in a variety of activities (e.g., professional development, developments in educational theory and best practice) in order to ensure that they, and their teaching practices, are up to date. In many regards, efforts to remain up to date are particularly important for teachers in Ireland. Many work in very small schools, have few work colleagues with whom to share practice, and tend to change employment infrequently. Despite this, teacher certification in Ireland is not linked to participation in CPD, a situation highlighted by Eivers et al. (2010) in relation to the low uptake of CPD related to either literacy or numeracy.

Teachers' commitment to their profession is another important, yet often overlooked aspect of teaching. Arising from dissatisfaction with their working conditions, career dissatisfaction, poor collegial relationships, or negative perceptions of pupils, lower levels of commitment can lead to burnout, or to opting out of the teaching profession altogether. This not only has personal cost to individual teachers, but also considerable system cost, as substantial time and resources will have been invested in their training (OECD, 2005). In addition, pupils whose teachers report low commitment to the profession are found to perform at a lower-than-expected level on achievement tests (Day, 2008).

Collie, Shapka, and Perry (2011) found that Canadian primary school teachers who perceived their pupils to be more motivated to learn and better-behaved reported greater commitment, both to the teaching profession generally and to their particular school. The authors suggest that this may be because teachers whose pupils are more motivated and engaged experience less work-related stress and greater job satisfaction, thereby reinforcing

their commitment to teaching. Similar observations have been made in the UK (Day, 2008) and in Ireland, where Morgan, Ludlow, Kitching, O'Leary, and Clarke (2010) noted that positive experiences in the classroom play a relatively more important role than negative experiences in fostering teachers' sense of commitment, as well as teaching efficacy (that is, how well and how effectively they feel able to teach). Examples of positive experiences reported by teachers include seeing children engage well with the material they are learning, and seeing pupils make progress or display their proficiency in a particular area (Kitching, Morgan & O'Leary, 2009).

Professional collaboration among teachers within a school also tends to support commitment, and can be particularly positive for new or recently-qualified teachers (Williams, Prestage, & Bedward, 2001). Good working relationships and the exchange of ideas among teaching staff can be useful in terms of classroom practice – for example, by discussing teaching strategies – and by creating a supportive and collegial atmosphere (Collie et al., 2011; Gu & Day, 2013). In contrast, poor relationships with colleagues can undermine teachers' resilience (Gu & Day, 2013), further emphasising the importance of a positive and professional working environment to effective teaching. In Ireland, Cannon and Moran (1998) reported high levels of collegiality among their sample of teachers in Donegal, but note that although most teachers reported that they would like to observe colleagues' classroom teaching and offer feedback, this happened only rarely in practice.

The remainder of the chapter is presented in three main sections. The first section describes the teachers who took part in the study in Ireland, with some comparison to their peers internationally. Characteristics covered include age and qualification, as well as teachers' career satisfaction, working conditions, professional development, and collaboration with other teachers. The second section focuses on the day-to-day activities of Fourth grade (internationally) and Fourth class (in Ireland) teachers. Topics discussed include teaching practices and behaviours in the classroom, homework, and the use of ICT in the classroom. In the final section, some key findings and over-arching themes are discussed.

As was noted in Chapter 1 (Eivers & Clerkin, 2013), data from the Teacher Questionnaire are reported at the *pupil* level, because the PT 2011 sample was selected to be representative of pupils, not their teachers (see Rutkowski, Gonzalez, Joncas, & von Davier, 2010 for a good discussion of this and other associated issues). This means that the focus of the chapter is on what pupils experience in Irish classrooms, rather than on how many teachers engage in particular practices with their own class.

Readers who would like more background information on PIRLS and TIMSS, or about Ireland's participation in PIRLS and TIMSS in 2011 are referred to Chapter 1 of this volume (Eivers & Clerkin, 2013).

Teacher characteristics

This section is divided into seven parts. The first part describes some of the basic characteristics of Fourth grade teachers, both in Ireland and throughout other countries participating in PT 2011, while the second deals with teachers' qualifications. In the third part, career satisfaction is considered, followed by teachers' reports of working conditions. The final three parts turn to matters related to professional practice – in turn, teachers' confidence teaching mathematics and science, followed by their participation in CPD and, finally, the extent to which they collaborate with other teachers.

Gender and age

Across PIRLS and TIMSS, a large majority (at least 80%) of Fourth grade pupils were taught by female teachers. In Ireland, primary school teaching also appears to be a femininised profession, but to a slightly lesser extent than in most PT 2011 countries. Here, 71% of Fourth class pupils were taught by female teachers. While Eivers et al. (2010) found that almost all (91%) of the Second class pupils in NA 2009 were taught by female teachers, the 69% of Sixth class pupils taught by female teachers is broadly in line with the gender balance observed in PT 2011. As was found also in NA 2009, teacher gender was related to school gender composition. Almost all pupils (91%) in all-girls schools were taught by female teachers, whereas in all-boys schools, relatively fewer pupils (55%) were taught by females. While most class teachers were female, school principal posts in Ireland were almost evenly divided between males (48%) and females (52%).

Teachers of Fourth class pupils in Ireland tend to be relatively less experienced than their counterparts in other countries. The average (mean) length of time for which Irish pupils' teachers had been teaching at the time of PT 2011 is slightly more than 12 years, compared to 17 years across all PIRLS and TIMSS countries. The Irish data are broadly in line with data from NA 2009, where average experience was 11 years for Second class and 16 years for Sixth class teachers (Eivers et al., 2010). Only a small number of other countries had less-experienced Fourth grade teachers, including England, Singapore, and New Zealand from our key comparison countries. Across both PIRLS and TIMSS, only two countries (Oman and Kuwait) had a teaching force that averaged less than 10 years of teaching experience. With an average of 26 years, Armenia had the longest-serving teachers, closely followed by a number of other post-Soviet or Eastern bloc states (Bulgaria, Hungary, Lithuania, and the Russian Federation).

Another way of looking at teacher experience is to examine the median length of service – the halfway point when all responses are ranked in order (or, the 50th percentile). In Ireland, the median length of experience was eight years. In other words, about half of Fourth class pupils were taught by teachers who have been teaching for less than eight years (and half for more than eight years). England, New Zealand, Singapore and the United Arab Emirates also report a median experience of eight years, which is the lowest figure reported for any country. Across all PIRLS countries, the median length of time teaching is slightly more than 16 years.

The relatively short length of service of Irish teachers in comparison to other countries may be related to their generally youthful profile (Table 5.1). Ireland, along with the Netherlands, had the highest percentage of pupils (11%) taught by teachers who are less than 25 years old (international averages: 3%). Ireland was also one of 12 countries where no more than 11% of pupils were taught by teachers aged 50 or over – much lower than the international averages of 25%.

Most Irish pupils (59%) were taught by teachers aged from 25-39, compared to about 41% of Fourth grade pupils internationally. In contrast, relatively few Fourth grade pupils were taught by teachers under 40 in Italy (10%), Poland (12%), Bulgaria (15%), and Hungary (17%). Among our selected comparison countries, Fourth grade teachers in England have the closest age profile to Fourth class teachers in Ireland.

Specific to Ireland, some differences were apparent in teacher age by school DEIS status. Relatively few pupils in DEIS Urban schools were taught by older teachers. While one-third of pupils (33%) in non-DEIS schools and 44% of pupils in DEIS Rural schools were in classes with a teacher aged 40 years old or more, the equivalent percentages in Urban schools were just 16% (Band 1) and 5% (Band 2). This largely mirrors teachers' age distribution by the area in which their school is located. For example, in schools in areas

where the population exceeds 500,000 (i.e., Dublin), only 6% of Fourth class pupils were taught by teachers aged 40 or over. In contrast, in schools in areas with a population of 3,000 or fewer (i.e., rural schools), 46% of pupils were taught by teachers aged 40 or over.

Table 5.1: Percentage of pupils taught by teachers of varying ages Ireland, comparison countries and study averages

	Under 25	25-29	30-39	40-49	50-59	60+
Australia	8	10	21	23	34	4
England	9	26	27	23	14	1
Finland	1	9	19	38	29	3
Hong Kong SAR	1	12	53	27	6	2
Ireland	11	29	30	19	10	1
Korea, Rep.	2	20	33	25	17	3
New Zealand	7	15	32	21	23	2
Northern Ireland	3	16	35	25	20	1
Russian Fed.	1	2	23	43	23	8
Singapore	3	22	44	20	8	4
United States	2	10	33	27	21	7
PIRLS	3	11	30	32	21	4
TIMSS	3	11	31	30	21	4

Qualifications

With regard to teachers' qualifications, more than 97% of Irish Fourth class pupils were taught by a teacher who had completed at least an undergraduate third-level degree, with18% taught by teachers who had also completed a postgraduate degree. The small number of teachers who were not qualified to degree level reported between 37 and 41 years' experience, and so may be described as "teachers holding diploma qualifications from prior to the establishment of degree requirements [who] are recognised as qualified teachers within the school system" (Coolahan, 2003, p. 38). For comparison, Second and Sixth class teachers in the National Assessments were not asked about their highest qualification, but were asked whether they were fully-qualified, not qualified, or in training. All pupils, at both grade levels, were taught by fully-qualified primary teachers. Between one-third and one-half of pupils in NA 2009 were taught by teachers who also reported an additional qualification related to their work as a teacher (e.g., an M.Ed. or diploma), slightly higher than the postgraduate degree data reported here.

The international average for Fourth grade teachers in PT 2011 was that 79% of pupils were taught by teachers with at least an undergraduate qualification, while 21% were taught by teachers who reported a lower level of education. About 25% of pupils internationally were taught by teachers who held a postgraduate degree. A relatively greater percentage of pupils in Ireland than internationally, therefore, are in classes where the teacher has attained at least an undergraduate degree, but relatively fewer pupils' teachers possess a postgraduate degree in Ireland.

Particularly high percentages (greater than 60%) of pupils taught by postgraduate-qualified teachers were reported in ten countries, most notably the Slovak Republic (99%), Poland (96%), the Czech Republic (93%), Finland (82%) and Russia (79%). It should be noted that in some countries (e.g., Czech Republic, Finland), specialised third-level teacher training programmes are considered to be equivalent to Master's level. In Ireland, in contrast, the specialised primary school teacher training degree (B.Ed.) is an undergraduate

programme, while holders of a non-teaching primary degree can qualify as teachers following completion of a specialised postgraduate diploma. Readers are referred to the PIRLS and TIMSS Encyclopedias (Mullis, Martin, Minnich, Drucker, & Ragan, 2012; Mullis, Martin, Minnich, Stanco et al., 2012) and to Chapter 2 of this volume (Lewis & Archer, 2013) for more detailed information on participating countries' education systems, including teacher training and teaching qualification requirements.

Teachers in PT 2011 were also asked to provide more detail on the *major or main* area(s) of study during their third-level education (Table 5.2). Most pupils in Ireland (92%) were taught by teachers who described primary education as being their major area of study, with 5% taught by teachers who named secondary education as the main area. The corresponding averages for all PIRLS and TIMSS countries were 79% and 77%, respectively, for primary education, and 13% in both studies for secondary education.

A minority of pupils internationally were taught by teachers who reported that mathematics or science were main areas of study (28%, for both domains), although the percentages were even lower in Ireland (9% and 8%). Greater numbers were taught by teachers who reported a major in the test language[1] and in other, unspecified, areas. Large percentages of pupils in Singapore were taught by teachers who reported that they had specialised in mathematics or science, although the high percentages claiming each of mathematics, science, languages, and "another area" as being *major or main* areas of study suggests that these figures should be interpreted with some caution.

Table 5.2: Percentages of pupils taught by teachers indicating their *major or main* areas of study during third-level education, Ireland, comparison countries and study averages

	Primary education	Secondary education	Maths	Science	Language of test	Another area
Australia	94	6	8	7	14	27
England	82	4	15	26	33	42
Finland	93	–	2	1	3	16
Hong Kong SAR	80	28	56	27	78	54
Ireland	92	5	9	8	19	42
Korea, Rep.	96	3	2	1	1	10
New Zealand	94	1	8	9	18	24
Northern Ireland	86	10	11	12	14	53
Russian Fed.	97	13	26	25	28	22
Singapore	65	10	52	47	56	51
United States	82	6	6	6	13	32
PIRLS	79	13	15	15	32	35
TIMSS	77	13	28	28	20	32

Rows do not sum to 100 as teachers could choose one or more responses to this question.
Figures in the "Maths" and "Science" columns, and in the "Korea" row, are drawn from TIMSS data. All other columns are drawn from PIRLS data.

Teachers who cited primary education as their main area of study were also asked if they had a specialisation in mathematics or science within education (e.g., if they had taken an elective course). These reported specialisations, taken in combination with the major or main areas of study shown in Table 5.2, provide a more nuanced view of teachers' mathematical or scientific education (Table 5.3).

[1] In Ireland, this was considered to be English.

The percentages of teachers in Ireland without a major/specialisation in mathematics or science are higher than the corresponding TIMSS international averages, but are broadly in line with the percentages in many of our comparison countries. The Russian Federation, Singapore, and Hong Kong are notable for the very high percentages of teachers who report specialisations in mathematics or science as well as primary education. Relatively high percentages of teachers in Singapore and Hong Kong also report majoring in mathematics (and in Singapore only, in science) *without* a major in primary education. It should be noted, however, that majoring in a subject does not necessarily suggest superior teaching of that subject (Greaney, Burke, & McCann, 1999).

Table 5.3: Percentages of pupils' teachers indicating specialisations in primary education and/or mathematics or science, Ireland, comparison countries and TIMSS study average

	Major in primary education			Major in primary education		
	Yes	Yes	No	Yes	Yes	No
	Maths specialisation			Science specialisation		
	Yes	No	Yes	Yes	No	Yes
Australia	14	81	1	9	84	2
England	17	65	2	25	50	7
Finland	13	80	0	15	79	0
Hong Kong	54	27	12	27	52	6
Ireland	14	78	0	11	81	1
Korea, Rep.	10	86	0	14	81	0
New Zealand	15	76	<1	13	77	1
N. Ireland	10	76	1	11	75	3
Russian Fed.	59	38	1	55	42	2
Singapore	54	14	11	43	21	15
United States	10	74	1	10	75	2
TIMSS	26	44	10	24	46	11

Rows do not sum to 100 as columns for "all other majors" and "no formal education beyond upper secondary" are not shown.

Career satisfaction

As part of the Teacher Questionnaire, teachers were asked to indicate level of agreement with six statements about their work as a teacher[2]. These were combined to form a *Teacher Career Satisfaction* scale.

Overall, Irish teachers expressed far higher levels of career satisfaction than teachers in most other countries. Over two-thirds (69%) of Irish pupils were taught by a *satisfied* teacher, compared to 54% of pupils internationally (Table 5.4). The percentage of pupils in Ireland who are taught by satisfied teachers is substantially greater than in almost all of our comparison countries, and most notably those in the Asia-Pacific region.

[2] Statements included "I am frustrated as a teacher" and "I do important work as a teacher". Full details of the scale are included in the three international reports on PIRLS and TIMSS (e.g., Mullis, Martin, Foy, & Drucker, 2012).

Table 5.4: Percentages of pupils' teachers in each *Teacher Career Satisfaction Scale* category, Ireland, comparison countries and study averages

	Satisfied	Somewhat satisfied	Less than satisfied
Australia	53	41	6
England	52	42	6
Finland	42	50	8
Hong Kong SAR	38	50	12
Ireland	69	29	2
Korea, Rep.	19	69	11
New Zealand	55	41	5
Northern Ireland	54	41	5
Russian Fed.	60	36	4
Singapore	35	54	11
United States	47	47	6
PIRLS	54	40	5
TIMSS	54	41	5

Table 5.5 shows information about career satisfaction within the Irish system. The high satisfaction among the teachers of the vast majority of pupils in DEIS Rural and Urban Band 1 schools is particularly striking (96% and 86% of pupils' teachers, respectively, were classified as *satisfied*). The very high satisfaction expressed by teachers in Rural DEIS schools is not explained by rurality alone. When examined by location, rural teachers generally are *satisfied* with their careers (76%), but not to as marked an extent as those in Rural DEIS schools. Some differences were also found by school patronage or ethos. While 68% of pupils in schools with a Catholic patron were taught by teachers satisfied with their career, this rose to 84% of pupils in schools with other forms of patron models.[3]

Table 5.5: Percentages of Irish pupils' teachers in each *Teacher Career Satisfaction Scale* category, by school DEIS status and patronage model

		Satisfied	Somewhat satisfied	Less than satisfied
DEIS	Urban Band 1	86	14	0
	Urban Band 2	40	55	5
	Rural	96	4	0
	Non-DEIS	68	30	2
Ethos	Catholic	68	30	2
	Other	84	13	3

In contrast to their generally positive sentiments, one-third of pupils in DEIS Band 1 schools – and a majority of pupils in Band 2 schools (56%) – were taught by teachers who *agreed a little* or *a lot* with the statement "I am frustrated as a teacher". Also, the teachers of 56% of pupils in Urban Band 2 schools agreed with the statement "I had more enthusiasm when I began teaching than I have now". The latter may be somewhat surprising, in light of the relatively youthful profile of Irish teachers noted earlier. However, when compared to

[3] Due to the small numbers of teachers working in non-Roman Catholic schools, and the sensitive nature of this measure, their responses have been combined to preserve anonymity.

the study averages, Irish teachers generally appeared to have lost less enthusiasm than teachers in most countries.

Working conditions

As part of PT 2011, teachers were presented with a list of potential difficulties in their working conditions (overcrowded classrooms, building in need of repair, too many teaching hours, lack of workspace, and lack of instructional materials or supplies) and were asked to rate the extent to which each was seen as a problem. The responses were combined to create an overall measure, *Teacher Working Conditions* (Table 5.6).

On this composite measure, 37% of Irish Fourth class pupils were in classrooms where their teachers reported *hardly any problems* with their working conditions, and 47% of pupils were in classrooms with *minor problems* only. The corresponding international averages for *hardly any problems* are 27% (PIRLS) and 26% (TIMSS), suggesting that a higher percentage of Irish pupils were in classes where teachers are generally satisfied with their working conditions. However, 16% of Irish pupils (and 25-27% internationally) are taught by teachers who report *moderate problems* with their working conditions. Among our comparison countries, *moderate problems* with working conditions were most likely to be reported in Korea and Hong Kong, and least likely in England and the US.

Table 5.6: Percentages of pupils' teachers in each *Teacher Working Conditions Scale* category, Ireland, comparison countries and study averages

	Hardly any problems	Minor problems	Moderate problems
Australia	43	38	19
England	44	46	10
Finland	20	62	18
Hong Kong SAR	16	57	28
Ireland	37	47	16
Korea, Rep.	14	49	36
New Zealand	33	50	17
Northern Ireland	35	49	16
Russian Fed.	24	54	22
Singapore	32	51	17
United States	47	42	11
PIRLS	27	48	25
TIMSS	26	47	27

The most common problem identified by Irish teachers was overcrowded classrooms (with 43% describing it as a *moderate* or *serious problem*, compared to approximately 31%, internationally). As was outlined in Chapter 2 (Lewis & Archer, 2013), with an average of 26 pupils, Irish classes were slightly larger than the study averages of 24 for PIRLS and 25 for TIMSS. Although class size and overcrowding are related, but not identical, constructs, this may partially explain why Irish teachers were more likely than the average to describe overcrowding as a problem. However, in a number of our comparison countries where average class size was larger than in Ireland, the percentage of pupils whose teachers raised overcrowding as an issue was much smaller (e.g., England [12%], New Zealand [20%], Singapore [21%], and Hong Kong [23%]). Comparison countries where teachers raised overcrowding as an issue to the same extent as did Irish teachers included Finland (37% of pupils' teachers saw it as a *moderate* or *serious* problem, despite an average class size of 21 pupils) and Korea (48%; average class size, 30 pupils).

The issue least likely to be rated as a *moderate* or *serious* problem by Irish teachers was too many teaching hours – regarded as problematic by the teachers of only 6% of Irish pupils, which is considerably lower than the international average of 26%. Across both PIRLS and TIMSS, in only five countries were teachers less likely than in Ireland to see too many teaching hours as a problem (Belgium [French-speaking], the Czech Republic, Finland, Lithuania, and Poland). Again, considering some of the characteristics of education systems outlined in Chapter 2 may help to contextualise teacher responses. With the exception of Belgium, all (including Ireland) had fewer instructional hours per annum than the PIRLS and TIMSS averages.

Table 5.7 shows Irish teachers' reports of working conditions, split by their schools' DEIS status and ethos. All pupils in DEIS Rural schools were in classes where the teachers reported *hardly any* or *minor* problems, whereas almost one-quarter of pupils in Urban (Band 1 and Band 2) schools were in classes where teachers had *moderate problems* with their working conditions. However, a substantial minority of pupils in Band 1 schools were also in classes with *hardly any problems*.

Teachers in multidenominational or Educate Together schools were among those most likely to report *moderate problems* with working conditions. Specifically, the teachers of a sizeable minority of pupils in multidenominational schools described *serious problems* with the school building (37%) and with classroom overcrowding (37%), compared to the teachers of just 9% and 11%, respectively, of pupils in schools under Catholic patronage.

Lack of instructional materials and supplies is identified as a particular problem in DEIS Urban schools, representing a *moderate* or *serious problem* for 15% of pupils in Band 1 schools and 39% in Band 2 schools. Classroom overcrowding is also reported as a *moderate* or *serious problem* by the teachers of 41% of pupils in Band 2 schools, and by the teachers of 45% of pupils in non-DEIS schools. Most pupils in DEIS Rural schools are taught by teachers who report relatively few problems with their working environment.

Table 5.7: Percentages of Irish pupils' teachers in each *Teacher Working Conditions Scale* category, by school DEIS status and patronage model

		Hardly any problems	Minor problems	Moderate problems
DEIS	Urban Band 1	44	34	23
	Urban Band 2	19	59	23
	Rural	58	42	0
	Non-DEIS	37	47	15
Ethos	Catholic	35	49	16
	Church of Ireland	79	21	0
	Multidenominational	50	13	37

Confidence teaching mathematics and science

Teachers were asked about their confidence with regard to several aspects of mathematics and science teaching (but not reading). These responses were used to calculate two overall measures, *Confidence in Teaching Mathematics* and *Confidence in Teaching Science*.

The percentage of pupils in Ireland whose teachers were confident in teaching mathematics is similar to the percentage internationally (Table 5.8). In contrast, Irish pupils are significantly more likely to be taught by a teacher who is only *somewhat confident* in teaching science (59% in Ireland compared to 41% across all TIMSS countries). The pattern of teacher responses in Northern Ireland and Australia was very similar. Teachers in all of our

comparison countries were more confident teaching mathematics than science, although Russian pupils, in particular, were extremely likely to have a teacher who is confident with teaching both domains.

Table 5.8: Percentages of pupils' teachers expressing different levels of confidence in teaching mathematics and science

	Mathematics		Science	
	Very confident	Somewhat confident	Very confident	Somewhat confident
Australia	76	24	43	57
England	73	27	63	37
Finland	62	38	32	68
Hong Kong SAR	48	52	26	74
Ireland	74	26	41	59
Korea, Rep.	48	52	42	58
New Zealand	63	37	26	74
Northern Ireland	78	22	40	60
Russian Fed.	97	3	92	8
Singapore	71	29	56	44
United States	84	16	57	43
TIMSS	75	25	59	41

A closer look at teachers' responses to the individual items making up the *Confidence in Teaching Mathematics* and *Confidence in Teaching Science* scales reveals further detail on specific aspects of mathematics and science teaching (Table 5.9). In most countries, pupils learn in classes where their teachers are less confident with some aspects of science teaching than mathematics teaching, such as answering pupils' questions and providing challenging tasks for more capable students. These appear to be regarded as more difficult for science lessons than for mathematics. In contrast, with regard to adapting their teaching to engage pupils' interests and helping pupils to appreciate the value of the subjects, the TIMSS averages are similar for each domain.

Table 5.9: Percentages of pupils' teachers who reported being *very confident* teaching specified aspects of mathematics and science, Ireland and TIMSS averages

		Answer pupils' questions about maths / science	Provide challenging tasks for capable pupils	Adapt teaching to engage pupil interests	Help pupils appreciate the value of learning maths / science	Show pupils a variety of problem-solving strategies	Explain science concepts or principles by doing science experiments
Maths	Ireland	92	63	63	61	70	
	TIMSS	84	59	65	69	75	
Science	Ireland	39	28	44	54		44
	TIMSS	62	43	63	68		51

In Ireland, the percentages of pupils whose teachers are *very confident* with the aspects of mathematics lessons shown in Table 5.9 are, broadly speaking, reasonably similar to the international averages. However, there is a very pronounced difference between the percentage of pupils in Irish classes where the teacher is *very confident* answering questions about science (39%) and about mathematics (92%). In general, fewer than half of Irish

pupils are in classes where their teacher is *very confident* with any of the specified aspects of science teaching, with the (marginal) exception of helping pupils to appreciate the value of science.

Continuing professional development

Teachers were asked a series of questions about their engagement in continuing professional development (CPD) in the two years prior to PT 2011. Questions for reading differed from those asked about mathematics and science, and therefore are presented separately below. Irrespective of domain, Irish teachers were far less likely to engage in regular CPD than were teachers in most countries.

Reading

For reading, teachers were asked to indicate the number of hours (if any) they had spent on reading-related CPD, and the frequency with which they read children's books for professional development. The 11% of Irish pupils who were taught by a teacher who had engaged in 16 hours or more of reading-related CPD (such as reading theory, or methods of teaching reading) was well below the PIRLS average of 24% (Table 5.10). Conversely, 37% of Irish pupils were taught by a teacher who had not engaged in *any* reading-related CPD over the previous two years, compared to 25% of pupils internationally.

Among our comparison countries, Finland is somewhat atypical, as 68% of Finnish pupils were in classes where their teacher reported spending no time on reading-related CPD in the previous two years. In all other comparison countries, attendance at reading-related CPD was more widespread than in Ireland. Although the percentages of pupils in classes where the teacher had engaged in 16 hours or more of reading CPD in England and Northern Ireland were similarly low to the percentage in Ireland, a greater percentage of Northern Irish and English pupils' teachers had spent at least some time on CPD (69% and 66%, respectively, compared to 52% in Ireland).

Table 5.10: Percentages of pupils' teachers who reported taking part in various amounts of CPD related to reading in the two years prior to PIRLS, Ireland and study averages

	16 hours or more	Some time, but less than 16 hours	No time
Australia	30	57	13
England	7	66	27
Finland	4	28	68
Hong Kong SAR	29	63	8
Ireland	11	52	37
New Zealand	27	60	13
Northern Ireland	12	69	19
Russian Fed.	39	43	18
Singapore	31	51	18
United States	41	55	4
PIRLS	24	50	25

Within Ireland, younger teachers were more likely to engage in CPD. Among teachers under 25 years of age, 42% of pupils' teachers reported participating in at least 16 hours of CPD over the previous two years. The corresponding percentages were lower for 25-29-year-olds (9%), 30-39-year-olds (5%), and 40-49-year-olds (10%), with no teachers over 50 reporting this level of reading-related CPD. More than half of pupils' teachers in the

40-49 and over 50 age groups had not taken part in *any* CPD related to reading over the two years before PT 2011, compared to 16% among teachers under 25.

Irish pupils were also less likely to be taught by a teacher who read children's books regularly for professional development purposes (Table 5.11). Across all PIRLS countries, 31% of pupils were taught by teachers who read children's books on an at least weekly basis – double the 15% of pupils in Ireland. Most Irish teachers read children's books at least occasionally. However, 14% of Irish pupils were in classes where their teacher *never or almost never* did so – almost three times as high as the PIRLS average of 5%. *Never or almost never* reading children's books was most common in Ireland among teachers under 25 (33% of Irish pupils, compared to 4% at the PIRLS average).

Table 5.11: Percentages of pupils' teachers reporting the frequency with which they read children's books for professional development, Ireland and PIRLS averages

	At least weekly	Once or twice a month	Once or twice a year	Never or almost never
Ireland	15	30	42	14
PIRLS	31	42	22	5

Mathematics and science

For CPD related to mathematics and science, teachers were not asked about the amount of time spent, but whether or not they had participated in CPD focusing on specific areas of instruction and assessment over the two years preceding the survey.

Two general themes emerged. First, compared to the TIMSS study average, pupils in Ireland are less likely to be taught by a teacher who had participated in *any* of the specified types of CPD in the previous two years. Second, Irish teachers' participation in science-related CPD was much lower than their participation in mathematics-related CPD. This seems a pertinent point, considering their lower confidence in most aspects of the teaching of science, relative to mathematics. As can be seen from Table 5.12, teachers in Ireland had lower than average participation rates generally, but particularly low rates of participation for CPD related to assessment.

Table 5.12: Percentages of pupils' teachers who participated in CPD related to specified aspects of mathematics and science teaching, Ireland and TIMSS averages

		Content	Pedagogy/ instruction	Curriculum	Integrating ICT into subject	Assessment	Addressing individuals' needs
Maths	Ireland	32	32	34	31	25	33
	TIMSS	44	46	41	33	37	43
Science	Ireland	23	16	24	17	9	12
	TIMSS	35	34	34	28	27	32

Collaborative practices

Teacher responses to five questions about the frequency with which they engaged in collaborative behaviours [4] with other teachers were used to create an overall measure called *Collaborate to Improve Teaching* (Table 5.13).

Only 16% of pupils in Ireland were taught by teachers classified as being *very collaborative*, less than half the PIRLS or TIMSS study averages. *Very collaborative* teachers are described as tending, on average, to take part in the specified activities at least 1-3 times per week for three of the activities, and 2-3 times per month for the other two. At the other end of the composite scale, 25% of Irish pupils were taught by teachers who are categorised as being *somewhat collaborative*, compared to just 11% of pupils internationally. Such teachers never or almost never take part in three of the specified activities, and take part in the other two activities no more than 2-3 times per month, on average.

Of all countries that participated in PIRLS and TIMSS, only four (Malta, Morocco, Yemen and Tunisia) had lower mean scores than Ireland on the *Collaborate to Improve Teaching* scale, indicating infrequent professional collaboration. Professional collaboration was more common in all of our comparison countries than in Ireland, and particularly high in Korea, England, and the US.

Of particular note is that roughly one-quarter of pupils in Ireland were taught by teachers who say that they *never or almost never* discuss teaching (25%) or collaborate in preparing materials (27%) with another teacher. Most Irish pupils (82%) were in classes with teachers who *never or almost never* visit another classroom to learn more about teaching, compared to 53% of pupils in all TIMSS countries and 58% in all PIRLS countries.

Table 5.13: Percentages of pupils' teachers in each *Collaborate to Improve Teaching* category, Ireland, comparison countries and study averages

	Very collaborative	Collaborative	Somewhat collaborative
Australia	44	44	12
England	48	44	8
Finland	27	58	15
Hong Kong SAR	23	66	11
Ireland	16	60	25
Korea, Rep.	51	46	4
New Zealand	41	53	6
Northern Ireland	21	55	24
Russian Fed.	31	67	1
Singapore	29	64	8
United States	48	42	10
PIRLS	35	54	11
TIMSS	36	53	11

[4] These were: "discuss how to teach a particular topic", "collaborate in planning and preparing instructional materials", "share what I have learned about my teaching experiences", "visit another classroom to learn more about teaching", and "work together to try out new ideas".

Teaching practices and classroom activities

This section is divided into six main parts. The first part reports the practices that teachers use in the classroom to engage pupils in learning, generally. The second, third and fourth parts relate specifically to the teaching of reading, mathematics, and science, respectively. In the fifth part, teachers' approaches to setting and using homework assignments are described. Finally, the use of ICT in the classroom is examined. One feature worth noting in relation to the classroom practices described below is the relatively high percentage of Fourth class pupils in Ireland (33%) who are taught as part of a multigrade classroom. Only five countries in PT 2011 (Portugal, Canada, France, Australia and New Zealand) had a higher percentage of Fourth grade pupils in multigrade classes. Pupils' reports of their attitudes to learning reading, mathematics, and science, and general engagement at school, are reported in Chapter 3 (Clerkin & Creaven, 2013).

Engaging pupils in lessons

Teachers who took part in PT 2011 were asked about the various teaching practices that they use in the classroom, both generally and with specific reference to the teaching of reading, mathematics and science. Table 5.14 shows the percentages of pupils whose teachers employ a range of practices aimed at engaging pupils in lessons, generally.

Table 5.14: Percentages of pupils' teachers indicating the frequency with which they employed various strategies to engage pupils in lessons in general, Ireland and study averages

		Every or almost every lesson	About half of lessons	Some lessons	Never
Summarise what pupils should have learned from the lesson	IRL	52	29	18	1
	PIRLS	68	20	11	<1
	TIMSS	69	19	12	<1
Relate the lesson to pupils' daily lives	IRL	53	29	18	0
	PIRLS	57	28	14	<1
	TIMSS	57	28	15	<1
Use questioning to elicit reasons and explanations	IRL	91	8	<1	<1
	PIRLS	81	15	4	<1
	TIMSS	78	16	6	<1
Encourage all pupils to improve their performance	IRL	90	7	2	0
	PIRLS	85	12	3	<1
	TIMSS	83	13	4	<1
Praise pupils for good effort	IRL	94	6	<1	0
	PIRLS	87	10	2	<1
	TIMSS	86	10	3	<1
Bring interesting materials to class	IRL	26	39	35	<1
	PIRLS	29	42	29	<1
	TIMSS	30	39	31	1

Teacher reports indicate that Irish pupils were somewhat less likely than pupils internationally to have a teacher bring interesting materials to class, or to summarise what pupils were expected to have learned from the lesson, but slightly more likely to be praised when they were considered to have made a good effort. The frequency with which teachers reported engaging in each of these practices was used to create an overall composite measure

of the efforts that teachers make to engage their pupils in instruction, labelled *Instruction to Engage Students in Learning*. On this measure, 67% of Irish pupils were taught by a teacher who made efforts to engage them in *most lessons*, and 32% in *about half the lessons*. The corresponding averages for PIRLS countries are 71% and 27%, and among TIMSS countries 69% and 30%. Irish pupils are therefore slightly less likely than average to have a teacher who took steps to engage them in *most lessons*. About 1% of Irish pupils, and 2% internationally, had a teacher who took steps to engage them only in *some lessons*.

Although not shown in Table 5.14, Irish *pupils* reported that their teachers tell them that they are good at mathematics slightly more often than average (78% in Ireland *agreed a lot* or *a little*, compared to 75% internationally), and tell them that they are good at science slightly less often (67%, compared to 73% internationally).

Reading lessons

Irish teachers reported that the practices most likely to be employed in reading lessons *every day or almost every day* were asking pupils to read aloud and to answer oral questions about what they had read (Table 5.15). Asking pupils to read aloud was more common in Ireland than the average across PIRLS countries. Irish pupils were also more likely to be given time to read a book of their own choosing *every day or almost every day* (55%, compared to the international average of 32%). In contrast, teaching pupils new vocabulary, teaching skimming or scanning strategies for reading, and giving pupils a written test about what they had read occurred relatively less frequently in Ireland.

Table 5.15: Percentages of pupils' teachers indicating the frequency with which they employed various practices in **reading** lessons, Ireland and PIRLS averages

		Every day or almost every day	1 or 2 times a week	1 or 2 times a month	Never or almost never
Teacher reads aloud to the class	IRL	64	30	5	<1
	PIRLS	62	29	8	1
Ask pupils to read aloud	IRL	82	17	1	0
	PIRLS	70	25	4	1
Ask pupils to read silently on their own	IRL	63	35	1	<1
	PIRLS	65	30	4	1
Give pupils time to read books of their own choosing	IRL	55	39	7	<1
	PIRLS	32	34	28	6
Teach pupils strategies for decoding sounds and words	IRL	30	54	13	3
	PIRLS	32	34	21	13
Teach pupils new vocabulary systematically	IRL	36	45	14	5
	PIRLS	51	35	11	3
Teach or model skimming or scanning strategies	IRL	13	37	39	11
	PIRLS	22	34	29	15
Write something in response to what they have read	IRL	27	62	11	0
	PIRLS	24	45	27	5
Answer oral questions about or orally summarise what they have read	IRL	76	22	2	0
	PIRLS	58	34	7	1
Talk with each other about what they have read	IRL	24	49	22	4
	PIRLS	33	42	19	6
Take a written quiz or test about what they have read	IRL	8	20	49	24
	PIRLS	11	32	43	14

Mathematics lessons

In mathematics lessons (Table 5.16), fewer pupils in Ireland than at the TIMSS average were asked to memorise rules, procedures and facts *every day or almost every day* (30% compared to 37%), but Irish pupils were more likely to engage in memorisation of mathematics at least once a week (72% in Ireland and 61% internationally). Irish Fourth class pupils were also more likely than their peers internationally to work out problems with their class under their teacher's guidance, and to work out problems by themselves or with classmates while their teacher was doing something else. However, Irish pupils were somewhat less likely to relate what they learned in a mathematics lesson to their everyday lives, or to take a written mathematics test.

Table 5.16: Percentages of pupils' teachers indicating the frequency with which they employed various practices in **mathematics** lessons, Ireland and TIMSS averages

		Every day or almost every day	1 or 2 times a week	1 or 2 times a month	Never or almost never
Listen to me explain how to solve problems	IRL	67	23	10	1
	TIMSS	70	18	12	<1
Memorise rules, procedures and facts	IRL	30	42	26	2
	TIMSS	37	24	36	3
Work problems (individually or with peers) with my guidance	IRL	53	32	15	0
	TIMSS	55	28	16	<1
Work problems together with the whole class with direct guidance from me	IRL	53	32	15	1
	TIMSS	45	27	27	1
Work problems (individually or with peers) while I am occupied by other tasks	IRL	24	27	34	15
	TIMSS	16	16	39	29
Explain their answers	IRL	59	28	13	1
	TIMSS	62	24	14	<1
Relate what they are learning in mathematics to their daily lives	IRL	31	34	35	0
	TIMSS	44	31	24	0
Take a written test or quiz	IRL	5	19	75	<1
	TIMSS	18	21	60	1

Science lessons

With regard to the teaching of science, teacher reports indicated that relatively more pupils in Ireland than the TIMSS average watched a teacher demonstrate an experiment in class at least once a week (57%, compared to 39% of Fourth grade pupils internationally) (Table 5.17). Also, Irish pupils were more likely to regularly (weekly) conduct experiments or investigations, but significantly less likely to be asked to engage in memorisation of facts. Only 5% of Fourth class pupils memorised scientific facts and principles *every day or almost every day*, only one-sixth of the international average (30%). Similarly, about 19% of Irish pupils *never or almost never* memorise scientific facts in class (11% internationally).

Comparing Tables 5.15 and 5.16 to Table 5.17, it is clear that science-related activities in the classroom are less frequent than reading- and mathematics-related activities, both in Ireland and internationally.

Table 5.17: Percentages of pupils' teachers indicating the frequency with which they employed various practices in **science** lessons, Ireland and TIMSS averages

		Every day or almost every day	1 or 2 times a week	1 or 2 times a month	Never or almost never
Observe natural phenomena such as the weather or a plant growing and describe what they see	IRL	14	28	58	1
	TIMSS	19	25	54	2
Watch me demonstrate an experiment or investigation	IRL	11	46	42	2
	TIMSS	17	22	57	4
Design or plan experiments or investigations	IRL	11	34	44	11
	TIMSS	11	22	57	9
Conduct experiments or investigations	IRL	16	39	43	3
	TIMSS	14	24	57	4
Read their textbooks or other resource materials	IRL	32	32	35	1
	TIMSS	45	25	27	3
Have pupils memorise facts and principles	IRL	5	13	63	19
	TIMSS	30	22	37	11
Give explanations about something they are studying	IRL	49	31	20	1
	TIMSS	57	24	18	1
Relate what they are learning in science to their daily lives	IRL	50	32	18	0
	TIMSS	61	24	15	<1
Do field work outside the class	IRL	1	11	79	9
	TIMSS	5	14	70	11
Take a written test or quiz	IRL	2	10	68	20
	TIMSS	16	18	60	6

Homework

Teachers' reports show that Fourth class pupils in Ireland tended to receive reading and mathematics homework more frequently than Fourth grade pupils in other countries (Tables 5.18 and 5.19). For example, 60% of Irish pupils were assigned reading homework *every day*, almost double the international average of 34%. Only in four countries (Azerbaijan, Bulgaria, Norway and the United States) did teachers report more pupils receiving reading homework *every day* than in Ireland (all 63-69%). Similarly, for mathematics, 62% of Irish pupils receive homework *every day* in comparison to 36% of pupils across all TIMSS countries.

Only 3% of Irish Fourth class pupils were either *not assigned* reading homework or received homework *less than once a week* (PIRLS average: 16%). Atypical countries on this measure are the Netherlands, where 75% of Fourth grade pupils receive homework *less than once a week*, or not at all, and Belgium (French-speaking) where 48% of pupils received homework no more than once a week.

Table 5.18: Percentages of pupils' teachers indicating the frequency with which they assigned **reading** homework, Ireland, comparison countries and study averages

	No homework	Less than once a week	1 or 2 times a week	3 or 4 times a week	Every day
Australia	1	3	15	22	59
England	13	14	29	15	29
Finland	1	3	22	42	32
Hong Kong SAR	4	27	34	15	20
Ireland	0	3	10	28	60
New Zealand	6	9	16	20	49
Northern Ireland	0	0	20	28	52
Russian Fed.	0	3	22	22	53
Singapore	12	37	38	9	4
US	3	4	11	19	63
PIRLS	4	12	30	21	34

Table 5.19: Percentages of pupils' teachers indicating the frequency with which they assigned **mathematics** homework, Ireland, comparison countries and study averages

	No homework	Less than once a week	1 or 2 times a week	3 or 4 times a week	Every day
Australia	7	9	47	18	20
England	3	19	76	1	2
Finland	0	0	3	78	19
Hong Kong SAR	0	0	0	4	96
Ireland	0	0	5	33	62
Korea, Rep.	7	22	46	23	1
New Zealand	20	15	40	13	13
Northern Ireland	0	0	53	30	17
Russian Fed.	0	1	1	47	52
Singapore	0	1	16	49	33
US	3	1	18	43	35
TIMSS	3	5	24	32	36

Science homework is assigned much less frequently than reading or mathematics homework (Table 5.20). Further, in contrast to the findings for reading and mathematics, pupils in Ireland receive science homework much less frequently than pupils in other countries. About 86% of Fourth class pupils in Ireland were either *not assigned* science homework or were assigned homework *less than once a week* (Table 5.20). The equivalent figure across all TIMSS countries is 48% of Fourth grade pupils. No Irish pupils received science homework *three or four times a week* or *every day*, compared to 13% of Fourth grade pupils internationally.

Among our comparison countries, substantial differences in practice are apparent. Reading homework is given less frequently (in terms of being never or very rarely assigned) in England, Hong Kong, and Singapore, and mathematics homework is less common in England, Korea, and New Zealand.

Table 5.20: Percentages of pupils' teachers indicating the frequency with which they assigned **science** homework, Ireland, comparison countries and study averages

	No homework	Less than once a week	1 or 2 times a week	3 or 4 times a week	Every day
Australia	60	36	4	0	0
England	39	53	8	<1	0
Finland	1	4	62	30	3
Hong Kong SAR	5	22	49	21	3
Ireland	40	46	14	0	0
Korea, Rep.	27	62	12	0	0
New Zealand	74	25	1	0	0
Northern Ireland	62	37	1	0	0
Russian Fed.	1	2	88	1	9
Singapore	1	29	63	5	2
US	33	41	22	4	1
TIMSS	18	30	39	8	5

The average length of time that Irish pupils were expected to spend on reading and mathematics homework by their teachers is generally less than the international average (Table 5.21). Teachers of 61% of Irish pupils indicated that reading assignments were expected to take no more than 15 minutes, compared to 22% of pupils at the PIRLS average. At the other extreme, teachers of about 5% of Irish pupils were expected to spend more than half an hour on each reading homework assignment, compared to 23% internationally. The Russian Federation was particularly notable for the long expected duration of reading homework there, with 13% of pupils expected to spend more than an hour on reading assignments.

A similar pattern is evident for mathematics. Table 5.21 shows that 61% of Irish pupils, but only 26% of pupils across all TIMSS countries, were expected to spend 15 minutes or less on their mathematics homework each time it is assigned. In contrast, teachers of 1% of Irish pupils, and 17% of pupils internationally, were expected to spend more than half an hour on each mathematics assignment. Teachers in Singapore, Hong Kong and – to a lesser degree – the Russian Federation and Northern Ireland assigned lengthy mathematics homework more frequently than teachers in Ireland or our other comparison countries, with between one-quarter and one-half of pupils expected to spend at least half an hour on mathematics assignments.

On the rare occasions (Table 5.20) when science homework was assigned in Ireland, teachers of 42% of pupils expected it to take less than 15 minutes, and teachers of only 1% of pupils expected it to take more than half an hour, compared to 11%, internationally (Table 5.21).

In general, therefore, Fourth class pupils in Ireland appear to receive shorter, but more frequent, reading and mathematics homework assignments than Fourth grade pupils in many other countries. In contrast, science homework was both less regularly assigned and of shorter length in Ireland than in most countries.

Table 5.21: Percentages of pupils' teachers indicating the amount of time they expected pupils to spend on homework, by domain, Ireland and study averages

		15 minutes or less	16-30 minutes	31-60 minutes	More than 60 minutes
Reading	Ireland	61	35	5	<1
	PIRLS	22	55	19	4
Maths	Ireland	61	38	1	0
	TIMSS	26	57	16	1
Science	Ireland	42	17	1	<1
	TIMSS	32	39	10	1

Rows do not sum to 100 as the item is not applicable for those teachers who do not assign homework in each domain.

Table 5.22 shows the percentages of Fourth grade pupils whose teachers engaged in specified interactions with pupils regarding their homework assignments. In Ireland, for reading and mathematics, large majorities of pupils were taught by teachers who corrected homework assignments and gave feedback to their pupils, discussed the homework in class, and monitored the completion of homework *always or almost always*. These practices are more frequent in Ireland than at the PIRLS or TIMSS averages. A very small percentage of Fourth class pupils (0-2% for reading, less than 1% for mathematics, and 1% for science) are in classes where teachers report that they *never or almost never* engaged in these three activities.

In this regard, Irish teachers appear to be more attentive to pupils' homework than their peers in many other countries, including the majority of our comparison countries.

Table 5.22: Percentages of pupils' teachers indicating frequency of providing different types of feedback on homework, by domain, Ireland and study averages

		Correct assignments and give feedback to pupils			Discuss the homework in class			Monitor whether homework was completed		
		Always/ almost always	Some-times	Never/ almost never	Always/ almost always	Some-times	Never/ almost never	Always/ almost always	Some-times	Never/ almost never
Reading	Ireland	82	17	1	76	22	2	97	3	0
	PIRLS	74	23	4	68	29	3	91	8	2
Maths	Ireland	93	7	<1	86	14	<1	100	<1	0
	TIMSS	77	19	2	63	33	2	89	8	1
Science	Ireland	51	8	1	46	13	1	54	5	1
	TIMSS	60	19	2	59	21	1	73	8	1

Rows do not sum to 100 as the item is not applicable for those teachers who do not assign homework in each domain.

Use of ICT in the classroom

Teachers reported that a small majority of Fourth class pupils in Ireland were taught in classes where a computer is available for pupils to use during reading (56%), mathematics (55%) and science (62%) lessons. The corresponding international averages are, respectively, 45% (for PIRLS countries), and 42% and 47% (for TIMSS countries), showing that there is slightly greater than average availability of computers in Ireland. A little over half (53%) of pupils with computer access in Ireland also had access to the internet, compared to two-fifths (39%) among PIRLS countries.

Almost all (98%) Fourth class pupils in Ireland were taught by a teacher who reported using a computer for classroom instruction, well above the PIRLS and TIMSS international averages (74% for both studies). The use of computers in class was also almost universal in England, Singapore, Hong Kong and Northern Ireland, but was slightly less common in Finland (89%).

Table 5.23 displays the percentages of pupils (as reported by their teachers) who used computers for a range of activities in their reading, mathematics, and science lessons. Approximately one-quarter to one-half of Irish Fourth class pupils used computers at least once a month to look up ideas or information in the three domains. About two-fifths of Irish pupils used computers to read or write stories or texts during reading lessons, and to explore concepts and practice skills during mathematics lessons.

Computer were used less frequently in reading lessons to develop reading skills and strategies, and to practise scientific skills, procedures, and experiments in science lessons. About one-third of Irish pupils *rarely or never* used computers to practise scientific skills (31%) or to do scientific experiments or procedures (33%).

Table 5.23: Percentages of pupils' teachers indicating frequency with which computers were used in lessons for different types of activities, by domain, Ireland and study averages

			Every day or almost every day	1 or 2 times a week	1 or 2 times a month	Rarely or never
Reading	To look up information	IRL	3	22	25	5
		PIRLS	4	17	17	6
	To read stories or other texts	IRL	3	19	20	13
		PIRLS	3	12	18	12
	To write stories or other texts	IRL	1	10	32	12
		PIRLS	3	10	19	12
	To develop reading skills and strategies with instructional software	IRL	1	10	18	25
		PIRLS	3	11	15	15
Maths	To explore mathematics principles and concepts	IRL	2	16	24	13
		TIMSS	2	9	15	15
	To look up ideas and information	IRL	1	7	26	21
		TIMSS	3	8	16	15
	To practise skills and procedures	IRL	3	22	18	12
		TIMSS	4	14	16	7
Science	To do scientific procedures / experiments	IRL	<1	5	23	33
		TIMSS	1	6	16	23
	To look up ideas and information	IRL	2	15	38	6
		TIMSS	3	13	24	6
	To practise skills and procedures	IRL	1	5	24	31
		TIMSS	2	9	20	16
	To study natural phenomena through simulations	IRL	1	6	28	26
		TIMSS	2	6	18	22

Pupils' use of computers in the classroom may be considered in light of teachers' preparation for teaching with computers, and the support that they receive in doing so. Table 5.24 shows several factors that may influence teachers' use of computers in the classroom for Ireland and some of our comparison countries.

In Ireland, the majority of pupils (93%) were taught by a teacher who *agreed a little* or *a lot* that they felt comfortable using a computer in their teaching. This is similar to the international averages and to the percentages reported in Finland and the Russian Federation, but lower than in most other comparison countries.

The percentage of pupils in Ireland whose teachers considered themselves to have received adequate support for integrating the use of computers into their teaching (72%) is somewhat lower, and slightly below the international averages. By comparison, at least 90% of pupils in England, Northern Ireland, Hong Kong and Singapore are taught by teachers who received adequate support for integrating computers into their teaching.

"Teaching support" was more commonly available than access to adequate technical support in Ireland, England and Northern Ireland. In Ireland, about two-thirds (64%) of Fourth class pupils were taught by a teacher who said that they could access technical support when required. Although similar to Finland, this represents a lower percentage of pupils than in any of our other comparison countries, or the PIRLS and TIMSS international averages. The four comparison countries where access to support staff exceeded 90% – Hong Kong, Korea, Russian Federation and Singapore – all had average school enrolments well above the study averages (see Lewis & Archer, 2013), suggesting that ease of access to support staff may be, to some extent, a function of school size.

Table 5.24: Percentages of pupils' teachers indicating the extent of their agreement that they were comfortable or supported in using computers for teaching purposes, Ireland and study averages

	Feel comfortable using computers in teaching		Have access to computer support staff when there are technical problems		Receive adequate support for integrating computers into teaching	
	Agree*	Disagree*	Agree	Disagree	Agree	Disagree
Australia	97	3	78	22	81	19
England	99	1	75	25	90	10
Finland	92	8	62	38	60	40
Hong Kong	98	2	97	3	94	6
Ireland	93	7	64	36	72	28
Korea, Rep.	97	3	81	19	89	11
New Zealand	98	2	79	21	79	21
N. Ireland	97	3	82	18	91	9
Russian Fed.	91	9	90	10	89	11
Singapore	100	<1	95	5	95	5
United States	97	3	76	24	76	24
PIRLS	93	7	74	26	75	25
TIMSS	92	8	76	24	78	22

* *A lot* or *a little*.

Within Ireland, pupils in DEIS Urban schools were somewhat more likely to be taught by a teacher who was comfortable using computers while teaching – particularly in Band 2 schools, where no teachers *disagreed* that they felt confident. Teachers' lack of confidence in using computers to teach was more pronounced in DEIS Rural schools where under one-third of pupils (28%) were taught by teachers who *disagreed a little* that they were

confident (although no pupils were taught by teachers who *disagreed a lot*). Whether this is a function of different support and resource availability or of the older profile of teachers in DEIS Rural schools (and rural schools in general) is unclear.

As well as confidence teaching with ICT, appropriate access to support staff was also highest in Urban Band 2 schools (79% *agreed a little* or *a lot*). Although almost half of pupils (46%) in Band 1 schools were taught by teachers who *agreed a lot* that they had access to support staff when required (a greater percentage than in non-DEIS schools), a similar percentage were taught by teachers who *disagreed a little* or *a lot*. The availability of technical support for pupils in DEIS Rural schools (67% *agreed a little* or *a lot*) was broadly similar to that in non-DEIS schools (63%).

Finally, pupils in Urban Band 1 schools were markedly more likely to have had a teacher who reported having received adequate support in integrating technology in their teaching, with only 6% taught by teachers who *disagreed* that this was the case. This compares to 40% in Urban Band 2 schools, 14% in Rural schools, and 29% in non-DEIS schools. Differences may be related to the younger profile of teachers in Urban Band 1 schools, who are more likely to be recent graduates, and to have explored integrating ICT into teaching as part of their initial teacher education.

Discussion

This final section summarises and highlights some of the main findings from PT 2011 about the teachers, and teaching, of Fourth class pupils. Ireland is notable for the high percentage of pupils being taught by young teachers in the early stages of their careers. For example, almost four times as many pupils in Ireland as at the PIRLS or TIMSS international averages are taught by a teacher aged 25 or under. A more detailed examination of the reasons for this finding – drawing on data relating to teacher recruitment and retirement, pupil enrolment, and policy relating to pupil-teacher ratios, for example – may be worthwhile.

Irish teachers generally expressed high levels of satisfaction with their profession, compared to teachers in most other countries. However, teacher satisfaction is noticeably lower in DEIS Urban Band 2 schools than in other school types, reflecting Day's (2008) assertion that teachers' commitment to the profession is "more persistently challenged" in schools serving more disadvantaged communities. The relatively low percentage of pupils taught by older or more experienced teachers in Urban Band 2 schools is worth noting in this regard. The higher teacher satisfaction found in Band 1 schools may suggest that the additional supports they receive may help to mitigate some of the challenges faced by teachers in DEIS schools. Day (2008) suggests that supporting resilience and commitment among staff – particularly in schools with more disadvantaged pupil intakes or with greater disciplinary problems – should be considered an issue for professional development, a point also made by Banks and Smyth (2011).

Teacher' questionnaire responses also show that Ireland is unusual, in international terms, for the very low level of collaboration and sharing of professional expertise among teachers of Fourth class pupils. For example, about one-quarter of Irish pupils are taught by teachers who never or almost never discussed teaching with their colleagues, or worked with their teaching colleagues in preparing instructional materials. Only in four countries (Malta, Morocco, Tunisia and Yemen) were collaborative practices less frequent. At post-primary level, too, collaborative practices such as observing other teachers' classes have been shown to be quite rare in Irish schools (Shiel, Perkins, & Proctor, 2009). The Teaching Council's code of professional conduct, last revised in 2012, encourages collegiality and collaboration, regarding it as a key component of the profession. For example, they recommend that teachers should "work with teaching colleagues and student teachers in the interests of

sharing, developing and supporting good practice and maintaining the highest quality of educational experiences for pupils/students" and "in a context of mutual respect, be open and responsive to constructive feedback regarding their practice and, if necessary, seek appropriate support, advice and guidance" while exercising their duties (Teaching Council, 2012, pp. 7-8). The Department of Education and Skills' recently-updated guidelines for school self-evaluation also actively promote collaboration among teachers in planning lessons and observing each other's work (DES, 2012a).

Irish teachers reported being much less confident teaching science than mathematics. While this was also the case in many other countries, it was particularly apparent in Ireland. In comparative terms, similar percentages of pupils in Ireland and internationally were taught by teachers who were *very confident* teaching mathematics, while the percentage of pupils in Ireland whose teachers were *very confident* teaching science was about two-thirds of the corresponding TIMSS average. Specific areas where confidence was particularly low in science teaching included answering pupils' questions about the subject, and providing suitably challenging tasks for high-performing pupils. Irish teachers' lack of confidence in these areas may be considered in light of their relatively low participation in subject-specific CPD. Compared to pupils internationally, pupils in Ireland are less likely to be taught by a teacher who had participated in any CPD relating to a range of specific instructional and assessment-related topics in the two years prior to PT 2011. This is the case for both science- and mathematics-related CPD.

Similarly, compared to teachers in most countries, Irish teachers spent less time on reading-related CPD, and were far less likely to report reading children's books for the purpose of professional development. In fact, just under two-fifths of Irish pupils were taught by teachers who reported engaging in *no* reading-related CPD over the previous two years. Low rates of participation in CPD in Ireland, relative to many other countries, have also been noted at post-primary level (Gilleece et al., 2009).

Unlike some other European countries (European Commission/EACEA/Eurydice, 2013), participation in CPD is optional for Irish teachers rather than being a contractual requirement or a necessity for promotion. The Irish approach can be contrasted to that in many other countries. Teachers' engagement in significant CPD is by no means universal, but it is a prominent feature of most of the higher-performing education systems. For example, primary school teachers in Singapore are entitled to a minimum of 100 hours of CPD annually (Chin et al., 2012). In Korea, teachers with more than three years of service must complete a 180-hour CPD programme in order to advance from being a "Grade II" teacher (newly-qualified) to a "Grade I" teacher (Cho, Kim, Kim, & Rim, 2012). In Finland, participation in CPD is a requirement, and teachers – all qualified to Master's level – must participate in a *minimum* of three days CPD per annum (Kupari & Vettenranta, 2012). However, many Irish principals report that "nearly all" of the teachers in their school would be eager to participate in CPD (Banks & Smyth, 2011).

Thus, while the mean scores achieved by Irish pupils for each of the three assessed domains were significantly above the international centrepoints (Eivers & Clerkin, 2012a), targeted CPD might help to support teachers' confidence and competence in the classroom, and thereby further support pupil learning. The findings reported here suggest that teachers' confidence when discussing and teaching science in the classroom is especially low compared to confidence with mathematics, and could benefit from further professional development. The suggestion by Eivers et al. (2010) that schools should identify their key CPD requirements at both the school- and the individual teacher-level, in order to ensure that teachers participate in CPD in areas where it is most needed, is worth reiterating.

The 2009 National Assessments showed that the use of ICT in the classroom was identified by teachers as the highest-priority topic for CPD in relation to mathematics teaching, and one of the highest in relation to reading, at both Second and Sixth class levels. Teachers also reported a lack of confidence in using computers to teach reading or mathematics (Eivers et al., 2010). In contrast, most teachers in PT 2011 reported feeling comfortable using a computer in the classroom, and a large majority say that they receive adequate support in integrating ICT into their teaching. Almost all Fourth class pupils in Ireland were in classes where their teacher uses a computer for instruction – more than the international study averages. However, although computers are widely available in Irish classrooms, pupils' use of the technology is often at a relatively basic level, such as looking up information or reading a story on-screen. In addition, a minority of pupils *rarely or never* use a computer in class at all. The integration of ICT into teaching therefore appears to remain an area where professional development is key.

Finally, the data from PT 2011 show clearly that teachers, both in Ireland and internationally, spend substantially less time on science-related teaching activities than on reading or mathematics. For example, few Irish pupils are expected to memorise scientific facts or principles more frequently than once or twice a month, although this practice is much more common in mathematics lessons, possibly suggesting that pupils' basic scientific knowledge is being under-developed. Irish pupils also receive much less science homework – and less frequently – than reading or mathematics homework. Of relevance here is the amount of time allocated to teaching each of the three domains, with relatively little time allocated to science instruction in Ireland. This is described further in Chapter 2 of this volume (Lewis & Archer, 2013).

Additional references

This section does not repeat the core references already listed in Chapter 1. These include the three international reports and the Irish national report on PT 2011, and those related to other key studies such as National Assessments and PISA.

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Chapter 6
Home-school interaction

Eemer Eivers and Ann-Marie Creaven

Introduction

The introduction to the Primary School Curriculum states "It is widely recognised that significant educational, social and behavioural benefits accrue to the child as a result of effective partnership between parents and teachers. Close co-operation between the home and the school is essential, therefore, if children are to receive the maximum benefit from the curriculum." (DES/NCCA, 1999, p. 21). Valuing of parental involvement in children's education is not limited to Ireland, and a large majority of countries that took part in PIRLS and TIMSS 2011 (PT 2011) have a national policy to encourage parental involvement in their children's education (Mullis, Martin, Minnich, Drucker, & Ragan, 2012; Mullis, Martin, Minnich, Stanco, et al., 2012).

One reason for the promotion of parental involvement is the belief that significant benefits (academic and socio-emotional) can accrue. Research has produced somewhat mixed findings on parental involvement, but this is largely due to definitional issues, to collapsing across levels of education, confusion of formal parental programmes with informal engagement with school life, and to poorly designed studies. On balance, the evidence is that parental involvement can be beneficial, but it depends on the type of involvement and the stage of education. At a very broad level, informal at-home involvement (e.g., helping with homework, discussing school) shows a strong positive association with achievement, while the relationship is less clear for formal, in-school parental involvement (e.g., joining the Parents' Council, volunteering for committees) (Archer & Shortt, 2003; Archer & Weir, 2005; Desforges, 2003; Harris & Goodall, 2007).

In Ireland, it is only relatively recently that the potential benefits of parental involvement, or indeed the rights of parents to be involved, have been recognised, although their right to choose a school was highly valued and protected, and the promotion of parental involvement in addressing disadvantage was recognised as early as the Rutland Street Project, set up in 1969 (Holland, 1979; Kellaghan, 1977). From the foundation of the State to the late 1960s, education was seen almost entirely as the domain of school managers, and "parents or lay persons were not welcome by the church authorities as participants in managing primary education" (INTO, 1997, p. 3). In the context of wider societal reform in the 1960s, the church hierarchies began to acknowledge that parents had some rights to consultation about their child's education. This change in attitude led to the establishment of Boards of Management in 1975, although it is likely that the offer of increased state support for schools with such Boards helped to sway traditionalists. The Boards of Management allowed for limited representation for parents (and teaching staff)[1] and represented the first significant change in the management of primary schools since the system was established in 1831 (Coolahan, 1981).

[1] Prior to 1975, school management was entirely under the control of the school manager, who was almost always a local priest or rector.

The opening of the first multidenominational school (the Dalkey School Project) in 1978 was described as the first real recognition of parents' Constitutional right to determine the type of school for their children without input from the Church (Mac Ruairc, 2011). However, change came slowly, and only three multidenominational schools had been set up by 1985. Mac Ruairc (2011) singles out reluctance of Department of Education officials for the slow pace of change, but it is likely that other explanations – such as difficulties in acquiring sites and funding, lack of a coherent strategy and of an established patron body – also need to be considered.

It was not until 1997 that more or less equal representation on Boards for parents, teachers and the patrons was introduced. Walshe (1999) attributed the rebalancing of the Boards to lobbying by the National Parents Council (NPC), formed in 1985 as part of a commitment under the Programme for Government. However, of at least equal importance was the National Education Convention, held in 1993. The Convention was attended by invited representatives of 42 organisations, and was the first time that what we now call the "education partners" were brought together to discuss issues in Irish education. Parental involvement in school decision-making emerged as a key area where the need for change was perceived (Coolahan, 1994). However, the gathering momentum for change was matched by concerted opposition from patron bodies, which won concessions such as retaining full control of the chairperson role, and stipulations that community representatives on the Boards must have a commitment to the ethos of the school (e.g., in Church of Ireland schools they should be members of the Church of Ireland).

Six documents were pivotal in the changing role of parents in schools. The report of the Primary Education Review Body (Ireland, 1990) was perhaps the first official recognition that better home-school links might contribute to better educational outcomes. Shortly afterwards, Circular 24/91 (Parents as Partners in Education) explicitly stated that schools should be required to establish a clearly defined policy for productive parental involvement (Department of Education, 1991). Next, the Green Paper (1992) and White Paper (1995) both proposed significant roles for parents. The Green Paper was perceived as acknowledging that educational aims can only be achieved by a partnership of parents, teachers and management (INTO, 1992). The White Paper indicated that the NPC would be given statutory recognition, that parents would be given statutory rights to representation on Boards of Management, and that Boards would be required to promote the setting up of Parents' Associations and formal home-school links. It was followed by the Education Act (1998), which enacted much of the content of the White Paper.

Finally, in 1999, a revised Primary School Curriculum, with a focus on partnership in education, was introduced. These legislative changes were accompanied by two key practical changes. First, the Home School Community Liaison (HSCL) Scheme was established in 1990, and second, in 2006, Circular 138/06 advised schools that parents were entitled to access any information held by the school about their child's performance on standardised tests and other related assessment outcomes, and reiterated Circular 24/91's requirement on parental involvement. Another innovative development in this regard is the recent national strategy to improve literacy and numeracy (DES, 2011b), which devotes one of its eight sections to enhancing parental involvement.

Despite these changes, there have been criticisms of how the aspirations for parental involvement have been translated into practice (e.g., Hanafin & Lynch, 2002; Mac Giolla Phádraig, 2005; Mac Ruairc, 2011). Parental involvement in schools is perceived as being mainly about fundraising and rubber-stamping of decisions already made within the school. Parents may feel excluded from decisions about substantive policy issues, and even from school-level decisions that may have significant financial implications for parents, such as a new uniform policy, or changing textbooks (Hanafin & Lynch, 2002). The Your Education

Survey, conducted in 2004, found that 57% of Irish adults surveyed believed parents had too little influence on the education system, while only 49% felt that parents were sufficiently involved in the management of primary schools (Kellaghan, McGee, Millar, & Perkins, 2004).

The recent Department of Education and Skills (DES) survey on Diversity of Patronage marked a change in the nature of consultation with parents of primary-aged children. For the first time, large numbers of parents were formally consulted about their views on the preferred patronage model for primary schools in their area. Unlike previous consultations concerning new-build schools, the Diversity of Patronage survey was designed to gauge the level of parental preferences for patronage types in a locality and then to see how these preferences could be met using *existing* school building stock. While limited to only 44 areas – all with populations in excess of 5,000 and therefore excluding parents in rural areas – the 2012/13 survey was perhaps the first time that parental choice in patronage was addressed proactively, rather than reactively, by the DES. An anticipated outcome of the survey is that the patronage of some of the more than 90% of primary schools currently under the patronage of the Catholic Church would change.

The gradual system-level shift towards recognising the importance of parental involvement has also been reflected within primary schools, although Irish research evidence on the extent to which the shift has occurred or to which it varies between schools is somewhat limited. In the UK, Desforges (2003) found that the extent of parental involvement is influenced by family social class, maternal education, pupil age, pupil attainment and, to some extent, by the ethnic culture of the family. Peters, Seeds, Goldstein and Coleman (2008) reported that British parents who left full-time education later were more likely than average to feel very involved in their child's education, while lone parents and "non-resident" parents (i.e., those not usually living with the child) were less likely than average to feel very involved.

Available Irish research evidence tends to be broadly consistent with the UK studies just cited. For example, Hall, Conway, Rath, Murphy and McKeon (2008) reported that working-class parents were less comfortable than were middle class parents with the type of language used in primary school reports and were less likely to question teachers, while other studies have found higher levels of parental involvement in Irish- than in English-medium schools (Gilleece, Shiel, Clerkin, & Millar, 2012; Mac Giolla Phádraig, 2003). Eivers et al. (2010) found that many parents – especially those whose children were performing at the lower end of the achievement spectrum – did not have a clear understanding of the progress their child was making in school.

All schools are expected to have a Parents' Association, but only 1480, or slightly less than half of primary schools in Ireland, are affiliated with the NPC (NPC, 2010). Whether this is due to non-affiliation, or because a large number of schools do not have Parents' Associations is unclear. However, an outcome is that in more than half of schools, parents need not be consulted during whole-school evaluations, as the evaluation team are only obliged to consult with groups affiliated with the NPC. In practice, a sample of parents in every school completes a short questionnaire. However, a meeting is held with NPC-affiliated parent groups only. Where no such group exists, a meeting is held with the parent representatives on the Board of Management.

Although there has been a gradual increase in parental participation in children's education, not all types of parental involvement have proceeded at the same speed. Epstein's (1995, 2001) typology of parental involvement outlines six main categories of activities through which schools can engage with parents. The first, *parenting,* involves assisting families with parenting skills and supporting child and adolescent development. The second,

communicating, refers to effective communication on school and individual-level topics, such as school accomplishments or individual academic achievement. The third, *volunteering* refers to the provision of volunteer opportunities for parents, at various times and locations throughout the year. The fourth type of involvement, *learning at home*, acknowledges the importance of parents' assistance to their children with homework and in other curriculum-related activities. The fifth type, *decision-making* means including parents in decisions at the school and pupil level. Finally, *collaborating with the community* refers to the school's role in coordinating community resources for families, pupils, and the school itself.

Against the backdrop of changed policies on the role of parents in education, and the perception that on-the-ground experience may lag behind the policy changes, PT 2011 data present an opportunity to examine the role of parents in Irish schools. In addition to direct comparisons with other countries, it is also possible to compare the views of parents and school staff in Ireland, and to examine what differences there may be in different types of school settings. The remainder of this chapter describes PT 2011 data related to home-school links. (Readers who would like more background information on PIRLS or TIMSS, or about Ireland's participation in PT 2011 generally, are referred to Chapter 1 of this volume [Eivers & Clerkin, 2013].)

First, we present principal and class teacher responses to some general questions about parental support and involvement in their schools. The second section outlines parental views on how included and involved they feel in their child's education. Section three outlines parental perceptions of the academic and pastoral care provided by their child's school. Section four describes the nature and extent of communication with parents about how their child is progressing, and is followed by a section on how schools keep parents informed about school-level information. Section six examines the frequency with which parents were invited to act as volunteers in school-related activities; section seven examines schoolwork in the home, and section eight discusses the findings.

Generally, Ireland is compared against the PIRLS and TIMSS study averages, where available (information from the Parent Questionnaire is only available for PIRLS). However, in some cases, comparisons are also made, where relevant, with the key set of countries referred to in Chapter 1, namely, English-speaking countries, and top performers in reading, mathematics, and science. As parents in England did not complete a Parent Questionnaire, particular attention is paid to home-school links in Northern Ireland, as our closest neighbouring educational system. Differences within the Irish education system (such as by DEIS status or school location) are also reviewed.

Many of the questions in PT 2011 contextual questionnaires were combined into scales measuring a single underlying latent construct (e.g., a "students motivated to read" scale). Unusually, such international scales were not developed from questions relating to home-school interaction. Therefore, the present chapter focuses primarily on individual items, rather than scale scores.

Staff views of parental support and involvement

As summarised in Table 6.1, Irish principals and teachers were far more positive in their ratings of parental support than were their counterparts in most PT 2011 countries. For example, 70% of pupils in Ireland attended schools where the principals rated parental support for pupil achievement as *very high* or *high*, roughly double the average across countries participating in PIRLS (38%) and TIMSS (35%). Across both studies, in only four countries

(Northern Ireland, Chinese Taipei, Indonesia and New Zealand) were pupils' principals more likely to rate parental support as *very high*. As a corollary, relatively few Irish pupils (7%) attended schools where the principal rated parental support for academic achievement as *low* (none rated parental support as *very low*).

Similarly, class teachers in Ireland were far more positive in their ratings of parental support for pupil achievement than the average for PIRLS or TIMSS. Teachers of only 6% of pupils in Ireland gave *low* or *very low* ratings to the level of support in their school. This compares very favourably with the averages across all PIRLS (16%) and TIMSS (17%) countries. As with principal ratings, teachers in Indonesia, Northern Ireland and New Zealand gave particularly favourable ratings of parental support.

Table 6.1: Percentages of pupils whose principals and class teachers reported various levels of parental support and involvement, Ireland, PIRLS and TIMSS study averages

			High	Medium	Low
Parental support for pupil achievement	Principal	Ireland	70	23	6
		PIRLS	38	46	16
		TIMSS	35	48	17
	Teacher	Ireland	59	35	6
		PIRLS	37	47	16
		TIMSS	34	49	17
Parental involvement in school activities	Principal	Ireland	44	38	17
		PIRLS	33	46	21
		TIMSS	31	46	23
	Teacher	Ireland	46	40	15
		PIRLS	35	44	20
		TIMSS	32	45	22

Some response categories have been combined for ease of presentation (*Very high* and *High; Very low* and *Low*).

Irish principals and class teachers were also much more positive than the average in how they rated parental involvement in school activities. In Ireland, 44% of pupils were in schools where the principals rated parental involvement as *very high* or *high*, compared to international averages of 33% (PIRLS) and 31% (TIMSS). Similarly, the teachers of 46% of Irish pupils reported parental involvement as *very high* or *high*, compared to the international averages of 35% (PIRLS) and 32% (TIMSS).

Irish teaching staff (principals and teachers) tended to rate parental involvement in school activities slightly less positively than they rated parental support for academic achievement. Nonetheless, their ratings on both measures were more positive than in most countries.

In Ireland, as in almost all countries, there was a clear relationship between mean achievement and both the extent of parental support for academic achievement and parental involvement in school activities. Table 6.2 illustrates the relationship, using principal ratings of parental support for academic achievement. However, the same general relationship is apparent for parental involvement, and for teacher ratings of support and involvement. As no Irish principal rated parental support as *very low*, no Irish data are shown under that heading.

Table 6.2: Mean achievement scores for reading, mathematics and science by principals' rating of the extent of parental support for academic achievement, Ireland and study averages

		V. high	High	Medium	Low	V. low*
Reading	Ireland	570	556	535	520	–
	PIRLS	527	525	508	488	463
Maths	Ireland	548	533	510	491	–
	TIMSS	508	504	487	470	440
Science	Ireland	539	521	499	481	–
	TIMSS	504	500	483	464	429

*No Irish principal rated parental support for achievement as *very low*.

Differences within Irish schools

Depending on school characteristics, there were noticeable differences within Ireland on staff ratings of parental support and involvement. For example, no pupils in DEIS Urban Band 1 or Band 2 schools had principals or teachers who indicated *very high* parental support or involvement. For non-DEIS schools, the principals of 80% of pupils rated parental involvement as *high* or *very high*, in stark contrast to only 10% of pupils in DEIS Urban Band 1 schools (Table 6.3). Principal ratings for involvement in school activities showed a similar pattern. For the majority of pupils (73%) in DEIS Band 1 schools, their principals rated parental involvement as *low* or *very low,* considerably more than for pupils in non-DEIS schools (11%), or indeed, pupils in Band 2 and rural DEIS schools.

Table 6.3: Percentages of pupils in DEIS Urban, Rural, and non-DEIS schools whose principals and class teachers reported various levels of parental support and involvement, Ireland only.

Rating by...	Parental …	DEIS	High	Medium	Low
Principal	...support for pupil achievement	Urban Band 1	10	48	42
		Urban Band 2	39	61	0
		Rural	44	34	22
		Not in DEIS	80	17	3
	…involvement in school activities	Urban Band 1	10	17	73
		Urban Band 2	29	41	29
		Rural	30	56	14
		Not in DEIS	50	39	11
Teacher	...support for pupil achievement	Urban Band 1	18	43	39
		Urban Band 2	9	77	14
		Rural	37	59	4
		Not in DEIS	69	29	2
	…involvement in school activities	Urban Band 1	4	50	46
		Urban Band 2	25	53	23
		Rural	37	34	29
		Not in DEIS	52	38	10

Some response categories have been combined for ease of presentation (*Very high* and *High; Very low* and *Low*).

Ratings by pupils' teachers showed a similar overall pattern. For example, just 2% of pupils in non-DEIS schools had teachers rating parental support for pupil achievement as *low* or *very low*, compared to 39% of pupils in DEIS Band 1 schools. Taking teacher and

principal ratings together, staff in DEIS Urban Band 1 schools were least likely to rate parents favourably on these measures, and ratings from staff in DEIS rural schools tended to be more closely aligned with those from staff in non-DEIS schools than with those from other categories of DEIS schools.

Regarding language of instruction, pupils in Irish-medium schools were slightly more likely to have principals give *high* or *very high* ratings for parental support (74%, compared with 70% in English-medium schools) and involvement (54%; 44%). However, they were less likely to have teachers give *high* or *very high* ratings for parental support (55%, and 60% in English-medium schools) and involvement (32%; 47%). Although this might be taken as indicative of differences in principal and teacher views on parental supportiveness, it is important to note that only a very small proportion of pupils were enrolled in Irish-medium schools. As such, few substantive conclusions can be drawn from these data.

In a related vein, only a very small number of pupils were enrolled in schools where the patron/ethos was other than Roman Catholic (seven schools were Church of Ireland, four were multi-denominational, and one, Muslim). To avoid identification of individual schools and staff (due to the very small numbers involved) the three patron/ethos models are described together. Within the 12 schools, no principals rated parental involvement or support for pupil achievement as *low* or *very low*. Of the 15 teachers, 13 rated parental support as *high* or *very high,* with 11 reporting the same for parental involvement.

Parents' views of inclusion and involvement

Table 6.4 summarises responses to three items from the Parent Questionnaire relating to perceptions of parental inclusion and involvement. Although not exactly the same as the questions asked of principals and teachers, they allow for some broad comparisons. Data are shown for PIRLS only, as a Parent Questionnaire was not administered in countries that took part in TIMSS only.

In Ireland, 60% of parents *agreed a lot* with the statement "My child's school includes me in my child's education", slightly higher than the PIRLS average of 55%. There was considerable variation between countries in response to the statement. For example, only 29% of German parents *agreed a lot*, compared to 88% of Azerbaijani parents. Further, there was no obvious relationship (at the country level) between parents' perceptions and academic outcomes. Indeed, of the five highest-performing PIRLS countries, only in Northern Ireland did the percentage who *agreed a lot* match or exceed the PIRLS average.

For the negatively phrased "My child's school should make a greater effort to include me in my child's education" a much greater percentage of parents in Ireland (29%) than in most other countries (PIRLS average, 16%) *disagreed a lot* with the statement (i.e., indicating that they did not want the school to make greater efforts to include them). Roughly one quarter (23%) of Irish parents *agreed a lot* that the school should make more effort to include them, lower than the PIRLS average of 31%. Similarly, for "My child's school should do better at keeping me informed of his/her progress", Irish parents were noticeably less likely than the PIRLS average to want increased information from schools. For example, the percentage of Irish parents that *disagreed a lot* was approximately double the PIRLS average (31% and 14%, respectively), and in only one of our key comparison countries were parents less likely to want more information (in Northern Ireland, where 36% *disagreed a lot*).

Questionnaire responses to parental involvement and inclusion show similar patterns in Ireland and Northern Ireland. In both, while principals and teachers are more likely than the PIRLS average to rate parental involvement as high, parents are not unusually positive in their ratings of current involvement. They are, however, noticeably less inclined than the PIRLS average to *want* increased involvement.

Table 6.4: Percentages of parents reporting various levels of inclusion in their child's education, and awareness of their child's progress, Ireland and PIRLS study average

My child's school …		Agree a lot	Agree a little	Disagree a little	Disagree a lot
….includes me in my child's education	Ireland	60	32	6	2
	PIRLS	55	36	7	2
… should make a greater effort to include me in my child's education	Ireland	23	29	19	29
	PIRLS	31	31	22	16
… should do better at keeping me informed of his/her progress	Ireland	25	26	18	31
	PIRLS	39	29	18	14

Differences within the Irish population

Irish data from the three items were combined to generate an "inclusion" score, ranging from a maximum of 12 (parents felt very satisfied with the level of inclusion) to a minimum of 4 (very dissatisfied). As ratings were typically quite positive and somewhat skewed, differences were apparent only for a small number of characteristics (Table 6.5). For example, parent ratings were just over half point higher for schools teaching through Irish, and just over a point higher for Church of Ireland compared to all other patronage models combined. However, as Church of Ireland schools tend to be small, it is likely that some of this difference is accounted for by the fact that, generally, parents whose children attended smaller schools tended to give higher inclusion ratings.

Table 6.5: Mean parental inclusion score and selected school and parent characteristics, Ireland only

		% pupils	Inclusion score	
			Mean	SE
School size*	Small	33	8.9	.12
	Medium	26	8.6	.17
	Large	41	8.2	.08
School language of instruction	Irish	8	9.1	.17
	English	92	8.5	.06
School ethos	Church of Ireland	4	9.6	.16
	Non-Church of Irl	96	8.5	.02
Child spoke English/Irish prior to starting school	Yes	94	8.7	.06
	No	6	7.5	.16
Who completed survey	Mother	89	8.6	.06
	Father	20	8.4	.11

*Based on categories used to sample schools (20 or fewer Fourth class pupils in a school, 21-34, and 35 or more).

Parental characteristics were largely unrelated to overall perceptions of inclusivity. For example – and perhaps surprisingly – there seemed to be no differences in ratings by parental educational attainment, employment status or socioeconomic group. Where the Parent Questionnaire had been completed by a father, the inclusion score was slightly, but not markedly, lower than when completed by a mother (a gap of 0.2). However, parents whose children had not spoken English or Irish prior to starting school gave noticeably lower ratings (a gap of 1.2) for the extent to which they felt included and informed.

Although the overall inclusion score varied little by school DEIS status or by location, some variation was noted on individual questions. Parents in DEIS rural schools

appeared to be most satisfied with how well their child's school kept them informed of progress, as almost 60% *disagreed a little* or *a lot* that the school should do better at providing information, compared with less than half of parents in the other types of schools.

Some differences in parental perceptions of inclusion were apparent by the population density of their school locale. Parents of pupils in suburban schools were least likely to *agree a lot* that they were included in their child's education (54%, compared with 61-63% for schools in other types of locations). Parents of pupils in small town and rural schools were slightly more likely than the average to be satisfied with the school's efforts to include them in their child's education. Just under half of parents in small town and in rural schools felt that the school should make greater efforts to include them in their child's education (49%), and keep them better informed on their child's progress (46% for small town pupils, and 48% for remote rural pupils). In contrast, 57-59% of parents in urban or suburban schools wanted more effort from the school regarding inclusion and information.

Parents' views of academic support and pastoral care

As well as their views on how well the school included parents, parents were asked for their opinions about how good a job their child's school was doing, both academically and in terms of pastoral care. A very positive finding from PIRLS was that, irrespective of country, most parents believed their child's school provided a safe environment and cared about their child's progress. In Ireland, 89**%** of parents *agreed a lot* that their child's school provided a safe environment, noticeably higher than the PIRLS average of 66**%** (Table 6.6), and higher than in all but two countries (Northern Ireland and Indonesia). Similarly, at 85**%**, the percentage of parents in Ireland who *agreed a lot* that "My child's school cares about my child's progress in school" was well above the PIRLS average of 65%, and slightly above the Northern Ireland average of 81%.

Table 6.6: Percentages of pupils' parents reporting various levels of agreements with statements about pastoral care aspects of their child's school, Ireland, comparison countries, PIRLS average

		Agree a lot	Agree a little	Disagree a little	Disagree a lot
My child's school provides a safe environment	Australia	80	16	4	1
	Finland	55	40	5	<1
	Hong Kong SAR	82	16	1	<1
	Ireland	89	9	2	1
	New Zealand	83	14	3	1
	Northern Ireland	93	7	<1	<1
	Russian Fed.	42	45	11	2
	Singapore	72	25	2	<1
	PIRLS	66	28	5	1
My child's school cares about my child's progress in school	Australia	63	30	5	2
	Finland	51	43	5	1
	Hong Kong SAR	61	32	6	1
	Ireland	85	14	1	<1
	New Zealand	74	22	4	1
	Northern Ireland	81	16	3	1
	Russian Fed.	58	37	5	1
	Singapore	60	34	5	1
	PIRLS	65	29	4	1

In all but seven countries a majority of parents *agreed a lot* that their child's school provided a safe environment, while in five of those seven (Belgium [French-speaking area], France, Italy, Portugal and Slovenia) less than half of parents also *agreed a lot* that their child's school cared about their child's progress. Thus, parents generally were very positive, while parents in both Ireland and Northern Ireland held a particularly positive view of the school's pastoral care. Among our comparison countries, parents in Finland and the Russian Federation had the most negative views (e.g., only 42% of parents in the Russian Federation *agreed a lot* that the school provided a safe environment).

Parents were also positive when asked for their views on how good a job their child's school did in teaching each of reading, mathematics and science. Across all PIRLS countries, an average of at least 90% of parents agreed (*a lot* or *a little*) that the school did a good job teaching reading, mathematics and science. It is worth noting that national levels of parental satisfaction with how a subject is taught were not always a close match with national performance on a subject. To illustrate this point, Table 6.7 shows, for Ireland and key comparison countries, mean achievement scores beside parent ratings for satisfaction with reading instruction. Countries are sorted by mean score on the reading assessment rather than alphabetically.

Table 6.7: Percentages of pupils' parents reporting various levels of agreements about academic support for reading provided by their child's school, Ireland, comparison countries, PIRLS average

	Mean score	Agree a lot	Agree a little	Disagree a little	Disagree a lot
Hong Kong SAR	571	45	44	9	2
Finland	568	51	43	5	1
Russian Fed.	568	54	38	7	1
Singapore	567	47	41	10	2
Northern Ireland	558	71	23	5	1
Ireland	552	78	18	2	1
New Zealand	531	61	32	6	1
Australia	527	53	37	8	2
PIRLS	-	60	31	6	2

No data are shown for England and US, as they did not administer a Parent Questionnaire.

As can be seen, less than half of parents in Hong Kong and Singapore *agreed a lot* that their child's school was doing a good job on reading instruction, despite the two countries being among the top performers on the PIRLS reading test. Amongst countries shown in Table 6.7, parents in Ireland and Northern Ireland expressed most satisfaction (78% and 71%, respectively, *agreed a lot*), both well above the PIRLS average of 60%. Across PIRLS as a whole, parents in Indonesia were most likely to *agree a lot* (93%) while Slovenian parents were least likely to do so (24%). Indonesia averaged 428 on the PIRLS assessment, while Slovenia averaged 530.

Table 6.8 shows similar data for mathematics and science (Ireland and PIRLS average only). Irish parents expressed above average levels of endorsement for the teaching of mathematics (73% of Irish parents *agreed a lot* compared to a PIRLS average of 58%), but were slightly less positive when asked about science. Here, 51% *agreed a lot* (PIRLS average: 53**%**) while 15% *disagreed a lot* or *disagreed a little*, compared to a PIRLS average of 10**%**.

Looking at parental ratings for school academic support across the three subjects, parents in Northern Ireland and Hong Kong responded in a somewhat similar manner to parents in the Republic of Ireland. Over two-thirds of pupils' parents in Northern Ireland

agreed a lot for reading and mathematics, yet only half did so for science. While parents in Hong Kong were not particularly positive in their ratings for reading or mathematics instruction, they were even less so for science, with only 30% of pupils' parents indicating they *agreed a lot*. In all three, the international country ranking for science achievement was noticeably lower than for either reading or mathematics. Thus, while parental satisfaction with academic support may not be a very useful measure for comparing between countries, it may be of use within a country.

Table 6.8: Percentages of pupils' parents reporting various levels of agreements with statements about academic support provided by their child's school, Ireland and PIRLS study average

My child's school does a good job at helping him/her become better at …		Agree a lot	Agree a little	Disagree a little	Disagree a lot
…mathematics	Ireland	73	22	4	1
	PIRLS	58	34	6	2
…science	Ireland	51	34	11	4
	PIRLS	53	37	8	2

Informing parents about their child's progress

The previous section outlined staff and parent views on parental involvement in the school, but at a very general level. In this section, the extent to which parents are kept informed about how their child is progressing is examined, drawing on responses to items in the Teacher and School Questionnaires. As data are drawn from school staff, not parents, both PIRLS and TIMSS averages are available.

Teacher reports indicate that parent-teacher communication about pupil progress was far less frequent in Ireland than in most countries (Table 6.9). In Ireland, 85% of pupils were taught by teachers who met individually with parents to discuss learning progress between one and three times a year. The comparable study average is 34% for both PIRLS and TIMSS. Across all countries participating in PT 2011, parents of 37% (PIRLS) to 40% (TIMSS) of pupils had individual discussions about learning progress on at least a monthly basis: the corresponding percentage in Ireland was 4%. Only in Northern Ireland did parents meet less regularly with their child's class teacher to discuss progress.

Table 6.9: Percentages of pupils whose teachers reported various frequencies of discussing learning progress with parents of a typical pupil, Ireland and PIRLS and TIMSS study averages

	At least once a week	Once or twice a month	4-6 times a year	1-3 times a year	Never
Ireland	1	3	11	85	<1
PIRLS	8	29	27	34	1
TIMSS	10	30	24	34	2

In a similar vein, teachers sent home progress reports on pupil learning less frequently in Ireland than in most other countries (Table 6.10). Here, 85% of pupils' parents received a progress report from their child's class teacher less than four times a year, compared to an average of 42% for PIRLS and 40% for TIMSS. However, whereas almost all pupils in Ireland (97%) were enrolled in a school where teachers indicated that progress reports were sent home at least once per year, progress reports are not the norm in some countries. For example, parents of roughly half of pupils in Belgium, Austria and Germany never received progress reports on pupil learning from teachers. In addition, in some of the

higher performing countries, such as Chinese Taipei, Finland, Hong Kong and Singapore, progress reports were sent less frequently than the study averages.

Although ranking first and second in reading and mathematics, respectively, progress reports were *never* sent home for 16% of pupils in Hong Kong. However, principal (rather than teacher) reports indicated that *all* parents in Hong Kong were informed about their child's progress at least once a year, with the majority (97%) being informed at least 2-3 times a year. This may indicate that in some countries, progress reports are sent from the principal rather than from the class teacher, or that progress updates are verbal, not written.

Table 6.10: Percentages of pupils whose teachers reported various frequencies of providing a progress report for parents of a typical pupil, Ireland and PIRLS and TIMSS study averages

	At least once a week	Once or twice a month	4-6 times a year	1-3 times a year	Never
Ireland	4	3	5	85	3
PIRLS	9	17	20	42	12
TIMSS	8	18	21	40	13

Principal responses to similar questions in the School Questionnaire show a pattern of response that broadly matches that from teachers. Schools in Ireland provided information to parents about their child's learning progress with the lowest frequency of all PIRLS or TIMSS participating countries. Well over half (58%) of parents internationally, but only 13% of parents in Ireland, were informed about their child's learning progress at least three times a year. On average, 16**%** of parents in Ireland were informed about their child's learning progress only once per year, compared to 2% for both the PIRLS and TIMSS study averages (Table 6.11). Thailand, Morocco and Yemen were the only other countries with similarly infrequent levels of school reports.

Table 6.11: Percentages of pupils in schools where the principal reported various frequencies of providing different types of individual pupil information to parents, Ireland and PIRLS and TIMSS study averages

		Never	Once a year	2-3 times a year	3+ times a year
Inform parents about their child's learning progress	Ireland	1	16	70	13
	PIRLS	<1	2	40	58
	TIMSS	<1	2	40	58
Inform parents about the behaviour and well-being of their child at school	Ireland	0	10	68	21
	PIRLS	<1	2	35	62
	TIMSS	<1	3	36	61
Discuss parents' concerns or wishes about their child's learning	Ireland	0	17	50	34
	PIRLS	1	6	40	54
	TIMSS	1	7	40	52
Support individual parents in helping their child with schoolwork	Ireland	5	15	32	48
	PIRLS	3	6	29	61
	TIMSS	4	7	30	59

Concerning the behaviour and well-being of their child, an average of almost two-thirds of parents in PIRLS and TIMSS countries were updated by the school at least three

times a year. By comparison, only 21% of parents of Irish pupils received information this regularly. Internationally, only 2-3% of pupils' parents received this information no more than once a year. In Ireland, the equivalent figure was 10%, similar only to Morocco, Yemen, Tunisia and Northern Ireland.

Irish principals' responses to how often they discussed parents' concerns or wishes about their child's learning, and how often the school supported individual parents in helping their child with schoolwork were slightly closer to – but still below – the study averages. For example, over 80% of Irish pupils were in schools where parental concerns were discussed at least twice a year, compared to study averages of 92% for both PIRLS and TIMSS. Also, 80% of Irish pupils were in schools that supported individual parents in helping their child with schoolwork at least twice a year. This is broadly comparable with data from Eivers et al. (2010) showing that most parents could avail of a parent programme to support in helping with reading (68%), while a minority (32%) could avail of a similar programme for mathematics. However, Ireland is still below the study averages (of about 90%) for both PIRLS and TIMSS.

Informing parents about school-level issues

In addition to providing parents with feedback about their own child, schools can also keep parents informed about school-level information. Tables 6.12 to 6.14 present principal responses to a series of questions about frequency of engaging in a series of parent-related activities, broadly divided into those regarding a) school academic achievement, b) school goals, rules and activities, and c) parental support for learning.

On average, across both PIRLS and TIMSS countries, only 7% of pupils were in schools where parents were *never* informed about the overall academic achievement of the school (Table 6.12). With 25% of Irish pupils attending schools in the *never* category, Ireland is unusual in this regard. Across both studies, only in Belgium, Finland and Morocco was parental feedback on school performance less common (from 29-32% *never* received information). In contrast, 97% of pupils in Northern Ireland and 100% in England, the Russian Federation and Singapore were in schools where parents received at least annual feedback on school-level academic achievement.

Table 6.12: Percentages of pupils in schools by frequency of informing parents about the overall academic achievement of the school, Ireland, comparison countries, PIRLS and TIMSS averages

	Never	Once a year	2-3 times a year	4+ times a year
Australia	1	20	52	27
England	0	52	39	8
Finland	32	48	17	3
Hong Kong SAR	7	30	45	18
Ireland	25	53	19	3
Korea, Rep.	0	5	31	64
New Zealand	2	23	45	30
Northern Ireland	3	52	42	3
Russian Fed.	0	18	32	50
Singapore	0	15	51	34
United States	0	31	34	35
PIRLS	7	33	38	22
TIMSS	7	31	39	23

Twenty percent of Irish pupils' parents were *never* informed about the educational goals and pedagogic principles of the school – ten times the PIRLS and TIMSS study average of 2% (Table 6.13). In contrast, Irish parents were more likely to be updated on news about school non-achievement accomplishments than the study averages. Whereas 64% of parents in Ireland received at least tri-annual updates, averages of only 38% in TIMSS and 39% in PIRLS received such regular updates.

Table 6.13: Percentages of pupils in schools where the principal reported how often their school provided information on school goals, rules and activities to parents, Ireland, PIRLS and TIMSS study averages

		Never	Once a year	2-3 times a year	Over 3 times a year
Inform parents about the educational goals and pedagogic principles of the school	Ireland	20	56	15	9
	PIRLS	2	40	37	21
	TIMSS	2	39	37	21
Inform parents about school accomplishments (e.g., tournament results, facility improvements)	Ireland	2	6	29	64
	PIRLS	4	21	37	39
	TIMSS	5	21	37	38
Discuss parents' concerns or wishes about the school's organisation (e.g., rules and regulations, time tables) safety measures)	Ireland	3	42	33	22
	PIRLS	3	32	39	25
	TIMSS	4	32	39	25
Inform parents about the rules of the school	Ireland	1	62	20	17
	PIRLS	1	49	28	23
	TIMSS	1	47	29	23

Regarding school rules, almost all parents of pupils in Ireland (99%) were told about school rules at least annually. Over one-third were updated on rules at least twice a year, slightly below the international averages of just over half of parents. Principal reports also indicate that 22% of pupils are enrolled in schools where parents' concerns about the school's organisation are discussed at least three times a year, broadly in line with the PIRLS and TIMSS averages.

In sum, Irish parents are far less likely than are parents in most countries to be updated on school educational goals, far more likely to be updated on non-academic school news, and about average for frequency of updates on school rules.

Irish schools organised workshops or seminars for parents on learning or pedagogical issues less frequently than was the average across the PIRLS and TIMSS studies (Table 6.14). For example, 43**%** of pupils in Ireland were enrolled in schools that *never* organised such workshops or seminars (compared to a PIRLS study average of 26**%** and a TIMSS average of 20**%**). There was considerable diversity between countries in response to this question. For example, over half of pupils in the Nordic countries of Finland, Norway and Sweden attended schools that *never* organised such workshops. However, this was true of less than 1% of pupils in Singapore, Korea, Chinese Taipei and the Russian Federation.

In contrast, schools in Ireland provided parents with additional learning materials for children more frequently than was the case in most participating countries. For example, 32% of Irish pupils were in schools that provided such material at least four times a year, compared to averages of 21**%** for PIRLS and 20**%** for TIMSS.

Table 6.14: Percentages of pupils in schools where the principal reported how often their school provided various types of parental support for learning, Ireland, PIRLS and TIMSS study averages

		Never	Once a year	2-3 times a year	Over 3 times a year
Provide parents with additional learning materials (e.g., books, computer software) for their child to use at home	Ireland	19	20	29	32
	PIRLS	27	26	26	21
	TIMSS	27	26	26	20
Organise workshops or seminars for parents on learning or pedagogical issues	Ireland	43	31	17	8
	PIRLS	26	30	29	15
	TIMSS	20	31	32	17

As shown in Table 6.15, there was considerable variation, by school DEIS status, in the frequency with which these activities occurred. Pupils in rural DEIS schools were most likely to be in schools that provided learning materials to their parents (only 7% were in schools that *never* did this). In contrast, one-fifth (21%) of non-DEIS pupils' parents were *never* provided with such materials, with DEIS Urban parents falling in between.

A large majority of pupils in DEIS Urban schools were in schools where workshops or seminars were organised for parents at least twice a year, while all DEIS Urban Band 2 schools organised such workshops at least once a year. Half (51%) of non-DEIS pupils and one-fifth (22%) of rural DEIS pupils were in schools that *never* did this.

Overall, DEIS schools compared favourably with non-DEIS schools in terms of the frequency of providing parental support for learning, though clear urban/rural differences in the type of support provided are observed. This may reflect the different resources allocated and the different circumstances of organising courses in rural schools (e.g., the often relatively small numbers of parents, or the lack of a dedicated parents' room). It should also be noted that the differences reflect the intention of the relevant schemes.

Table 6.15: Percentages of pupils in schools where the principal reported how often their school provided various types of parental support for learning according to DEIS status, Ireland only

	DEIS	Never	Once a year	2 or more times a year
Provide parents with additional learning materials (e.g., books, computer software) for their child to use at home	Urban Band 1	16	19	65
	Urban Band 2	10	39	51
	Rural	7	16	78
	Not in DEIS	21	19	60
Organise workshops or seminars for parents on learning or pedagogical issues	Urban Band 1	10	9	81
	Urban Band 2	0	10	90
	Rural	22	42	36
	Not in DEIS	51	34	15

Some response categories have been combined for ease of presentation (*2-3 times a year* and *more than 3 times a year*).

Parents as volunteers

Based on principals' reports, frequency of parental engagement in volunteer work (the third of Epstein's categories) was similar in Ireland to both the PIRLS and TIMSS study averages, while the frequency with which parents were asked to serve on school committees was below the international study averages, but only slightly so (Table 6.16). For example, almost three-quarters of pupils in Ireland and on average in PIRLS and TIMSS were in schools where parents were asked to volunteer for projects or trips at least twice a year. Asking parents to volunteer was almost universal in some countries. For example, among our comparison countries, at least 99% of pupils in England, Singapore, New Zealand, the Russian Federation and the United States were in schools where parents were asked to do voluntary work. Northern Ireland, on the other hand, was similar to Ireland in the extent to which parents were invited to do so.

Approximately half of Irish pupils were in schools where parents were asked at least twice a year to serve on committees, compared to approximately two-thirds across the two studies. Only 2% of Irish pupils attended schools where parents were not asked to serve on school committees, slightly lower than the study averages or in England (7%), Finland (14%), Northern Ireland (13%), and Hong Kong (9%).

Table 6.16: Percentage of principals reporting the frequency with which parents are asked to volunteer for school events or to serve on committees, Ireland, PIRLS and TIMSS study averages

		Never	Once a year	2-3 times a year	Over 3 times a year
Volunteer for school projects, programmes, and trips	Ireland	8	19	41	32
	PIRLS	9	18	38	35
	TIMSS	10	21	39	31
Serve on school committees	Ireland	2	46	23	28
	PIRLS	7	31	32	31
	TIMSS	8	30	31	32

Given the requirement in many countries – including Ireland, England and Northern Ireland – to have parent membership on Boards of Management or equivalent, it seems likely that some principals did not consider the school Board when answering the question. Unfortunately, the question did not address the type or number of committees, nor the numbers of parents involved. Thus, for example, Irish responses may relate only to two parents appointed to the Board of Management, or it may apply to broader efforts within the school to involve many parents in decision-making. The same caveat applies to the data supplied from other countries.

In addition to school-level volunteering, some countries have a tradition of parents helping in the classroom. Therefore, teachers were asked about the availability of adult or parent volunteers to work with pupils who have difficulty with reading (i.e., a PIRLS-only question). On average across PIRLS countries, 72% of pupils were in classrooms where there was *never* access to such volunteers, compared to 84% of pupils in Ireland (Table 6.17). Of our key comparison countries, the use of parent or adult volunteers was almost non-existent in Finland, but quite common in the Russian Federation, and reasonably common in England and Australia.

Table 6.17: Percentages of pupils taught by teachers reporting various frequencies with which an adult or parent volunteer was available to them to work with pupils who have difficulty with reading, Ireland, comparison countries, PIRLS average

	Always	Sometimes	Never
Australia	9	51	40
England	9	53	38
Finland	<1	3	97
Hong Kong SAR	8	36	56
Ireland	2	14	84
New Zealand	6	37	57
Northern Ireland	2	22	75
Russian Fed.	26	60	14
Singapore	8	24	68
United States	3	45	52
PIRLS	5	23	72

Schoolwork at home

Although often not considered as such, homework probably represents the main form of home-school communication, at least in terms of frequency of contact. The NPC notes that "Homework represents a regular link between home and school and as such represents a good opportunity for the development of a practical partnership between parents and teachers." (NPC, n.d., p.2). The NPC also advises parents that a typical Third or Fourth class pupil will probably get homework on four nights per week, a view supported by two large, recent Irish studies (Eivers et al., 2010; Williams et al., 2009). The NPC also advises that 30-40 minutes homework per night is the norm for Fourth class pupils, which is slightly at odds with the Growing Up in Ireland (GUI) finding that about 20% of 9-year-olds (a year younger than the PT 2011 average) spent 60-90 minutes on homework (GUI, 2009). Chapter 5 of this volume (Clerkin, 2013) discusses teachers' reports of the duration and frequency of homework in more detail. In addition to regular homework, teachers may ask for extra parental assistance at home, particularly where a pupil begins to fall behind in class. As part of PT 2011, teachers and parents – though, perhaps surprisingly, not the pupils themselves – were asked about homework. In addition, teachers were asked about involving parents of struggling readers. This section summarises their responses.

Helping struggling readers

In Ireland, and in almost all PIRLS participant countries, the vast majority of pupils were in classes where their teacher asked parents to help struggling readers (Table 6.18). There was relatively little variation in response between countries, as the percentage of pupils whose teachers enlisted parental help ranged only from 85% in Singapore to 100% in the Russian Federation. In only five PIRLS countries (Chinese Taipei, France, Hong Kong, Morocco and Singapore) did the percentage fall below 90.

Notably, three of these countries are among the top performers in reading. It may be that teachers in the three countries are less likely to need to enlist parental help, due to relatively fewer struggling readers. For example, at least 97% of pupils in Chinese Taipei, Hong Kong, and Singapore at least reached the Low International Benchmark in PIRLS 2006 and 2011 (Mullis, Martin, Kennedy, & Foy, 2007; Mullis, Martin, Foy, & Drucker, 2012). However, the extensive shadow education systems – grind schools – in these countries (see Bray & Kwok, 2003; Cheo & Quah, 2005; Kwok, 2010) may mean that parents play a less direct role in supporting their child's learning, especially where difficulties arise.

Table 6.18: Percentages of teachers indicating that they asked parents to help struggling readers, Ireland and PIRLS study average

	Yes	No
Ireland	95	5
PIRLS	96	4

Time spent on homework

Parent reports indicate that Irish pupils are in the middle range for PIRLS participating countries, in terms of how much time they spend on homework (Table 6.13). Receiving homework is an almost universal part of life for pupils in Ireland (almost 100**%**) and across most PIRLS countries (98%) (Table 6.19). Irish pupils spend a moderate amount of time per day completing homework – 47% spent 31-60 minutes while 37% spent 15-30 minutes. Only 12**%** spent longer than one hour per day on homework, slightly less than the PIRLS study average of 20**%**. Across all PIRLS countries, over half of children in Hong Kong and the Russian Federation spent over an hour a day on homework. At the other extreme, in the Netherlands almost no pupils (<1%) spent over an hour on homework, and 19% did not receive homework at all.

Table 6.19: Percentages of pupils whose parents report the amount of time their child typically spent on homework, Ireland, comparison countries, PIRLS average

	None	< 15 minutes	16-30 minutes	31-60 minutes	1 hour+
Australia	3	36	46	13	2
Finland	<1	14	56	27	3
Hong Kong SAR	<1	2	12	33	53
Ireland	<1	4	37	47	12
New Zealand	10	36	41	11	2
Northern Ireland	0	2	30	51	17
Russian Fed.	<1	1	9	33	57
Singapore	1	5	29	39	26
PIRLS	2	13	32	32	20

The data shown in Table 6.19 can be compared to related information in Chapter 5 of this volume (Clerkin, 2013). Teachers provided information on homework assignments separately for each of reading, mathematics and science, meaning that their reports are not directly comparable to the parent-generated, global measure of homework. Nonetheless, general comparisons can be made. For example, Irish pupils tended to receive reading and mathematics homework more frequently, but science homework less frequently than Fourth grade pupils in other countries. As the time their teachers expect them to spend on homework is shorter than the international average, Irish parent and teacher reports are in broad agreement.

Parental monitoring of learning

Although Irish schools provided lower than average levels of support for parents assisting with homework, Irish parents were above the international average in terms of their homework involvement. Almost all (95%) Irish parents ensured that time was set aside for homework on a daily basis. Cosgrove and Creaven's (2013) multilevel analyses of the Irish data for PT 2011 show that parents ensuring that time was set aside for homework on a daily

basis (rather than less often) was associated with higher reading and science performance, but not with higher mathematics performance.

Irish parents were more likely than were parents in most of our comparison countries to try to ensure on a daily basis that their child set aside time for homework (Table 6.20). Across all participating countries, only in Northern Ireland did a larger percentage of parents (98) ensure time is set aside. Of course, the frequency of ensuring time is set aside is influenced by the frequency with which homework is assigned. Thus, the fact that only 31% of Dutch parents ensure time is set aside on a daily basis is related to the fact that many Dutch schools do not give daily homework.

In Ireland, 69% of parents reported helping the child with homework on a *daily* or *almost daily* basis, very similar to data from the GUI study, where 72% of the children's parents reported that they or their spouse/partner always or regularly helped their child with their homework. Internationally, 55% of pupils' parents helped with homework on a *daily* or *almost daily* basis. Irish parents were also above average in frequency of checking completed homework (92%, compared with a PIRLS average of 75%), and close to average in asking their child about what they had learned in school. Internationally, 72% of parents reported doing so on a *daily* or *almost daily* basis, compared to 67% in Ireland. Among our comparison countries, parents in Finland were least likely to ask about what was learned in school (37% did so regularly), while parents in Northern Ireland were most likely (75%) to do so.

Table 6.20: Percentages of pupils whose parents report engaging in schoolwork-related activities on a *daily* or *almost daily* basis, Ireland, comparison countries, PIRLS average

	Set aside time for homework	Help with homework	Check homework completed	Ask what learned in school
Australia	65	38	61	68
Finland	77	26	54	37
Hong Kong SAR	68	56	67	49
Ireland	95	69	92	67
New Zealand	62	45	58	66
Northern Ireland	98	76	96	75
Russian Fed.	87	71	83	61
Singapore	72	50	71	56
PIRLS	79	55	75	72

Discussion

PT 2011 provided an opportunity to compare the nature and extent of home-school interaction in Ireland with that found in other countries. Irish parents were generally happy with their child's school. They almost universally agreed that the school provided a safe environment and that the school cared about their child's education – showing considerably higher levels of agreement than in most countries. They also expressed above average satisfaction with the academic support provided for teaching reading and mathematics, but were not overly positive about support for science.

In contrast to previous research, parental characteristics were largely unrelated to overall perceptions of inclusivity in their child's school. Ratings differed little by parental educational attainment, employment status or socioeconomic group. However, parents whose children had not spoken English or Irish prior to starting school were less likely than the average to feel included in the school or informed about their child's education.

Data from PT 2011 show that Irish parents are far more involved in their children's homework than are parents in most countries. They are far more likely than the average to set aside time for homework, to make sure it is completed, and, to provide help, where needed. Their close monitoring may explain their general satisfaction with the academic support the school provides for reading and mathematics, but lower satisfaction regarding science – which rarely featured in homework.

The Irish data contain some contradictory responses. Irish principals and teachers provided extremely positive ratings of parental support for pupil achievement and parental involvement in school activities, much more positive than teaching staff in most countries. Yet, Irish parents' reports of the extent of their involvement in their child's school were not atypical. They were, however, noticeably less inclined than the average to *want* increased involvement. Interestingly, a very similar pattern of responses from teachers and parents was found in Northern Ireland.

Irish teachers were well below average in the frequency with which they met individual parents to discuss their child's learning progress or sent home progress reports on pupil learning. In some countries, relatively limited formal teacher communication with the home was counterbalanced by regular communication from the principal. This was not the case in Ireland. Irish principals provided information to parents about their child's learning progress with the lowest frequency of all PIRLS or TIMSS participating countries. Compared to the average, Irish schools were far less likely to give parents regular updates on the behaviour and well-being of their child, and less likely to discuss parents' concerns or wishes about their child's learning. Only for supporting individual parents in helping their child with homework did communication from Irish schools approach average levels.

Some of these differences may be explained by the small size, relative to other countries, of Irish schools. For example, *informal* parent-teacher conversations may perhaps be more likely in smaller schools, and may not have been included when Irish teachers indicated the frequency with which they spoke to parents about their child's progress. Irish teachers are also likely to view homework, an aspect of home-school communication not considered above, as a key means of communicating with parents about pupil progress. However, while homework can provide parents with information about pupil progress, it may not always provide sufficient information about progress relative to other pupils. Although published in 2011, some parts of the strategy for literacy and numeracy (DES, 2011b) had not been rolled out when PT 2011 was administered. Key new obligations include requirements to inform parents about pupil progress, to raise parental understanding of the standards their child should achieve, and a more general objective that parental engagement is integrated into each school's School Improvement Plan.

In addition to communication about an individual child, school staff can communicate with parents about the school in general. PT 2011 results clearly show that Irish parents are far less likely than are parents in most countries to receive updates about academic achievement in the school or about the school's educational goals. Only for areas such as updates on school news, school rules, and asking parents to volunteer or serve on committees is home-school communication in Ireland similar to or more frequent than in most countries. However, on foot of the strategy for literacy and numeracy (DES, 2011b), all principals are required since 2012 to provide an annual report to the Boards of Management on aggregated performance data from standardised tests of reading and mathematics.

It is difficult to reconcile the apparently quite limited communication from Irish schools (compared to schools in other countries) with the finding that Irish parents are less likely than the average to want more communication. Perhaps some felt that they receive

sufficient information about their child's progress through homework assignments and homework journals. Other parents may have had mechanisms such as school newsletters in mind when responding, rather than substantive information about their child's progress in school or about the school's academic achievements. Whatever the explanation, introduction of the new requirements related to parental engagement in *Literacy and Numeracy for Learning and Life* (DES, 2011b) would seem to provide an opportune time for Irish schools to review how and what information they communicate to parents.

Differences in ratings of parental support and involvement by school type were evident, some of which supported anecdotal views referred to in the introduction to this chapter. For example, teaching staff in DEIS Urban schools gave below average ratings of parental involvement and support. Two recent reviews – one independent (Weir, Archer, O'Flaherty, & Gilleece, 2011) and one by the Inspectorate (DES, 2011a) – suggested that DEIS schools are active in setting targets for the involvement of parents in schools, and linking these in practice to clearly identifiable and effective interventions and strategies. PT 2011 does not contradict these findings directly, but does identify some issues that should be the subject of further research.

DEIS Urban schools were well above average on the frequency with which they organised parent workshops and courses (schools in the rural component of DEIS were more likely to provide additional learning materials for parents). Thus, schools offering parent courses most frequently had staff with the least positive ratings of parental involvement, while *parental* perceptions of inclusion varied little by DEIS status. This apparent conundrum does not mean that efforts by DEIS schools to engage parents are unsuccessful. Although teacher ratings were poorer than in non-DEIS schools, teachers of a majority of pupils in DEIS schools nonetheless rated parental support and involvement as medium or high. Also, a common feature of outreach measures for parents in low-SES or disadvantaged schools is that a minority of parents – often those most marginalised – fall into the "hard to reach" category (see, for example, Archer and Shortt's [2003] review of the HSCL scheme). Such parents may partially account for the relatively low ratings of parental support given by teachers in DEIS Urban schools.

In sum, PT 2011 data indicate that compared to the average, Irish parents receive less information from school staff on academic achievement and more information on non-academic accomplishments. Irish parents are average for volunteering and well above average at monitoring homework.

The results of the study raise a number of issues that merit further consideration. First, the role of homework in Irish schools requires examination. In particular, the extent to which it appears to be relied on as the key means of communication between home and school should be re-evaluated. Second, the type of information given by schools to Irish parents is imbalanced, dissimilar to most other countries, and needs to be adjusted. Third, the proposals in the literacy and numeracy strategy (DES, 2011b) should be re-considered in light of the findings presented here.

Additional references

This section does not repeat the core references already listed in Chapter 1. These include the three international reports on PT 2011 and the Irish national report and those related to other key studies such as National Assessments and PISA.

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Chapter 7
Reading literacy in PIRLS 2011

Tara Concannon-Gibney and Gerry Shiel

Introduction

This chapter takes an in-depth look at the performance of pupils in Ireland on the PIRLS 2011 reading items. In doing so, it seeks to situate PIRLS in the context of the Primary School English Curriculum (PSEC) (DES/NCCA, 1999a), National Assessments of English reading, and initiatives arising from *Literacy and Numeracy for Learning and Life* (DES, 2011).

First, the chapter reflects on the definition of reading literacy in PIRLS and looks at links between the PIRLS assessment framework, the PSEC and National Assessments. Second, it looks at performance on the PIRLS International Benchmarks – descriptions of performance at different points on the PIRLS reading literacy scale – and the proportions of pupils in Ireland and internationally achieving at each Benchmark. Third, it provides examples of two passages of text used as part of the assessment. Fourth, it compares the performance of pupils in Ireland to that of pupils internationally on a selection of associated test items. Fifth, it examines the performance of boys and girls on the selected PIRLS items. The concluding section reflects on the outcomes of PIRLS, and suggests some implications for curriculum and instruction. Readers should note that this chapter examines only one aspect of the PIRLS 2011 data. Those who would like more general information about PIRLS or about PIRLS and TIMSS 2011 are referred to Chapter 1 of this volume (Eivers & Clerkin, 2013).

As outlined in more detail in the national report by Eivers and Clerkin (2012), Ireland's overall performance in PIRLS was strong. Pupils in Fourth class in Ireland ranked 10th of 45 participating countries, with a mean score of 552 points – well above the PIRLS international centrepoint of 500. Just five countries achieved mean scores that were significantly higher than Ireland's. The gap between the mean score of pupils in Ireland and in the highest-scoring country (Hong Kong) was 19 points (just under one-fifth of a standard deviation). In Ireland, girls achieved an average score of 559 points, compared with an average of 544 for boys. The 15-point gap, which is statistically significant, is marginally smaller than the overall international average gender difference (17 points). As Ireland's overall performance was well above average, pupil performance on most test items was also well above average, as will be apparent in the section examining performance on selected items.

Prior to 2011, the last international study of reading literacy in which primary-level pupils in Ireland had participated was the IEA Reading Literacy Study in 1991. In that study, nine-year-olds in Ireland (pupils in Third class) ranked 12th of 27 participating countries/systems, achieving a mean score 509 (Martin & Morgan, 1994). While this was above the international average of 500, it was significantly lower than the mean scores of pupils in eight countries/systems, and was considerably lower (by one-half of a standard deviation) than the mean score of the highest-scoring country (Finland, 560 points). In the Reading Literacy Study, boys in Third class in Ireland had a mean score that was 15 points lower than that of females – about the same size gap as in PIRLS 2011, though marginally larger than the international difference of 12 points in favour of girls in 1991.

Definitions of reading literacy and links across curriculum and assessment frameworks

This section examines definitions of reading literacy and explores links between the PIRLS assessment framework, the PSEC and National Assessments. First, the definition of reading literacy in PIRLS is considered:

> Reading literacy is defined as the ability to understand and use those written language forms required by society and/or valued by the individual. Young readers can construct meaning from a variety of texts. They read to learn, to participate in communities of readers in school and everyday life, and for enjoyment (Mullis, Martin, Kennedy, Trong, & Sainsbury, 2009, p. 11).

Significant aspects of this definition include reference to constructing meaning from different text types (i.e., reading is viewed as an active, meaning-making process), the recognition that learning to read is a social process for young children, and the acknowledgement that children read to learn and to experience enjoyment.

The definition of reading underpinning the two most recent National Assessments (NAER 2004, NA 2009) is quite similar to that found in PIRLS in that it emphasises reading as a constructive process, and recognises that young children read for enjoyment. The National Assessments definition goes beyond PIRLS by specifying in more detail the various sources of knowledge that interact in the construction of meaning, including the reader's existing (prior) knowledge:

> Reading is the process of constructing meaning through the dynamic interaction among the reader's existing knowledge, the information suggested by the written language, and the context of the reading situation. Young readers read to learn, to participate in communities of readers, and for enjoyment (Eivers, Shiel, Perkins, & Cosgrove, 2005, p. 15).

The definition of literacy underpinning the recent literacy and numeracy strategy (DES, 2011) is broader than the definition of reading literacy in PIRLS or the National Assessments, in that it refers to oral language and writing as well as reading, while also making reference to digital media:

> Traditionally we have thought about literacy as the skills of reading and writing; but today our understanding of literacy encompasses much more than that. Literacy includes the capacity to read, understand and critically appreciate various forms of communication including spoken language, printed text, broadcast media, and digital media. Throughout this document, when we refer to "literacy" we mean this broader understanding of the skill, including speaking and listening, as well as communication using not only traditional writing and print but also digital media (DES, 2011, p. 8).

PIRLS framework and item specifications

PIRLS is designed to provide a snapshot of reading literacy achievement of pupils in their fourth year of formal schooling. In Ireland, pupils in Fourth class completed PIRLS.[1] The PIRLS test comprised ten reading passages, spread over multiple test booklets, which were divided equally across two reading purposes: reading for Literary Experience and to Acquire and Use Information (Table 7.1). Within each of the two reading purposes, PIRLS items measured four comprehension processes: focus on and retrieve explicitly stated information,

[1] For international comparison purposes, Infants classes are classified as ISCED 0 (or pre-primary). Primary (or ISCED 1) is considered to start at First class.

make straightforward inferences, interpret and integrate ideas and information, and examine and evaluate content, language and textual elements. As shown in Table 7.1, performance on PIRLS item types is reported for:

- two **purpose** subscales: Literary and Informational.
- two **process** subscales: Retrieve/Infer (based on items categorised as retrieving explicitly stated information or making straightforward inferences); and Interpret/Evaluate (based on items categorised as interpreting and integrating, or examining and evaluating).

PIRLS used multiple-choice and constructed-response items, with about 50% of items in each format. Constructed-response items were scored by trained markers in participating countries, using procedures designed to ensure high levels of reliability.

Table 7.1: Reading purposes and processes in the PIRLS 2011 assessment framework, and associated subscales

	Framework Element	Subscales
Purposes	For literary experience (50%) To acquire and use information (50%)	Literary Experiences (50%) Acquire/Use Information (50%)
Processes	Retrieve explicitly stated information (20%) Make straightforward inferences (30%)	Retrieve/Infer (50%)
	Interpret and integrate ideas and information (30%) Examine and evaluate content, language and textual elements (20%)	Interpret/Evaluate (50%)

PSEC content – Third and Fourth classes

The PSEC consists of two documents:

- curriculum content (DES/NCCA, 1999a) that is grouped by successive class groups (for example, Third and Fourth class have a common curriculum).
- teacher guidelines (DES/NCCA, 1999b) for instruction across reading, writing and oral language for pupils throughout their primary school experience.

While the documents specify broad objectives and give examples of methodologies, each school is responsible for enactment of the curriculum at local level and is required to develop a school plan that states which objectives they have chosen for a particular class level and the particular methodologies adopted by the school that are appropriate for their particular context. This process is supported by whole-school evaluation and, most recently, by school self-evaluation.

Within the strands of reading, writing and oral language, content is presented in four strand units at each level: receptiveness to language, competence and confidence in using language, developing cognitive abilities through language, and emotional and imaginative development through language. The PSEC calls for the integration of oral language, reading and writing, and there is a strong emphasis on developing positive attitudes towards reading through well-stocked classroom libraries, regular opportunities to pursue personal interests in reading and frequent discussions about texts with teachers and peers. Teachers are encouraged to engage their pupils in a wide range of genres including narrative, expository, documents and poetry, and reading across different curricular areas is strongly

recommended. The development of pupils' oral language is prioritised and teachers are encouraged to teach reading using a range of approaches.

The PSEC delineates the importance of not just learning language, but also using language as a learning tool. This is particularly relevant around Fourth class, when the focus turns from learning to read to reading to learn. While the curriculum documents do not mandate particular textbooks or materials, class readers, novels, library books and large format books are mentioned as possible classroom resources. Parental involvement in language learning is also strongly recommended.

The PSEC encourages Irish primary schools to use a range of assessments (both formal and informal) to monitor pupils' progress in literacy. While NA 2009 (Eivers et al., 2010) found that most schools conduct standardised tests in every grade level, the DES's (2011) national strategy for literacy and numeracy and subsequent circulars have mandated that all schools carry out standardised tests on a yearly basis in Second, Fourth and Sixth classes, and report summarised results to the DES, board of management and parents. In the future, these results will be compared to both school-based and national targets for literacy (and numeracy).

The PSEC states that "the ultimate objective of reading is comprehension" (DES/NCCA, 1999b, p.61) and that comprehension strategies and skills should be taught in a cyclical manner, beginning with basic recall and predictions in the earlier grades and progressing to skills such as analysis, synthesis, inference and deduction by Third and Fourth class. There is some criticism of this approach to comprehension as other research emphasises the importance of developing higher order comprehension strategies from the outset of instruction (Pressley, 2002).

The curriculum for Third and Fourth class stresses the importance of comprehension tasks being purposeful and authentic, and it specifies appropriate activities for building comprehension (including scanning, skimming, search-reading, reflective reading, cloze procedures, sequencing tasks, prediction assignments, study reading, finding word meanings in context and writing personal responses). Pupils are also expected to develop some basic information retrieval skills, such as using tables of contents, indexes and chapter headings, and strategies for interpreting diagrammatic information.

Some concerns in relation to the PSEC include the static nature of reading standards at national level since its inception (Eivers et al., 2005; DES, 2011), the lack of emphasis on balanced literacy (Eivers et al., 2010), over-attention to constrained skills taught out of context (Kennedy et al., 2012) and a need to further develop metacognitive learning (Eivers et al., 2010). Curriculum overload has also put pressure on the allocation of time for literacy instruction (NCCA, 2005, 2010), which is currently being extended.

Comparing PIRLS and PSEC

In examining how the PIRLS assessment aligns with the PSEC, it is helpful to discuss the types of reading tasks that are involved, and the manner in which pupils are expected to respond to a text. PIRLS includes two reading purpose subscales – reading for Literary Experience and reading to Acquire and Use Information, while the PSEC recommends that pupils in Fourth class read across a wide variety of genres, though the ratio of narrative and expository texts is not specified, and the balance seems to favour narrative texts to a greater extent than in PIRLS. Indeed, a review of class textbooks, conducted as part of the 2004 National Assessment of English Reading (Eivers et al., 2005), revealed that pupils in Irish classrooms experienced a very uneven split between the two reading purposes. While this was much more pronounced in the earlier grades (Eivers et al., 2010), it could have a cumulative effect across grade levels. Related to this, the most recent National Assessment

(Eivers et al., 2010) recommended that class libraries in Irish primary schools should include more of a balance of text types, rather than the current strong bias towards narrative texts.

Four types of comprehension processes are assessed in PIRLS: retrieve explicitly stated information, make straightforward inferences, interpret and integrate new ideas and information, and examine and evaluate text content and language. Pupils in Fourth class in Ireland will have had ample opportunities to develop the first two processes as they are to be found in PSEC content for earlier classes. However, the latter two processes only begin to be taught at Third and Fourth class level so it is likely that pupils undertaking PIRLS may have had limited instruction in these processes. The PSEC recommends the use of "real books" in the classroom, though they may be used in conjunction with class readers at Fourth class level. Therefore, pupils should have some degree of familiarity with the "authentic texts" used in PIRLS. There have been recent calls to reduce the reliance on the class reader as it persistently dominates classroom instruction in Ireland and tends to be associated with poorer reading achievement (Eivers et al., 2010).

While the PSEC seems to align reasonably well to the demands of the PIRLS assessment, the PIRLS framework recognises other extraneous factors that may affect pupil achievement, including teacher CPD, school climate, teacher attitude and home-school relations. CPD is a continual concern in relation to the Irish education system as, unlike many countries, teacher participation in formal CPD is generally not mandated, and uptake in literacy-related CPD is fairly limited (Eivers et al., 2010). While the national literacy and numeracy strategy (DES, 2011) makes reference to mandatory professional development for teachers, plans for this have not been announced to date. Chapter 5 (Clerkin, 2013) of this volume contains information on CPD as reported by teachers in PT 2011.

Comparing PIRLS and reading in the National Assessments

The framework underpinning the reading component of the National Assessments was revised prior to implementation of the 2009 assessment in Second and Sixth classes. As noted, the definition of reading underpinning the National Assessments is broadly similar to that of PIRLS, and the assessed reading processes are also very similar. However, the National Assessments also include an assessment of reading vocabulary, and performance is reported for reading vocabulary, reading comprehension and overall reading, and for the four reading subprocesses. There are no separate subscales for reading purposes. Moreover, multiple-choice items only are used in Second class, while at Sixth, two-thirds of the items follow a multiple-choice format and one-third follow a constructed-response format. In general, National Assessments tend to be more difficult for Irish pupils than PIRLS, since PIRLS is targeted at a broad range of reading ability among pupils in 45 countries, including some where average pupil achievement is much lower than in Ireland.

Performance at the International Benchmarks

In addition to reporting performance on an overall reading literacy scale, and on four subscales, PIRLS reported on performance at four International Benchmarks: the Advanced International Benchmark (625 points), the High International Benchmark (550), the Intermediate International Benchmark (475), and the Low International Benchmark (400). A key feature of the PIRLS International Benchmarks is that they include descriptions of what pupils scoring at each Benchmark can achieve (see next section) as well as estimates of the percentages of pupils in each country achieving them.

In Ireland, twice as many pupils as at the international median reached the Advanced International Benchmark in PIRLS 2011 (16% in Ireland, and 8% internationally) (Table 7.2). Only Singapore had a markedly higher percentage of pupils (24%) at this Benchmark. The

percentages achieving this Benchmark in other high-scoring countries were similar to Ireland – ranging from 19% in Northern Ireland and the Russian Federation to 17% in Finland.

Over half (53%) of pupils in Ireland reached at least the High International Benchmark compared with the international median of 44% (Table 7.2). These percentages are cumulative and therefore include those scoring at Advanced or High Benchmarks. In general, high-scoring counties had more pupils than Ireland reaching this Benchmark – 67% in Hong Kong, 63% in Finland and in the Russian Federation, and 62% in Singapore. The proportion reaching the High Benchmark in Northern Ireland (58%) is slightly, but not markedly, higher than the percentage in Ireland.

In Ireland, 97% of pupils achieved the Low International Benchmark, compared with an international median of 95%. Corresponding estimates for other high-scoring countries were 99% for Finland, Hong Kong and the Russian Federation, and 97% for Singapore and Northern Ireland. Only 3% of Irish pupils did not reach the Low International Benchmark, meaning that PIRLS cannot describe the reading skills of these pupils. It should be noted that other international assessments that include reading literacy (e.g., the OECD's PISA) typically allocate greater proportions of pupils to the lowest (off-scale) levels of achievement. In NA 2009, 10% were categorised as scoring below the lowest proficiency level. The low percentage in Ireland achieving below the Low International Benchmark is a function of cut-off points used in establishing PIRLS Benchmarks, the overall distribution of achievement in PIRLS, and the relatively strong performance of pupils in Ireland.

Table 7.2: Cumulative percentage of pupils, Ireland and the international median[2], reaching the PIRLS 2011 International Benchmarks for overall reading

	Advanced	High	Intermediate	Low
Ireland	16	53	85	97
International median	8	44	80	95

Test items were also categorised by difficulty, and assigned to an International Benchmark level. Thus, for each Benchmark, it was possible, based on items at that Benchmark, to develop descriptions of the types of reading processes on which pupils would be expected to be successful (see the national report by Eivers and Clerkin, 2012 [Table 3.1], and Mullis, Martin, Foy and Drucker, 2012 [Exhibit 2.1]). In the next section, two released test units (pieces of text and related test items) are described. This is followed by a section describing Irish pupils' performance on a selection of sample items, and illustrating the skills that exemplify the four International Benchmarks.

PIRLS also provided estimates of the percentages of pupils at each Benchmark on Literary and Informational scales (Table 7.3) and on the Retrieve/Infer and Interpret/Evaluate scales (Table 7.4). In Ireland, the percentages of pupils reaching each Benchmark on the Retrieve/Infer and the Interpret/Evaluate subscales are virtually identical, and are well above the PIRLS averages. [3] However, slightly more pupils achieved the Advanced Benchmark on the Literary scale (20%) than on the Informational scale (16%), reflecting the better Irish performance overall on the Literary scale. The international percentages shown in Tables 7.3 and 7.4 are almost identical across subscales, indicating little variation in the percentages of pupils reaching each Benchmark.

[2] The values shown as the international median for each Benchmark are the percentages that divide countries evenly. For example, Advanced has a median value of 8%. This means that in half of participating countries more than 8% of pupils reached the Advanced Benchmark, and in the other half, fewer than 8% did so.
[3] Note that, whereas Table 7.2 provides international medians, Tables 7.3 and 7.4 provide international means, which tend to be lower.

Table 7.3: Cumulative percentage of pupils reaching the 2011 International Benchmarks on the Literary and Informational subscales, Ireland and international average

	Literary				Informational			
	Adv.	High	Inter.	Low	Adv.	High	Inter.	Low
Ireland	20	56	85	96	15	52	84	97
PIRLS	10	38	70	87	9	38	70	88

Table 7.4: Cumulative percentage of pupils, reaching the 2011 International Benchmarks for Retrieve/Infer and Interpret/Evaluate subscales, Ireland and international average

	Retrieve/Infer				Interpret/Evaluate			
	Adv.	High	Inter.	Low	Adv.	High	Inter.	Low
Ireland	16	54	84	96	17	54	85	97
PIRLS	9	38	70	88	9	38	70	87

Examples of reading texts

Four of the ten passages (and their associated items) used in PIRLS 2011 were released in December 2012. Two were Literary texts (titled *Enemy Pie* and *Fly, Eagle, Fly*) and two were Informational (*Discover the Fun of Day Hiking* and *The Giant Tooth Mystery*).

In this section, *Enemy Pie* and *Discover the Fun of Day Hiking* are presented as representative texts, as they exemplify the different elements of the framework and also include some large gender differences. All four released texts and their questions (shown in the format in which they were presented to pupils) are available at http://www.erc.ie/documents/pirls_2011_reading_items.pdf. The same document provides information on how constructed-response items (where pupils write the answers to questions) are scored, and summarises information on Irish and international performance on each test item.

The presentation of the items and the commentary that follows is intended to highlight the types of reading literacy items used in PIRLS, including those that challenged pupils in Ireland and those they found easy. However, as noted, Irish pupils performed well above the PIRLS centrepoint, meaning that relatively few items were very challenging for Irish pupils.

The first passage, *Enemy Pie* (Figure 7.1), is slightly less than 800 words in length and is categorised as a Literary text. A narrative text, it formed part of the PIRLS Reader – a document comprising two texts (one Literary and one Informational) formatted in the style of a real book, and perhaps providing pupils with a more authentic reading experience than is possible when texts and test items are together in test booklets. Pupils assigned the PIRLS Reader (one of the thirteen booklets presented to pupils) were asked to respond to questions about the texts in a separate answer booklet. In the PIRLS Reader, *Enemy Pie* was spread over four pages and several coloured illustrations were provided. Here, it is presented in compressed format, without illustrations. In all, *Enemy Pie* has 16 items, of which three will be discussed in the next section.

The second passage, *Discover the Fun of Day Hiking*, is categorised as a text employed by pupils to Acquire and Use Information. In PIRLS 2011, it was folded as a brochure and appended to one of the test booklets. Pupils could detach it from the test booklet and fold and unfold it as needed. Associated questions were in the accompanying test booklet. Figure 7.2 shows the brochure, including the text, a map, a table and illustrations. In all, *Day Hiking* has 12 items, of which three are discussed in the next section.

Figure 7.1: *Enemy Pie* text

Enemy Pie *by Derek Munson*

It was a perfect summer until Jeremy Ross moved in right next door to my best friend Stanley. I did not like Jeremy. He had a party and I wasn't even invited. But my best friend Stanley was.

I never had an enemy until Jeremy moved ifcnto the area. Dad told me that when he was my age, he had enemies, too. But he knew of a way to get rid of them. Dad pulled a worn-out scrap of paper from a recipe book. "Enemy Pie," he said, satisfied.

You may be wondering what exactly is in Enemy Pie. Dad said the recipe was so secret, he couldn't even tell me. I begged him to tell me something—anything. "I will tell you this, Tom," he said to me. "Enemy Pie is the fastest known way to get rid of enemies." This got me thinking. What kinds of disgusting things would I put into Enemy Pie? I brought Dad worms and rocks, but he gave them right back.

I went outside to play. All the while, I listened to the sounds of my dad in the kitchen. This could be a great summer after all. I tried to imagine how horrible Enemy Pie must smell. But I smelled something really good. As far as I could tell, it was coming from our kitchen. I was confused.

I went inside to ask Dad what was wrong. Enemy Pie shouldn't smell this good. But Dad was smart. "If it smelled bad, your enemy would never eat it," he said. I could tell he'd made this pie before. The oven buzzer rang. Dad put on oven gloves and pulled out the pie. It looked good enough to eat! I was beginning to understand. But still, I wasn't sure how this Enemy Pie worked. What exactly did it do to enemies? Maybe it made their hair fall out, or their breath stink. I asked Dad, but he was no help.

While the pie cooled, Dad filled me in on my job. He whispered. "In order for it to work, you need to spend a day with your enemy. Even worse, you have to be nice to him. It's not easy. But that's the only way that Enemy Pie can work. Are you sure you want to do this?" Of course I was. All I had to do was spend one day with Jeremy, then he'd be out of my life. I rode my bike to his house and knocked on the door.

When Jeremy opened the door, he seemed surprised. "Can you come out and play?" I asked. He looked confused. "I'll go and ask my mum," he said. He came back with his shoes in his hand. We rode our bikes for a while, then ate lunch. After lunch we went over to my house. It was strange, but I was having fun with my enemy. I couldn't tell Dad that, since he had worked so hard to make the pie.

We played games until my dad called us for dinner. Dad had made my favourite food. It was Jeremy's favourite, too! Maybe Jeremy wasn't so bad after all. I was beginning to think that maybe we should forget about Enemy Pie. "Dad", I said, "It's really nice to have a new friend." I was trying to tell him that Jeremy was no longer my enemy. But Dad only smiled and nodded. I think he thought I was just pretending.

But after dinner, Dad brought out the pie. He served up three plates and passed one to me and one to Jeremy. "Wow!" Jeremy said, looking at the pie. I panicked. I didn't want Jeremy to eat Enemy Pie! He was my friend! "Don't eat it!" I cried. "It's bad!"

Jeremy's fork stopped before reaching his mouth. He gave me a funny look. I felt relieved. I had saved his life. "If it's so bad," Jeremy asked, "then why has your dad already eaten half of it?" Sure enough, Dad was eating Enemy Pie. "Good stuff," Dad mumbled. I sat there watching them eat. Neither one of them was losing any hair! It seemed safe, so I took a tiny taste. It was delicious! After dessert, Jeremy invited me to come over to his house the next morning.

As for Enemy Pie, I still don't know how to make it. I still wonder if enemies really do hate it or if their hair falls out or their breath turns bad. But I don't know if I'll ever get an answer, because I just lost my best enemy.

Figure 7.2: *Discover the Fun of Day Hiking* brochure

Planning Your Day Hike

- Pick somewhere to go that will be fun and interesting. If in a group, consider everyone when choosing where to go.
- Find out the distance of the hike and how much time it is supposed to take.
- Check out the weather conditions and forecast. Plan and dress the right way for the weather.
- Pack light. Don't make the weight of what you will carry too heavy (see checklist).

Packing Checklist

- ☐ Plenty of water – to keep from getting thirsty
- ☐ Food – high energy snacks or take a picnic lunch
- ☐ First Aid Kit – in case of blisters, scrapes and scratches
- ☐ Insect repellent – to protect from bites (for example – ticks, bees, mosquitoes, and flies).
- ☐ Extra socks – feet may get wet
- ☐ Whistle – important if going alone, three short whistles mean you are in trouble and need assistance
- ☐ Map and compass – very important for more difficult hikes

Keeping Safe on Your Day Hike

- **Start early.** This will give you plenty of time to enjoy your hike and still get back before dark.
- **Stay on hiking trails** unless you know the area.
- **Pace yourself.** Do not hike too quickly so that you can save your energy. When in a group, go only as fast as the slowest member.
- **Be careful where you are walking.** Watch out for things you might trip over like loose rocks, piles of leaves, and sticks. Take care through slippery areas . If you need to go into water, make sure you know how deep it is.
- **Look out for wildlife.** Be careful where you put your feet, when you pick up sticks or rocks, and before you sit down. Never approach animals in the wild. They may look cute and harmless, but they can be unpredictable and very protective of their territory.

IMPORTANT: Tell someone where you are going hiking and when you expect to return. This could help in case something happens and you get into trouble. Let him or her know when you get back.

Most of all, don't forget to have fun on your hike. Enjoy being outdoors. Look at all the interesting things around you. Learn to identify new places, plants, and animals. Appreciate the beauty of the land and nature, and get good healthy exercise too!

Discover the Fun of Day Hiking

Looking for something fun and interesting to do at home or on holiday?

One of the greatest ways to enjoy the outdoors is hiking, and day hiking is the most popular kind. It doesn't have to take much time or need any special equipment.

Day Hiking Is Fun and Good Exercise!

You are in charge! You can choose where you want to go, how long you want to be gone, and how fast you want to go. You can simply stroll along enjoying nature or challenge yourself with difficult and steep hiking trails. It is up to you!

See interesting new things! Hiking can take you places that cannot be seen any other way. You can go to beautiful areas and see spectacular views. Or you can go to remote areas that may have hidden valleys, waterfalls, or caves. Hiking can give you a chance to see plants, birds, and animals that live in the wild. You might even see remains of buildings and things that belonged to people who lived long ago.

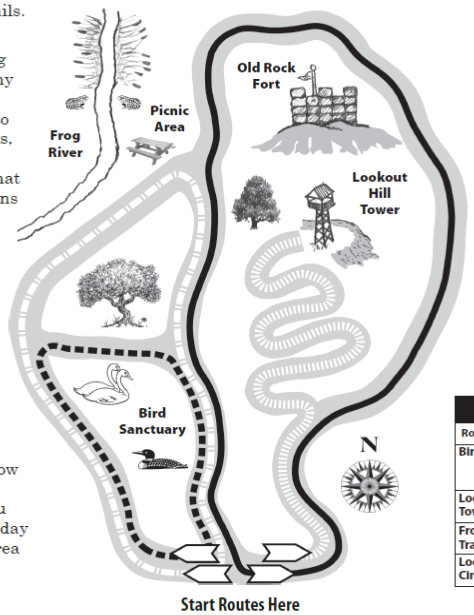
Keep physically fit! Walking is an excellent way to exercise, so hiking on a regular basis will help to keep you healthy. It provides time to think and can be relaxing. Hiking is a great way to spend time with your friends and family or to just spend a little time by yourself studying and enjoying nature.

Explore Lookout Hill

The map and map key for Lookout Hill show how you can choose the day hike that you would like best and the kinds of things you can see and do. It gives you an idea about day hiking in case you want to find a hiking area near where you live.

Lookout Hill

A Hike Full of Adventures



Choose which route to take!

Use one of our suggestions, or make up a route of your own.

Map Key

Route Name	Route	Time	Level	Description
Bird Walk	■ ■ ■	2 hours	Easy, Wheelchair access	Loop around the bird sanctuary
Lookout Tower Hike	▮▮▮▮▮▮▮	2 to 2.5 hours each way	Hard	Climb Lookout Hill and see the view
Frog River Trail	■ ▮ ■	3 hours	Medium	Hike to Frog River Picnic Area
Lookout Hill Circle	▬	5 hours	Medium	Hike around Lookout Hill to the Old Rock Fort

Analysis of a selection of released items

The previous section showed examples of two texts, upon which a total of 28 test items were based. This section provides examples of some of those test items, grouped by the International Benchmark at which they are categorised. Also included are details about Irish performance on each item, relative to the international PIRLS average, and information on the performance of boys and girls. Each item has a unique ID,[4] which identifies the source text, the item's location in the sequence of the text and whether it is a multiple-choice or constructed-response item. For example, Figure 7.3 contains a sample item from a PIRLS passage called *Fly, Eagle, Fly,* a released passage, though not one of those described in detail in the previous section. The item ID is FEF01_MC. The first part of the ID (FEF) indicates that the item is from *Fly, Eagle, Fly.* The item shown is the first item (denoted by 01) related to the *Fly, Eagle, Fly* text, and it is in multiple-choice format (MC). All Figures provide information on the performance of Irish girls and boys on the items selected for analysis. Differences, where they are viewed as substantive (i.e., a difference of at least 10%), are discussed in a subsequent section, along with additional items that show similarly large differences.

Items at the Low International Benchmark

As can be seen from Figure 7.3, pupils at the Low International Benchmark can display only very basic reading skills. Their skills are largely limited to retrieving and reproducing explicitly stated information from within the text. Inferential and evaluative skills do not feature. Just one PIRLS 2011 released item was categorised as being at the Low International Benchmark (i.e., very easy, internationally).

Figure 7.3: Summary description of the Low International Benchmark, and an exemplar item

Low International Benchmark

Pupils at this Benchmark are expected to demonstrate the following skills when reading …

LITERARY TEXTS

- Locate and retrieve an explicitly stated detail.

INFORMATIONAL TEXTS

- Locate and reproduce two or three pieces of information from within the text.
- Locate and reproduce explicitly stated information that is at the beginning of the text.

[CONTEXT: Fly, Eagle, Fly is an African tale about a farmer who, while searching for his calf, finds an eagle chick, takes it home and rears it with his chickens.]

Item ID: FEF01_MC

What did the farmer set out to look for at the beginning of the story?

a) a calf*
b) herders
c) rocky cliffs
d) an eagle chick

Purpose: Literary **Process:** Focus on and retrieve explicitly stated information

Correct: Ireland: 93% PIRLS: 89% Irish Girls: 95% Irish Boys: 91%

[4] These IDs were created for this chapter, and are not included with the items as presented in their original format on www.erc.ie/pirlstimss.

The multiple-choice item was from *Fly, Eagle, Fly*, and was categorised as assessing retrieval of explicitly stated information. In Ireland, 93% of pupils responded correctly to the item, compared to a PIRLS average of 89%. This item is very straightforward, requiring pupils to retrieve explicitly stated information. The answer is stated in the first sentence of the text ("A farmer went out one day to search for a lost calf"). It should be noted that the distractors – herders, rocky cliffs and eagle chicks – can be found in adjacent sentences. The gender difference on this item, 4% in favour of girls, is relatively small.

Items at the Intermediate International Benchmark

Figure 7.4 summarises some of the skills displayed by pupils responding to items at the Intermediate International Benchmark. For Literary texts, these include making straightforward inferences about a main character's attributes, feelings and motivations. For Informational texts, they include locating and reproducing two or three pieces of information from the text. Two exemplar items are shown, one from *Enemy Pie*, and the other from *Discover the Fun of Hiking*.

Item EP13_MC is from *Enemy Pie*. It provided pupils with a short statement from the text ("After dessert, Jeremy invited me to come over to his house next morning") and asked them to indicate, from among four choices, what the statement suggested about the two boys in the story. In Ireland, 90% of pupils selected the correct response while, internationally, 79% of pupils did so. Here, as in most other countries, a majority of pupils were able to dismiss the other options present. The text immediately preceding the statement supports the view that the boys were becoming friends (e.g., Tom's concern that Jeremy might eat the Enemy Pie), so it is not surprising that pupils dismissed alternative explanations and plumped for the possibility that the boys might become friends in the future. Pupils in most countries had little difficulty with this item – for example, 95% of pupils in Hong Kong and 94% in Finland selected the correct response. However, only 81% of pupils in New Zealand answered correctly.

In Ireland, 2.2% of pupils omitted this item (it was either not reached or simply skipped). This compares with 4.3% internationally and just 0.3% in Singapore and 0.4% in Hong Kong. The fact that this item was skipped by relatively small numbers, even though it appeared in 13th position in an item set, may be related to the fact that most pupils did not find it difficult, even though it falls under the general category of examining and evaluating content, language and text structures (i.e., arguably the most complex of the process skills assessed).

Item DH02_CR, from *Discover the Fun of Day Hiking*, asked pupils to give two interesting things the leaflet said they might see on a day hike. Pupils could provide any of a number of features mentioned in the text, including hidden valleys, waterfalls, caves, spectacular views, or any of the locations on the map in the leaflet. Responses were scored as correct only where two (or more) interesting things were listed. No credit was given for listing only one feature. In Ireland, 74% of pupils cited two interesting things, compared with 63% internationally. Many of our key comparison countries had higher percent correct scores on this item than Ireland – Hong Kong (92%), Singapore (86%) and the Russian Federation (84%). However, pupils in both Finland (78%) and Northern Ireland (77%) performed at a broadly similar level to pupils in Ireland. The gender difference on this item, 12% in favour of girls, is reasonably large.

Figure 7.4 also shows some examples of answers supplied by Irish pupils. In the incorrect or incomplete examples, pupils recorded one "thing" rather than the required two. That is, they were unable to distinguish between features specific to the hike, such as the animals mentioned in the leaflet, and peripheral features such as other people on a day hike,

or their responses were at too high a level of generality ("exciting things"). At 1.5%, the percentage of Irish pupils who did not answer the question is again lower than the international average of 4.5%. In a number of countries, including England, Hong Kong, the Netherlands, Singapore and the United States, fewer than 1% of pupils failed to attempt to answer the item.

Figure 7.4: Summary description of the Intermediate International Benchmark, and exemplar items

Intermediate International Benchmark

Pupils at this Benchmark are expected to demonstrate the following skills when reading …

LITERARY TEXTS

- Retrieve and reproduce explicitly stated actions, events, and feelings.
- Make straightforward inferences about the attributes, feelings, and motivations of main characters.
- Interpret obvious reasons and causes and give simple explanations.
- Begin to recognise language features and style.

INFORMATIONAL TEXTS

- Locate and reproduce two or three pieces of information from within the text.
- Use subheadings, text boxes, and illustrations to locate parts of the text.

Item ID: EP13_MC

'After dessert, Jeremy invited me to come over to his house the next morning'.
What does this suggest about the boys?

a) They are still enemies.
b) They do not like to play at Tom's house.
c) They wanted to eat some more Enemy Pie.
d) They might be friends in the future.*

Purpose: Literary **Process:** Examine & evaluate content, language & textual elements

Correct: Ireland: 90% PIRLS: 79% Irish Girls: 94% Irish Boys: 87%

Item ID: DH02_CR
Give two interesting things the leaflet said you might see on a day hike

_____

Scoring information: Score **1/0**. **Two** correct "things" (e.g., caves, waterfalls, hidden valleys)
1 point:
You can see animals. You can see remains of buildings.
Might go to lookout hill. or a remote area that may have been hidden valleys.
Animals, water.
0 point: One or no correct "things" or too vague
You might see some cool animals, and also some exciting things.
Animals & people

Purpose: Informational **Process:** Focus on and retrieve explicitly stated information

Correct: Ireland: 74% PIRLS: 63% Irish Girls: 80% Irish Boys: 68 %

Items at the High International Benchmark

Figure 7.5 summarises some of the skills displayed by pupils at the High International Benchmark. For Literary texts, these skills include locating and distinguishing significant actions and details embedded across texts, and interpreting and integrating story events and character actions and traits from different parts of the text. For Informational texts, they include locating and distinguishing relevant information within a dense text or complex table, and integrating textual and visual information to interpret relationships between ideas.

Thus, the skills that pupils performing at the High International Benchmark are expected to demonstrate are more complex than those of pupils performing at the Intermediate International Benchmark in that there is a stronger emphasis on integrating ideas, whether from different parts of a Literary text, or between text and accompanying visual information in the case of Informational text.

Figure 7.5: Summary description of the High International Benchmark, and exemplar items

High International Benchmark

Pupils at this Benchmark are expected to demonstrate the following skills when reading…

LITERARY TEXTS

- Locate and distinguish significant actions and details embedded across the text.
- Make inferences to explain relationships between intentions, actions, events, and feelings, and give text-based support.
- Interpret and integrate story events and character actions and traits from different parts of the text.
- Evaluate the significance of events and actions across the entire story.
- Recognise the use of some language features (e.g., metaphor, tone, imagery).

INFORMATIONAL TEXTS

- Locate and distinguish relevant information within a dense text or a complex table.
- Make inferences about logical connections to provide explanations and reasons.
- Integrate textual and visual information to interpret the relationship between ideas.
- Evaluate content and textual elements to make a generalisation.

Item ID: EP11_MC

How did Tom feel when Dad passed the piece of Enemy Pie to Jeremy?

a) Alarmed*
b) Satisfied
c) Surprised
d) Confused

Purpose: Literary **Process:** Make straightforward inferences

Correct: Ireland: 76% PIRLS: 64% Irish Girls: 80% Irish Boys: 72%

Item ID: DH04_MC

Which section of the leaflet told you to wear the right clothes for the weather?

a) Discover the Fun of Day Hiking
b) Planning Your Day Hike*
c) Packing Checklist
d) Keeping Safe on Your Day Hike

Purpose: Informational **Process:** Focus on and retrieve explicitly stated information

Correct: Ireland: 55% PIRLS: 55% Irish Girls: 61% Irish Boys: 49%

Figure 7.5 provides two multiple-choice questions as examples of items at the High International Benchmark. The difference in the percentage of pupils answering each item correctly (either in Ireland or across PIRLS as a whole) is illustrative of the fairly broad range of item difficulties among items categorised as being at the High International Benchmark. Item EP11_MC relates to *Enemy Pie*, and asks how Tom felt when Dad passed the piece of Enemy Pie to Jeremy. The reading process underpinning this multiple-choice question is given as making a straightforward inference. The question is relatively difficult (76% correct in Ireland; 64% internationally) because the reader must shift from an earlier position –

Jeremy was Tom's enemy, and the perceived purpose of the Enemy Pie was to rid him of Jeremy for good – to one in which he was gradually becoming friends with Jeremy. It is possible that some pupils did not fully understand this shift, either because it was not obvious to them, or because they did not engage in a deep reading of the text.

Pupils in Finland did best on this item (91% answered correctly) while pupils in Northern Ireland (79%), the Russian Federation (78%), Singapore (73%) and Hong Kong (71%) all performed at about the same level as pupils in Ireland. In Ireland, 8% more girls than boys achieved a correct answer on this item, indicating that the item was somewhat more difficult for Irish boys relative to girls. The corresponding international difference was just 2%. In Ireland, just 2% of pupils skipped or did not reach this item, compared with an international average of 3.6%.

Item DH04_MC, based on *Discover the Fun of Day Hiking*, asked pupils to identify the section of the leaflet which told them to wear the right clothes for the weather (the correct section is Planning Your Day Hike). The question is identified as assessing the reading process of focusing on and retrieving explicitly stated information. In Ireland and internationally, 55% of pupils answered this question correctly. It is one of the few questions on which the performance of pupils in Ireland is not above the international average. Pupils in Hong Kong obtained the highest percentage of correct responses on this item (85%), followed by Chinese Taipei (73%) and Germany and Singapore (both 71%). Like in Ireland, pupils in Northern Ireland (58%) and England (59%) performed close to the international average.

It is noteworthy that 33% of pupils in Ireland – and almost identical percentages in Northern Ireland and England – selected response option C (Packing Checklist). Under the packing checklist section, would-be day hikers are advised to bring extra socks in case their feet get wet. Some readers in Ireland may have interpreted this to refer to clothes more generally, as indirect reference is also made to weather (feet may get wet). In doing so, they may have made an inference viewed by PIRLS as being incorrect. Just over 1% of pupils in Ireland and just over 2% internationally did not respond to the item.

Items at the Advanced International Benchmark

Skills that pupils scoring at the Advanced International Benchmark are expected to exhibit are more complex than those at the Intermediate and High Benchmarks. In the case of Literary texts, they include interpreting story events and character actions to provide reasons, motivations and character traits, with full text-based support (Figure 7.6). For Informational texts, they include integrating information across a text to provide explanations and interpret significance. Because skills at the Advanced Benchmark often involve interpretation and evaluation, and/or require pupils to cite evidence from the text, they typically follow a constructed-response format.

EP16_CR is an Advanced Benchmark item based on the *Enemy Pie* text. Pupils are asked to write what lesson they might learn from the story. The comprehension process underlying this question is identified as examining and evaluating context, language and textual elements (i.e., it contributes to the Interpret/Evaluate scale). The question can be regarded as a higher-level one as the answer is not stated explicitly in the text, but must be inferred by the reader, possibly by establishing a link between information in the text and the reader's own experience of relationships. The scoring guide for PIRLS indicates that, to receive credit, pupils are expected to indicate the importance of giving a relationship a chance to grow before deciding whether someone is your friend, or to state that it is possible to change how you feel about someone. In Ireland, 45% of pupils provided a correct response to this question, compared with 30% internationally. Pupils in Finland (41%), Hong Kong

(40%) and Northern Ireland (38%) performed close to the level of pupils in Ireland, while pupils in Singapore (36%) and the Russian Federation (28%) did a little less well. In Germany, 60% of pupils provided a correct answer, the highest score among participating countries.

Responses judged as being correct tended to focus on entertaining the possibility that a potential enemy might well be a friend (e.g., "Give people a chance, you might like them"). Pupils providing incorrect responses tended to over-generalise (e.g., "everyone has an enemy", or provided incomplete themes (e.g., "if you're nice to other people"). As a relatively difficult constructed-response item, the percentage of pupils who did not answer the item is slightly higher than for some of the preceding examples of items. Just 4% of pupils in Ireland either skipped or did not reach this question, compared with an international average of 11%.

The second example item at the Advanced International Benchmark, DH03_CR, is drawn from *Discover the Fun of Day Hiking*. It asks pupils to write two things they should keep in mind when hiking in a group. To obtain full credit (score two points), pupils had to make one suggestion that referred to interests and another that referred to ability. The reading comprehension process underpinning this question is identified as interpret and integrate ideas and information, and, like EP16_CR, it contributes to the Interpret/Evaluate scale. The answers to this question appear in somewhat different locations in the brochure. One thing to keep in mind can be found in the section on Planning Your Day Hike. Pupils must establish a link between the sentence "If in a group, consider everyone when choosing where to go", and the previous sentence "Pick somewhere to go that will be fun and interesting". The second thing to keep in mind can be found in the section on Keeping Safe on Your Daily Hike, under a subhead, Pace Yourself ("When in a group, go only as fast as the slowest member").

Hence, to respond correctly, pupils had to identify two pieces of information in different parts of the text, with no obvious link between them – one related to interest and the second to ability. Moreover, in the case of the information on interest, they had to link adjacent sentences in the text – something that might not occur if the reader missed the information on an initial reading of the text, and scanned the text to look for an idea in order to answer the question. An example of a response receiving full credit is given in Figure 7.6. This response includes reference to both ability ("only go as fast as the slowest member of the group"), and interest ("consider everyone when choosing where to go"). In Ireland, 16% of pupils received full credit (i.e., they provided separate responses relating to ability and to interest), while internationally, 10% of pupils did so. Among our key comparison countries, some had marginally higher percentages of pupils than Ireland achieving full credit on this item (Finland, 21%; Northern Ireland, Hong Kong, the Russian Federation and Singapore, 18%). Others, such as Australia, the United States (both 15%) and New Zealand (13%) had marginally lower percentages.

Just over half (52%) of pupils in Ireland and 38% internationally achieved at least partial credit (one point), indicating that they correctly identified one thing to keep in mind when hiking in a group. Pupils in Denmark did best (59% received at least partial credit). Among our key comparison countries, the percentages obtaining at least partial credit ranged from 56% in the Russian Federation to 46% in New Zealand.

Figure 7.6: Summary description of the Advanced International Benchmark, and exemplar items

Advanced International Benchmark

Pupils at this Benchmark are expected to demonstrate the following skills when reading …

LITERARY TEXTS

- Integrate ideas and evidence across a text to appreciate overall themes
- Interpret story events and character actions to provide reasons, motivations, feelings, and character traits with full text-based support.

INFORMATIONAL TEXTS

- Distinguish and interpret complex information from different parts of text, and provide full text-based support
- Integrate information across a text to provide explanations, interpret significance, and sequence activities
- Evaluate visual and textual features to explain their function

Item ID: EP16_CR

What lesson might you learn from this story?

_____

Scoring information: Score **1/0.** Importance of giving a relationship a chance to grow before deciding if someone is your friend, **or,** it is possible to change your mind about someone.

1 point:

Always try to be friends with your enemy and don't call people enemies if you don't know them.
If you spend a day with your enemies, they might become your friends
Don't dislike people unless you know them well

0 points:

If someone is mean to you, tell your mam or dad:.
That everyone has an enemy. If you're nice to other people

Purpose: Literary **Process**: Examine & evaluate content, language & textual elements

Correct: Ireland: 45% PIRLS: 30% Irish Girls: 55% Irish Boys: 36%

Item ID: DH03_CR

What are two things the leaflet told you to keep in mind when you are hiking in a *group?*

_____

Scoring information: Score **2/1/0. Two** correct suggestions – one about ability, one about interests – for full credit. **One** correct suggestion for partial credit.

2 points:

Only go as fast as the slowest member of the group; if in a group, consider everyone when choosing where to go.

1 point:

Stay as slow as the slowest person
Stay at the pace of the slowest member; do not hike too quickly to save energy

0 points:

Take care of others in the group
You need to be careful and pack lots of stuff
It's a great day out for the family.

Purpose: Informational **Process:** Interpret and integrate ideas and information

Full credit: Ireland: 16% PIRLS: 10% Irish Girls: 21% Irish Boys: 11%

At least partial credit: Ireland: 52% PIRLS: 38%

In general, correct responses were not very different from one another, probably because the information could be found in the text, and, unlike EPQ16_CR, the item did not invite creativity. Just 4% of pupils in Ireland omitted or failed to reach this item, compared with an international average of 9%. In Finland, 7% omitted this item. As with many of the items reviewed, a cluster of countries composed of Chinese Taipei, Hong Kong, the Netherlands, Singapore and the United States had lower levels of non-response than most other countries.

Gender differences on PIRLS test items

In this section, gender differences in PIRLS 2011 are examined in greater detail. First, gender differences in Ireland on overall performance and on the PIRLS reading purposes and processes are examined. Then, individual items on which there are large gender differences in Ireland are described.

Gender and performance on overall scale and on subscales

As noted at the beginning of this chapter, girls in Ireland achieved an average score that was 15 points higher than that of boys. Girls outperformed boys by a statistically significant margin in almost all participating countries. The five countries with mean overall scores significantly higher than Ireland's all had gender differences that were close to the international average gender gap of 17 points (ranging from 16 points in Northern Ireland and Hong Kong to 21 points in Finland).

In Ireland, girls outperformed boys by 22 points on Literary texts, and by just 8 points on Informational texts. The corresponding international differences in favour of girls were 20 points and 12 points respectively. Differences in the highest-scoring PIRLS countries on the Literary scale ranged from 26 points in Finland to 21 in the Russian Federation, with a difference of 23 in Northern Ireland. Differences on the Informational scale ranged from 14 in Finland to 8 in Hong Kong with a difference of 12 in Northern Ireland. In the US, the difference on the Literary scale was 10 points, while on the Informational scale, it was just 7 points.

In Ireland, there was an average difference of 13 points in favour of girls on the Retrieve/Infer scale, and a difference of 18 points on the Interpret/Evaluate scale. Internationally, the gap in favour of girls on Retrieve/Infer was 16 points and on Interpret/Evaluate it was 17. The gap in high-scoring countries on Retrieve/Infer ranged from 17 in the Russian Federation to 13 in Hong Kong, with a difference of 15 in Northern Ireland. Differences on Interpret/Evaluate ranged from 21 in Finland to 17 in Singapore.

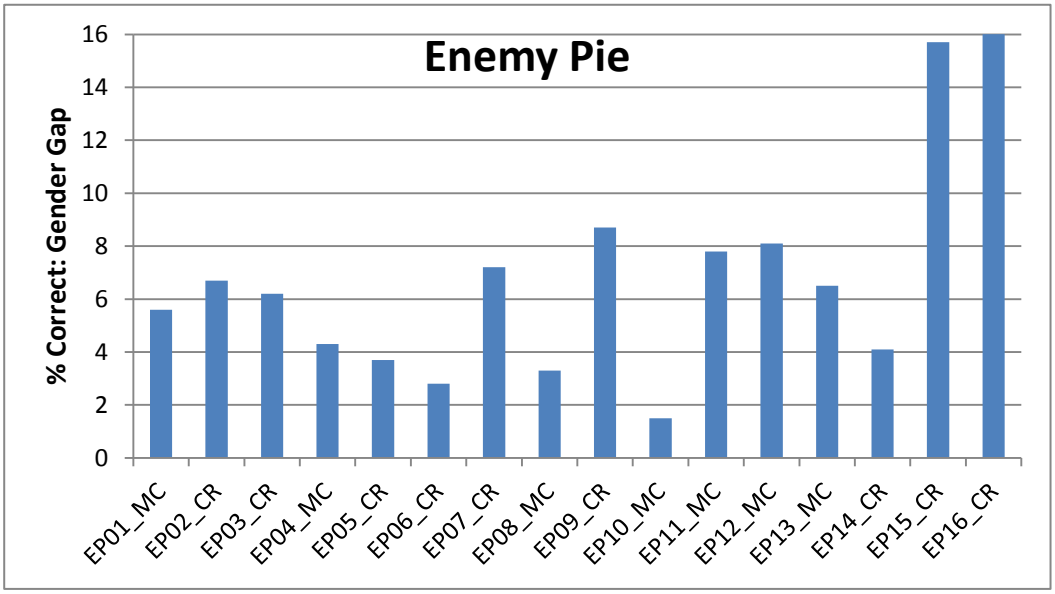
Gender differences on selected PIRLS items

In general, differences in favour of girls on individual PIRLS items were small. Figure 7.7 shows the differences for pupils in Ireland on items based on the *Enemy Pie* (Literary) text. For this text, which featured male characters only, all items showed a gender difference in favour of girls, with two showing a large difference (defined here as greater than 10%). These items (EP15_CR and EP16_CR) are both constructed-response items and are difficult in overall terms. Just 41% of Irish pupils achieved full credit on EP15_CR (69% received at least partial credit), and, as noted earlier, 45% achieved full credit on EP16_CR (no partial credit was available) (Figure 7.8).

Item EP15_MC asked pupils to identify the kind of person Tom's dad was, and to give an example from the story to show this. Forty-nine percent of girls and 33% of boys in Ireland achieved full credit (the corresponding international averages were 27% and 22%, indicating a smaller gender gap internationally). The question required higher-level thinking

(it contributed to the Interpret/Evaluate subscale) and also required an extended constructed-response answer as pupils had to justify the character trait they selected. The answer to the first part of the question (identification of a character trait) was not explicitly stated in the text, and had to be inferred.

Figure 7.7: Size of gender gap (all favouring girls) on items from *Enemy Pie,* Ireland only



For full/partial credit items, chart shows gender difference for full credit.

On EP16_CR (described earlier; the lesson that might be learned from the story), girls in Ireland had an average percent correct score of 55%, compared to 36% for boys. The corresponding international percentages were 34% and 28% respectively. Like EP15_CR, it contributed to the Interpret/Evaluate subscale, though, in general, a short (often single-sentence) response would have been appropriate.

Figure 7.8: Characteristics of selected PIRLS items with large gender differences (*Enemy Pie*)

Item ID: EP15_CR
What kind of person is Tom's dad? Give an example of what he did in the story that shows this.

_____

Scoring information: Score **2/1/0**. A plausible character trait that is central to his role in the story (e.g., helpful, caring, nice, good, smart, clever, tricky, secretive) **AND** sample action as evidence. A plausible character trait only for partial credit.

2 points:

He was caring because he wanted to help his son make friends.
He was smart in how he found a way for the boys to like each other

1 point:

He was a good dad.
He cared about his son.

Purpose: Literary **Process:** Interpret and integrate ideas and information

Full credit: Ireland: 41% PIRLS: 24% Irish Girls: 49% Irish Boys: 33%

At least partial credit: Ireland: 69% PIRLS: 54%

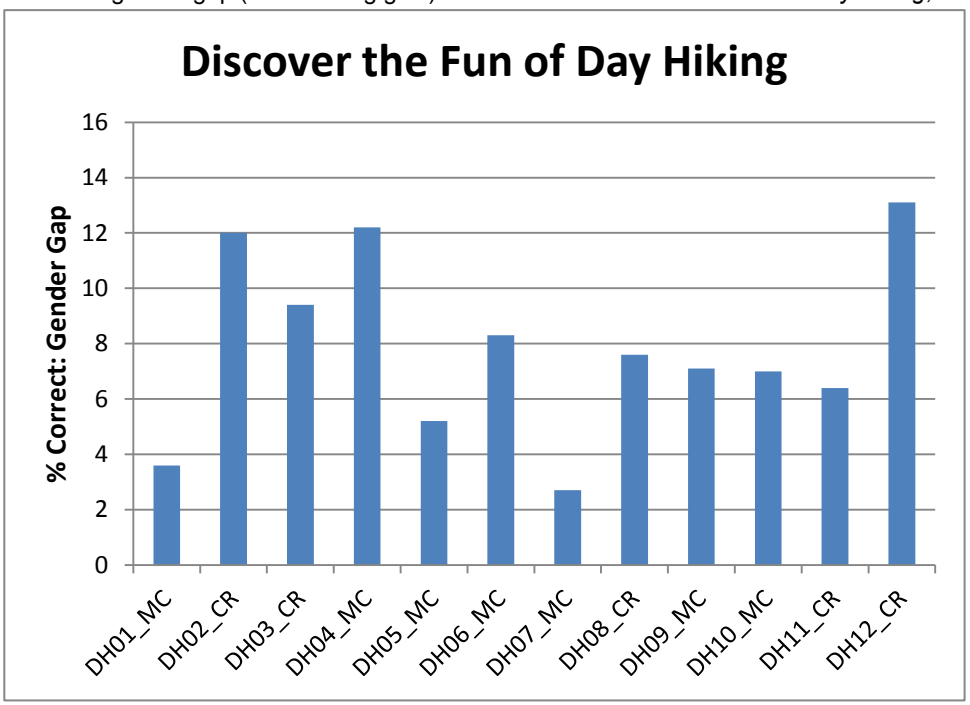
Item ID: EP16_CR
What lesson might you learn from this story?

See Figure 7.6 for more details.

There may be a number of reasons why these questions in particular show such large gender differences in Ireland. They involve a Literary text, require higher-level interpretation and evaluative reading skills, and they require pupils to demonstrate evidence of their understanding of the text in writing – all of which girls seem to do better on than boys.

Figure 7.9 summarises items based on the *Discover the Fun of Day Hiking* brochure (a text categorised as Informational). Three items had a gender difference in Ireland of at least 10%, while a further two had a difference of 8-10%.

Figure 7.9: Size of gender gap (all favouring girls) on items from *Discover the Fun of Day Hiking*, Ireland only



For full/partial credit items, chart shows gender difference for full credit.

DH02_CR – discussed earlier in Figure 7.4 – is a relatively easy constructed-response item. In Ireland, 74% of pupils provided a correct response, while internationally, 63% did so. In Ireland, 80% of girls and 68% of boys identified two interesting things the leaflet said you might do on a day out (no credit was given for identifying one or none). Internationally, 66% of girls and 60% of boys achieved full credit, a smaller gender difference than in Ireland. The item is unusual to the extent that girls in Ireland generally performed best on Literary items, especially those categorised as Interpret/Evaluate. This question is categorised as Informational and as Retrieve/Infer.

Item DH04_MC, described earlier in Figure 7.5, is an example of a multiple-choice item with a large gender difference. The question asked pupils to identify the section of the *Discover the Fun of Day Hiking* brochure that told them to wear the right clothes for the weather. Sixty-one percent of girls in Ireland, and 49% of boys, provided a correct response, roughly twice the size of the gap between the corresponding estimates internationally (59% and 53%, respectively). Like DH02_CR, the question is categorised as focus on and retrieve explicitly stated information and ideas, and contributes to the Retrieve/Infer scale. As noted earlier, 33% of pupils in Ireland selected an alternative option (Packing Checklist) to the specified correct answer, for which there was some support in the text, and boys were more likely than girls to do so, perhaps because they did not weigh the two competing responses in the same way as girls.

Item DH12_CR, another constructed-response item, asked pupils to identify a route on the map that they would choose and to provide two reasons from the text for doing so (Figure 7.10). In Ireland, 40% of pupils achieved full credit, and 71% achieved at least partial credit (i.e., they provided at least one reason), compared with 33% and 60% internationally. In Ireland, 47% of girls and 34% of boys achieved full credit, indicating a gender gap considerably larger than the 5% found internationally (35% and 30%, respectively). The question is categorised as interpret and integrate ideas and information, and contributes to the Integrate/Evaluate subscale.

Figure 7.10: Characteristics of selected PIRLS items with large gender differences (*Day Hiking*)

Item ID: DH02_CR
Give two interesting things the leaflet said you might see on a day hike

See Figure 7.4 for more details.

Item ID: DH04_MC
Which section of the leaflet told you to wear the right clothes for the weather?

See Figure 7.5 for more details.

Item ID: DH12_CR
Use the map of Lookout Hill and the map key to plan a hike. Check which route you would choose.
____Bird Walk
____Lookout Station
____Frog Creek
____Lookout Hill Circle
Give two reasons from the leaflet why you choose this route.

_____

Scoring information: Score **2/1/0:** Select route and give **two** appropriate reasons, drawn from text in the map key or features of the map. [Any route is acceptable, once appropriate reasons supplied]. Route and *one* reason only, for partial credit.

2 points: [sample answers for two routes.]

Frog Creek Trail. You can take a picnic lunch. You can stop and see the birds at the bird sanctuary on the way.
Lookout Station. I think it would have the best views and it is the most challenging hike.

1 point:

Bird Walk. It takes two hours. It is the shortest.

Purpose: Informational			**Process:** Interpret and integrate ideas and information	
Full credit:	Ireland: 40%	PIRLS: 33%	Irish Girls: 47%	Irish Boys: 34%
At least partial credit:	Ireland: 71%		PIRLS: 60%	

Although some PIRLS released items show differences in favour of boys, none reached 10%. However, one multiple-choice item based on the *Giant Tooth* text (about fossils and dinosaurs) came close with a difference – in Ireland – of 9% in favour of boys. *Giant Tooth* was also the only released text not to contain any items with a gender gap in excess of 10 points, perhaps partly because the text covers content stereotypically viewed as of interest to boys – fossils, lizards and dinosaurs. Of the 59 reading items released after PIRLS 2011, 19 were based on the *Giant Tooth* text. Ranked in order of gender difference, nine of the ten items on which boys did better compared to girls (internationally) were from *Giant Tooth*. Although not shown here, the text and items for *Giant Tooth* can be accessed at http://www.erc.ie/documents/pirls_2011_reading_items.pdf.

As well as responding to comprehension questions, pupils taking PIRLS 2011 indicated their liking for each of the passages they were asked to read. Table 7.5 summarises

the responses for girls and boys in Ireland and internationally. In Ireland, for *Giant Tooth*, 14% more boys than girls reported that they liked this text *a lot*. The corresponding international difference in favour of boys was 11%. It is notable that *Giant Tooth* was the only released passage that a substantially greater proportion of boys than girls reported enjoying *a lot*. It is also noteworthy that, for each of the released passages, fewer pupils in Ireland, whether boys or girls, reported enjoying the passage as much as pupils internationally.

Table 7.5: Percentages of girls and boys in Ireland and internationally reporting that they liked each released passage *a lot*

	Ireland		PIRLS	
	Girls	Boys	Girls	Boys
Enemy Pie	59	42	71	58
Day Hiking	40	33	56	51
Fly, Eagle, Fly	52	54	60	61
Giant Tooth	33	48	47	58

In summary, across released items in PIRLS, those items which show the largest gender differences tend to be those categorised as difficult (i.e., they are at the Advanced International Benchmark) (Table 7.6). They also tend to require a constructed-response that may include more than one part, and, more often than not, require pupils to engage in higher level reading comprehension processes (Integrate/Evaluate). Whereas, overall on PIRLS, the gender difference in favour of girls was greater for questions based on Literary than on Informational texts, equal numbers of items on which girls significantly outperformed boys were found on Literary and Informational texts across the released texts and items.

Table 7.6: Summary characteristics of PIRLS 2011 released items with gender differences in performance of at least 10%

	Item type*		Benchmark Level		Purpose		Process	
Text (no. items)	CR	MC	Advanced	Low	Literary	Info.	Ret/Inf	Int/Eval
Enemy Pie (2)	2	0	2	0	2	0	0	2
Day Hiking (3)	2	1	1	2	0	3	2	1
Fly, Eagle, Fly (1)	1	0	1	0	1	0	0	1
Total (6)	5	1	4	2	3	3	2	4

*Constructed-response (CR) and multiple-choice (MC).

Conclusions

In PIRLS 2011, pupils in Fourth class in Ireland ranked 10th of 45 participating countries, with a mean score of 552. Just five countries achieved mean scores that were significantly higher than Ireland's. While 24% of pupils in Singapore performed at the Advanced International Benchmark in PIRLS, compared with 16% in Ireland, no other country had a significantly higher percentage of pupils at this Benchmark than Ireland. Therefore, in overall terms, Irish pupils did well in PIRLS, though there is room for improvement. Perhaps some of this will be achieved through the actions outlined in *Literacy and Numeracy for Learning and Life* (DES, 2011).

In general, frameworks for both curriculum and assessment in Ireland are compatible with the PIRLS assessment framework. This compatibility is evident in the definition of reading literacy in PIRLS and in the National Assessments, with both focusing on reading as a constructive process, on the social aspects of learning to read, and on children's use of

reading to gain information and for enjoyment. The definition of literacy in the recent national strategy is somewhat broader, in that it refers to oral language and writing as well as reading, and refers to understanding of digital texts as well as print texts.

Both of the reading purposes in PIRLS (Literary, Informational) are covered in the PSEC, although, in Ireland, classroom libraries and textbooks for English tend to favour narrative texts. Similarly, while many of the comprehension skills in PSEC fall under the PIRLS categories of Retrieve/Infer and Integrate/Evaluate, the emphasis on Integrate/Evaluate is relatively weak before Third/Fourth classes.

An analysis of PIRLS 2011 items released in December 2012 revealed that pupils in Ireland did quite well, relative to pupils in other high-performing countries. In general, pupils in Ireland scored at about the same level or a little lower than their counterparts in the countries with the highest overall scores. While strong conclusions cannot be arrived at based on the performance of pupils in Ireland on a subset of released items, some broad patterns are suggested:

- Items at the PIRLS Low and Intermediate Benchmarks were generally easy for pupils in most PIRLS countries. However, such items were particularly easy for pupils in Ireland and other high-scoring countries, with three-quarters of pupils or more providing correct responses at these Benchmarks.
- Items at the High and Advanced Benchmarks were more challenging, with under half of pupils in Ireland responding correctly to some items at the Advanced Benchmark.
- Items requiring extended constructed (written) responses were more challenging than items presented in a multiple-choice format. This finding was not unique to Ireland.
- Items that required pupils in Ireland and internationally to engage in higher-level thinking (Interpret/Evaluate) were more challenging than those requiring pupils to engage in more basic thinking (Retrieve/Infer). In part, this may have been driven by the use of constructed-response items to assess higher-order thinking.
- Surprisingly, pupils in Ireland struggled with items that asked them to identify, and provide support in respect of, traits of a leading character. Irish pupils also struggled to articulate in writing the lesson they had learned from a story. Pupils would have been expected to be familiar with these important narrative reading skills, based on the PSEC.

These data confirm that, while overall comprehension levels in Ireland are high relative to most other countries, there is room for improvement, especially on items that ask pupils to interpret or evaluate, and on those that invite a written response (sometimes the same items). Among the instructional strategies that could be emphasised more in curriculum and in instruction, and that might lead to further improvement among pupils in Ireland, especially on higher-level reading skills, are:

- An increased emphasis on oral language in English lessons, including a stronger emphasis on vocabulary development and a more focused use of discussion to build reading comprehension skills (e.g., Almasi & Keligaras-York, 2009).
- An increased emphasis on developing literacy skills throughout the curriculum as well as in English classes (e.g., Shanahan, 2009).
- A focus on teaching higher-order reading comprehension strategies such as inferencing, visualising, creating mental imagery, generalisation and summarisation (Wharton-McDonald & Swiger, 2009).

- A focus on developing pupils' metacognitive reading strategies so that pupils can assess their own comprehension and apply fix-up strategies if comprehension breaks down (e.g., Massey, 2009).
- The establishment of stronger links between reading and writing, with writing used on a regular basis to evaluate ideas encountered in reading texts (e.g., Kennedy et al., 2012).

Girls in Ireland outperformed boys on the overall PIRLS reading scale, and on most of the released items. In general, girls appear to have a noticeable advantage in answering questions about Literary tests, in responding to Integrate/Evaluate items, and in responding to items requiring a written response.

Although girls outperformed boys on the vast majority of the released items, large differences, defined as 10% or greater (all in favour of girls) were identified on just six of these items. Nevertheless, the accumulation of relatively small differences in favour of girls on the vast majority of items leads to a robust overall difference in favour of girls. Although, overall, girls in Ireland outperformed boys by a greater amount on the Literary subscale compared with the Information subscale, equivalent numbers of released items with large gender differences in favour of girls were categorised as Literary and Informational.

PIRLS suggests that boys prefer to read informational texts such as *Giant Tooth* rather than literary texts like *Enemy Pie* and that they have somewhat greater understanding of informational texts. Such texts can, perhaps, provide a route into reading for some boys, if, as suggested elsewhere (DES, 2011; Eivers et al., 2010), greater use of informational texts is made in Irish classrooms. Similarly, increased used of digital texts in classrooms could encourage boys to engage in more reading (Perkins, Moran, Shiel, & Cosgrove, 2011). There may also be value in directing the attention of pupils (both boys and girls) to the ways in which gender is constructed socially, both in and out of school, how this impacts on pupils' own lives and is endorsed by others, and how gender is portrayed in texts.

Additional references

This section does not repeat the core references already listed in Chapter 1. These include the three international reports on PT 2011 and the Irish national report and those related to other key studies such as National Assessments and PISA.

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Chapter 8
Mathematics items: Context and curriculum

Seán Close

Introduction

TIMSS 2011 is Ireland's first time to participate in an international assessment of mathematics achievement at primary level since 1995. This chapter examines the performance of Irish pupils on mathematics in TIMSS 2011 at a broad level, and provides an in-depth analysis of performance on a subset of released test items in particular. Previous performance on TIMSS 1995 is considered, as are mathematics outcomes from the National Assessments and initiatives arising from *Literacy and Numeracy for Learning and Life* (DES, 2011).

Since Ireland last took part in TIMSS in 1995, a revised Primary School Mathematics Curriculum (PSMC) was introduced. Relative to its predecessor, the PSMC introduced in 1999 places more emphasis on constructivist theories of learning and teaching, on problem-solving, communication and discussion, and advocates the use of digital technology in teaching and learning. There were also some minor changes in content including the introduction of estimation in computation and measurement, simple probability, and encouraging the use of calculators from Fourth class onwards (DES/NCCA, 1999a).

Although Ireland has not participated in a large international assessment of mathematics since 1995, National Assessments of Mathematics Achievement (NAMA) were carried out at the Fourth class level in 1999 and 2004 (Shiel & Kelly, 2001; Shiel, Surgenor, Close, & Millar, 2006) and in Second and Sixth classes in 2009 (Eivers et al., 2010). Overall performance in Fourth class in 1999 and in 2004 was not significantly different, indicating no change in overall achievement from just before the revised curriculum was introduced to immediately after. There were significant improvements on two mathematics content areas (Data, and Shape and Space) and one skill process (Reasoning). In both assessments, relative weaknesses were identified in the content areas of Measures and aspects of Number, and in the process skills of Applying and Problem-solving.

In the National Assessments 2009 (NA 2009) of Second and Sixth class, performance on the process skills of Applying and Problem-solving and on the content area of Measures was poor, relative to other process skills and content areas, especially at Sixth class. TIMSS 2011 provides a timely opportunity to look at mathematics learning and achievement in Irish primary schools from an international comparative perspective. Full details of Irish pupils' performance in TIMSS 2011 are provided in the main report for Ireland (Eivers & Clerkin, 2012), but, broadly, national mathematics achievement is similar to that reported in TIMSS 1995, and slightly better than that reported in various PISA (Programme for International Student Assessment) cycles at post-primary level. In TIMSS 2011, Ireland's mean of 527 was significantly above the study centrepoint of 500, ranking 17th of 50 participating countries. Thirteen countries achieved mean scores that were significantly higher than Ireland's. Boys and girls in Ireland obtained similar mean scores on the overall assessment.

This chapter looks at relationships between TIMSS 2011 item performance in mathematics, at Irish and international levels, and item structures and demands in the context of the mathematics curriculum and the TIMSS 2011 mathematics framework and survey results.

This will be achieved by:

- comparing the TIMSS mathematics framework with the PSMC.
- clarifying the relationship between item difficulty and the international performance scale on which countries' mathematics performances are placed.
- analysing a selection of released items whose difficulty levels for Irish pupils are unusually high or low compared to the international norms, or are peculiar to Ireland in terms of gender differences.

The remainder of this chapter is divided into four sections, the first of which compares the TIMSS mathematics framework to the PSMC. Section two outlines International Benchmarks and items exemplifying each. Section three analyses a selection of mathematics items used in TIMSS 2011 and subsequently released for public review. The final section discusses some of the findings and the implications arising. Readers should note that this chapter examines only one element of the TIMSS 2011 data. Those who would like more general information about TIMSS or about Ireland's participation in PIRLS and TIMSS in 2011 are referred to Chapter 1 of this volume (Eivers & Clerkin, 2013).

TIMSS 2011 mathematics framework and the Irish PSMC

This section provides a brief comparison of the TIMSS 2011 mathematics framework for Fourth grade and the Irish mathematics curriculum for Third and Fourth class as set out in the PSMC handbook for teachers, and the results of a Test-Curriculum Matching Analysis (TCMA) carried out by a team of Irish mathematics educationalists.

TIMSS mathematics framework and item specifications

The TIMSS 2011 mathematics assessment framework provides an organisational structure for describing the mathematical knowledge and skills assessed in the 2011 survey, including the proportions of items assigned to test those skills (Mullis, Martin, Ruddock, O'Sullivan, & Preuschoff, 2009). As was the case with previous TIMSS frameworks the 2011 framework has two main dimensions: a **content** dimension, describing the three mathematical content domains to be assessed – Number; Geometric Shapes and Measures; and Data Display; and a **cognitive** dimension, listing the three domains of cognitive processes to be assessed – Knowing; Applying; and Reasoning. Table 8.1 gives the item percentages allocated to each of the content and cognitive domains assessed at Fourth grade in TIMSS 2011.

Table 8.1: Percentages of items for the content and cognitive domains in the TIMSS 2011 Fourth grade mathematics assessment

Content domains	Percentages of items
Number	50%
Geometric Shapes and Measures	35%
Data Display	15%
Cognitive domains	
Knowing	40%
Applying	40%
Reasoning	20%

The content dimension

The Number domain is assessed by approximately 50% of the items, and includes knowledge and skills relating to: numeration and place value; number operations with whole numbers (including estimation); fractions; decimals; measurement units;[1] number sentences; and number patterns. Geometric Shapes and Measures, which is assessed by 35% of the items, includes: length, area, and volume of figures; parallel and perpendicular lines; angles; 2-D coordinate system; properties of 2-D and 3-D shapes, line symmetry; rotational symmetry; and relationships between 2-D and 3-D shapes. The Data Display domain, which is assessed by 15% of the items, includes: data collection and classification; data representation with tables, pictograms, bar charts, pie charts, scales; interpretation of data displays and inference. Table 8.2 summarises the main topic areas under each content domain.

Table 8.2: Mathematical content domains and associated topic areas

Number	Geometric Shapes and Measures	Data Display
Whole numbers Fractions and decimals Number sentences with whole numbers Patterns and relationships	Points, lines and angles Two- and three-dimensional shapes	Reading and interpreting Organising and representing

The cognitive dimension

TIMSS is based on three cognitive domains – Knowing, Applying, and Reasoning. Table 8.3 summarises the key process skills associated with each. As can be seen, Knowing (assessed by roughly 40% of test items) refers to the basic facts, concepts, and procedures that pupils need to be able to recall to carry out routine mathematical tasks such as computation, measuring and identification, skills which are also often prerequisites for dealing with more complex tasks such as problem-solving and reasoning.

Table 8.3: Mathematical cognitive domains and associated process skills

Knowing	**Applying**	**Reasoning**
Recall terms, definitions, rules and properties	Select suitable method, operation or strategy for solving routine problems	Analyse mathematical relationships and problem situations
Recognise various mathematical objects and entities	Represent mathematical information and relationships in different modes	Generalise/Specialise mathematical patterns, rules, and principles
Compute – carry out algorithms and procedures	Model routine problems with suitable expressions or equations	Integrate/Synthesise mathematical elements and representations
Retrieve information and data	Implement a set of mathematical instructions	Justify methods, strategies and solutions
Measure things and choose appropriate units	Solve routine problems	Solve non-routine problems
Classify/Order objects, numbers, expressions		

Applying, assessed by 40% of the items, is concerned with the use or application of basic facts, concepts, and procedures in representing and solving routine well-practiced

[1] In the PSMC, measurement units are included in the Measures domain rather than the Number domain as in TIMSS 2011.

problems set in familiar mathematical or practical contexts. Reasoning (assessed by about 20% of the test items) is concerned with pupils' ability to analyse and think logically about mathematical objects, rules and relationships in the process of solving non-routine problems in both practical and purely mathematical contexts.

About 50% of the TIMSS 2011 items were multiple-choice, where pupils selected their answer from a choice of four, and about 50% were constructed-response, where pupils wrote in the answer. Pupils were not allowed access to calculators.

TIMSS mathematics framework and PSMC for Fourth class compared

Since TIMSS assessments were aimed at Fourth grade the focus in this section is on the PSMC for Fourth class.[2] As with the TIMSS mathematics framework, the PSMC has two principal dimensions – a content dimension and a cognitive dimension. The content dimension has five strands: Number, Algebra, Shape and Space, Measures, and Data. The strands and content domains can be loosely matched as follows:

PSMC		TIMSS
Number; Algebra	⟺	Number
Shape and Space; Measures	⟺	Geometric Shapes and Measures
Data	⟺	Data Display

To provide a rough comparison between TIMSS and the PSMC on the content dimension, Table 8.4 shows the percentage of specific teaching objectives listed in the PSMC for Fourth class for each content strand/domain, compared with the percentage of TIMSS items for each content domain. It can be seen from the table that, apart from Data, which is more heavily weighted in TIMSS, the PSMC content strands and the TIMSS content domains have fairly similar weightings.

Table 8.4: Percentages of teaching objectives in PSMC and items in TIMSS by content domain

Domain/Strand	% PSMC objectives	% PSMC objectives *(Re-categorised)**	% items in TIMSS 2011
Number, Algebra	45	54	50
Shape & Space, Measures	47	38	35**
Data	8	8	15

*Since TIMSS includes "units of measure" in the Number domain, this column includes PSMC objectives relating to "units of measure" in the Number & Algebra strand.

**TIMSS combines two PSMC strands (Shape and Space, Measures) in a domain called Geometric Shapes and Measures.

The cognitive dimension of the PSMC has six general process skill categories: Understanding and Recalling; Implementing; Reasoning; Integrating and Connecting; Communicating and Expressing; Applying and Problem-solving. One skill, Communicating and Expressing, was not a formal subject of assessment in TIMSS although, the extended constructed-response items could provide some informal information on this domain.

[2] A broader description of the PSMC can be found in DES/NCCA/Eivers' chapter in the TIMSS 2011 Encyclopedia (Mullis, Martin, Minnich, Stanco, et al., 2012). A more detailed description can be found in the PSMC Handbook (DES/NCCA, 1999b).

That aside, the PSMC general process skills and TIMSS cognitive categories align as follows:

PSMC		TIMSS
Understanding and Recalling, Implementing	⟺	Knowing
Reasoning, Integrating, Connecting	⟺	Reasoning
Applying and Problem-solving	⟺	Applying

Table 8.5 provides a comparison between TIMSS and the PSMC on the cognitive dimensions. The item percentages for each domain from NAMA 2004 are used as a proxy, since the weightings reflected in these percentages were inferred from curriculum documents and textbooks[3] for Fourth class at the time. It compares the percentage of items in the NAMA 2004 Fourth class test for each cognitive process skill of the PSMC with the percentage of TIMSS items for each cognitive domain. Apart from the combined category of Understanding and Recalling/Implementing, the PSMC and the TIMSS domains are somewhat differently weighted. However, defining categories and classifying items on the cognitive dimension is more subjective than is the case with the content domains and needs to be viewed in this light. For example, non-routine problems are included in the Reasoning category in the TIMSS framework, but in the Applying and Problem-solving category in the PSMC.

Table 8.5: Percentages of items for the cognitive domains of NAMA 2004 and TIMSS mathematics

NAMA 2004			TIMSS 2011	
Cognitive process skill	% items	% items (combined)	Cognitive process skill	% items
Understanding & Recalling	12	40	Knowing	40
Implementing	28			
Reasoning	21	28	Reasoning	20
Integrating & Connecting	7			
Applying & Problem-solving	32	32	Applying	40

Test-Curriculum Matching Analysis

In order to provide further evidence of the degree of correspondence between the TIMSS 2011 framework and the PSMC, a Test-Curriculum Matching Analysis (TCMA) was carried out in which three curriculum experts matched each of the 175 TIMSS test items with the specific objectives in the PSMC for Fourth class. Only 13 of the 175 TIMSS items (7%) were judged not to be covered in the PSMC for Fourth class. These non-matching items were all in the TIMSS Geometric Shapes and Measures domain and tested the topics of coordinates, rotational symmetry, volume of cuboids, and millimetre measures. Despite their not being covered in the PSMC, Irish pupils performed reasonably well on these items, with one exception. An item which belonged to the topic of coordinates systems (i.e., identifying the coordinates of a location) proved unusually difficult, and is discussed later in section four as Example Item 16 (*Write the grid square*). Only nine of the 47 countries that carried out a

[3] Recent National Assessments (Shiel et al., 2006; Eivers et al., 2010) indicate a heavy reliance on mathematics textbooks by teachers. Almost all primary school pupils were taught by teachers who used a textbook almost every day.

TCMA had a higher percentage of TIMSS items that matched their national mathematics curriculum for Fourth grade. When country scores were based solely on the items that matched their national curriculum, there was little change in the percent correct scores – just one or two percent – or on their comparative positions on the international scale (Mullis, Martin, Foy, & Arora, 2012).

The findings from the TIMSS mathematics framework/PSMC comparison and the TCMA indicate the high degree of overlap between the content of the Irish PSMC and the content of the TIMSS mathematics framework and items. It is, of course, TIMSS policy to design the assessment instruments so that they reflect as much as possible the curricula of the participating countries, and in the case of the Irish mathematics curriculum for Fourth class, it is a particularly close match.

International Benchmarks of mathematics performance

As explained in Chapter 1, TIMSS reports pupils' achievement using a scale with a mean of 500 (the centrepoint, anchored from the 1995 assessment) and a standard deviation of 100. In addition, four key points on this scale, **400, 475, 550**, and **625**, were identified for the purposes of setting and describing International Benchmarks of mathematics performance – Low, Intermediate, High, and Advanced, respectively. In order to describe what pupils can do at each of these four Benchmarks, the items used in TIMSS were located on the mathematics scale based on their difficulty. Once the items were placed and grouped on the scale they were used to derive descriptions of the knowledge and skills that pupils who scored at each International Benchmark should be able to demonstrate. (See the TIMSS methods and procedures website – http://timssandpirls.bc.edu/methods/index.html – for more detail). Following are the descriptions for the Fourth grade Benchmarks, along with released items to exemplify the Benchmarks and their descriptions. Readers should note that the manner in which items are presented here are – for reasons of space – somewhat different to how they were presented to pupils.[4]

Figure 8.1 outlines some of the mathematical skills that pupils at the Low International Benchmark are able to demonstrate, accompanied by two items exemplifying those skills. Example Item 1 (*5631 + 286*) involves implementing a procedure for adding a four-digit number to a three-digit number with renaming (carrying), a procedure for which copious practice is provided in textbooks and which is easily mastered by most pupils in most countries, including Ireland. Irish pupils scored 6% above a relatively high international average. Among the higher-performing countries, only Finnish pupils obtained a percent correct (58%) that was significantly lower than the international average. Irish girls scored about 6% higher than Irish boys.

On Example Item 2 (*This is a map of Lucy's town*), Irish pupils, girls and boys, did very well despite the fact that it involves Coordinates, a topic that is not on the PSMC for Fourth class. Pupils probably acquire an informal knowledge of reading coordinates from real-life experiences. For example, game boards (on or off computer screens) and maps in shopping centres often have a grid type setup similar to the grid in Example Item 2.

[4] All of the released items, shown as originally presented to pupils, can be viewed at http://www.erc.ie/documents/timss_2011_maths_items.pdf.

Figure 8.1: Summary description of the Low International Benchmark, with two exemplar items

Low International Benchmark – Have basic mathematical knowledge

Pupils at this Benchmark can...

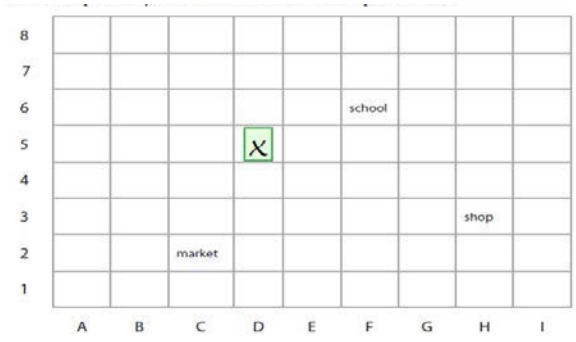
- Add and subtract whole numbers and enumerate into the thousands.
- Identify parallel and perpendicular lines and geometric shapes; locate positions on a map.
- Read and complete simple bar graphs and tables.

Example Item 1: **5631 + 286 =**

Answer: 5917

Item ID: M05_01[5]
Topic Area: Whole Numbers
Correct: Ireland: 78% TIMSS: 72%
Content Domain: Number
Cognitive Domain: Knowing
Irish Girls: 81% Irish Boys: 75%

Example Item 2: **This is a map of Lucy's town. The market is at the position C2. Lucy's house is at D5. Put an X on the map to show where Lucy's house is.**



Item ID: M06_07B
Content Domain: Geometric Shapes and Measures
Topic Area: Points, Lines, and Angles
Cognitive Domain: Applying
Correct: Ireland: 89% TIMSS: 78%
Irish Girls: 89% Irish Boys: 89%

Figure 8.2 outlines some characteristics of the Intermediate International Benchmark. Example Item 3 (*Joan had 12 apples*) involves connecting a word problem with the appropriate number sentence representing it. Pupils need to recognise which one of the four number sentences has the same structure as the word problem. At 74% correct, Irish pupils, surprisingly, scored marginally (4%) lower than the international average. This may be partly attributed to the fact that Number Sentences for Third and Fourth classes are more focused on multiplication and division sentences rather than on addition and subtraction sentences, which are covered well in the First and Second class curriculum. In fact, 45% of Irish pupils were taught by teachers who (in completing the Teacher Questionnaire administered as part of the overall PT 2011 study) said Number Sentences had been taught before Fourth class. Also, the task requires pupils to choose the number sentence that correctly models the problem rather than simply finding the missing number in a number sentence. By comparison, another released item (not shown here; ID code: M07_04) asked "*4* × □ = *28. What number goes in the box?*" This was answered correctly by 86% of Irish pupils.

In Example Item 4 (*Name the shapes on the bus*), pupils were asked to identify common 2-D shapes in a practical context. Full credit (2 points) was given to pupils who identified all three shapes correctly, while pupils who correctly identified two of three shapes were assigned partial credit (1 point). Irish pupils performed very well on this item, with 72%

[5] The code for each item indicates the location of the item within a block of items (e.g., M05_01 is item 1 in block 5). The codes for the 73 released mathematics items, along with Irish and international scores, can be found at: http://timssandpirls.bc.edu/timss2011/international-released-items.html. Examples of correct answers in cases where pupils had to write an answer, along with percent correct scores, are also available at www.erc.ie/pirlstimss.

obtaining full credit – 19% higher than the international average. In only three countries (Singapore, the Russian Federation and Serbia) were a greater proportion of pupils awarded full credit on this item.

Figure 8.2: Summary description of the Intermediate International Benchmark, and two exemplar items

Intermediate International Benchmark – Apply basic maths knowledge in routine contexts

Pupils at this Benchmark can...

- Add one-place decimals; identify an expression that represents an addition or subtraction situation; identify representations of fractions; solve simple proportional problems involving halving; extend simple geometric number patterns.

- Visualise 3-D shapes from 2-D representations; identify properties of familiar solids; order a set of angles by size; recognise a line of symmetry and draw the reflection of a simple shape; use a grid to describe how to get from one position to another.

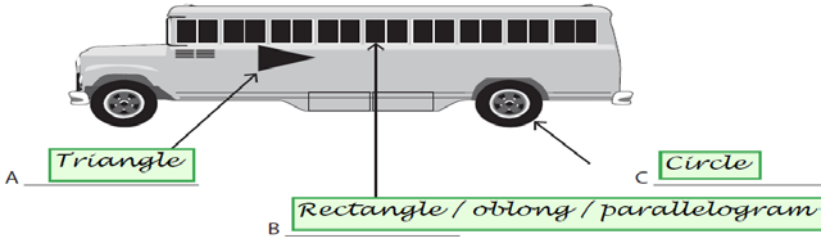
- Use information in bar graphs, pictographs, and tables to solve simple problems, and read and interpret different representations of the same data.

Example Item 3: **Joan had 12 apples. She ate some apples, and there were 9 left. Which number sentence describes what happened?**

A) 12 + 9 = ☐ B) 9 = 12 + ☐ **C) 12 – ☐= 9*** D) 9 – ☐= 12

Item ID: M06_01 **Content Domain**: Number
Topic Area: Number Sentences **Cognitive Domain**: Applying
Correct: Ireland: 74% TIMSS 78% Irish Girls: 81% Irish Boys: 68%

Example Item 4: **Write the names of shapes A, B, and C in the spaces provided**



Item ID: M03_08 **Content Domain**: Geometric Shapes and Measures
Topic Area: 2-D and 3-D Shapes **Cognitive Domain**: Knowing

Full credit:	Ireland: 72%	TIMSS: 53%	Irish Girls: 69%	Irish Boys: 75%
At least partial credit:	Ireland: 82%	TIMSS: 65%	Irish Girls: 81%	Irish Boys: 83%

(Full credit: All 3 shapes correct Partial credit: Two shapes correct)

Figure 8.3 summarises features of the High International Benchmark, including two exemplar items. Example Item 5 (*The scale on a map*) involves the use of a simple map scale to find the distance between two towns, given the distance between them on a map. Irish pupils scored just below the international average on this item (50% and 54%, respectively). This may be due to the fact that scale on charts and graphs is covered in the PSMC for Fourth class, but scale on maps is not.

Example Item 6 (*How much do the apples weigh?*) involves reading the weight of apples on a weighing scale. Again, Irish pupils scored just below the international average (52% and 56%, respectively). The relatively low performance of Irish pupils was partly due to the poorer performance of girls on this item (45% for Irish girls, and 59% for Irish boys). A

similar gender difference was also apparent in the international average (51% for girls, and 62% for boys).

Figure 8.3: Summary description of the High International Benchmark, and two exemplar items

High International Benchmark – Apply maths knowledge and understanding to solve problems

Pupils at this Benchmark can...

- Solve word problems involving operations with whole numbers; multiply two-digit numbers; use division in a variety of problem situations; identify missing digits in whole numbers, order them, and appropriately round them; add two-place decimals; order unit fractions; write a number between two consecutive whole numbers; extend patterns, and use two-step rules to continue a pattern.

- Label gradations on a scale and solve a word problem involving measures and proportional reasoning; solve word problems involving addition of time; classify shapes according to given properties including symmetry; recognise right angles, parallel, and perpendicular lines in different orientations; find perimeters of simple figures; recognise a net of a cube; and identify the stack of cubes with largest volume.

- Interpret and use data in tables and graphs to solve problems; use information in pictographs and tally charts to complete bar graphs.

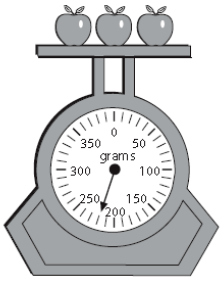
Example Item 5: **The scale on a map indicates that 1 centimetre on the map represents 4 kilometres on the land. The distance between two towns on the map is 8 centimetres. How many kilometres apart are the two towns?**

A) 2 B) 8 C) 16 **D) 32***

Item ID: M01_08 **Content Domain**: Number
Topic Area: Whole Numbers **Cognitive Domain**: Reasoning
Correct: Ireland: 50% TIMSS: 54% Irish Girls: 47% Irish Boys: 53%

Example Item 6: **How much do the apples weigh in grams?**

A) 200 B) 202 C) 210 **D) 220***



Item ID: M05_07
Content Domain: Data Display
Topic Area: Reading and Interpreting
Cognitive Domain: Knowing
Correct: Ireland: 52% TIMSS: 56%
Irish Girls: 45% Irish Boys: 59%

Example Item 7 (*Tom ate ½ a cake*) in Figure 8.4 is one of a number of items on fractions and decimals on which Irish pupils performed remarkably better than the corresponding international averages. For example, for Item 7, the national mean of 53% correct is 30% higher than the international average. Pupils in Northern Ireland also performed very well on this item (68% correct). The low international mean suggests that this is a particularly difficult item in many other countries, including the generally high-performing Japan (28% correct).

The item involves knowing when and how to add two related fractions (*½* and *¼*) in a practical context (eating parts of a cake), so the low international mean score is surprising. The considerably higher score of Irish pupils may be partly attributed to the familiar context of the task and to the substantial coverage of fraction concepts in the PSMC and Irish textbooks for Third and Fourth classes, although coverage of formal algorithms or procedures for addition and subtraction of fractions is left to Fifth class. The latter is affirmed by the fact that 66% of Irish pupils were taught by teachers who chose "Not yet

taught or just introduced" when asked if pupils had been taught addition and subtraction of fractions.

It is interesting to contrast performance on Example Item 7 with performance on the sample item below, on fractions in a similar problem context, which was included in NAMA 2004 (Shiel et al., 2006). Just 6% of Fourth class pupils obtained the correct answer to the item. However, its greater difficulty may be explained by the fact that it involved unrelated fractions (¼ and ⅓), and multiple steps (e.g., converting to twelfths, then combining and partitioning fractions). As a non-routine multi-step type of problem which is less well covered in most Irish textbooks and classroom instruction, it would be expected to be considerably more difficult than Item 7.

From: NAMA 2004 - Sample Item
Peter ordered pizza. He ate ¼ of it. His sister Niamh ate ⅓ of it. What fraction of the pizza was left?
National Score: 6%

Figure 8.4: Summary description of the High International Benchmark, and two exemplar items

Advanced International Benchmark – Apply maths in complex situations and explain reasoning

Pupils at this Benchmark can...

- Solve a variety of multi-step word problems involving whole numbers and proportions; solve problems with number sentences involving whole numbers; determine equivalent fractions represented in a variety of ways; identify a fraction larger than a given fraction. Identify the smallest among a set of one- and two-place decimals; solve two-step problems involving decimals; identify a two-step rule for a linear relationship.

- Apply knowledge of two- and three-dimensional shapes in a variety of situations; estimate the length of a curved line; use knowledge of perimeter to solve a multi-step problem; determine the areas of simple figures, find the number of cubes that fill a rectangular box.

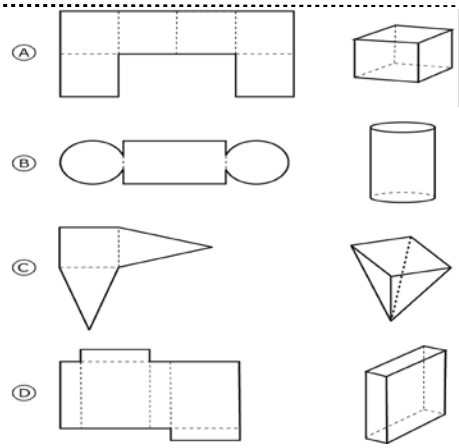
- Use data to solve two-step problems; draw and justify conclusions from data in a table.

Example Item 7: **Tom ate ½ of a cake, and Jane ate ¼ of the cake. How much of the cake did they eat altogether?**

Answer: *¾ or three-quarters*

Item ID: M03_06
Topic Area: Fractions and Decimals
Correct: Ireland: 53% TIMSS: 23%
Content Domain: Number
Cognitive Domain: Knowing
Irish Girls: 51% Irish Boys: 55%

Example Item 8: **Ina found the following patterns to make containers. Which pattern actually makes the container beside it?**



Item ID: M06_10
Content Domain: Geometric Shapes and Measures
Topic Area: 2-D and 3-D Shapes
Cognitive Domain: Reasoning
Correct: Ireland: 30% TIMSS: 37%
Irish Girls: 33% Irish Boys: 27%

Example Item 8 (*Ina found container patterns*) in Figure 8.4 requires considerable analysis and spatial reasoning as it involves identifying 2-D nets of 3-D shapes. Irish scoring on this item was slightly lower than the international average, with boys' performance below that of girls. This type of task benefits from manipulative activities which can be done with concrete materials or using digital tools in digital learning environments, which earlier research suggests are not being used to an appropriate degree in mathematics teaching in Irish primary schools (Eivers et al., 2010).

Summary of Benchmark performance

Table 8.6 compares the percentages of Irish Fourth class pupils, overall and by gender, reaching each of the four International Benchmarks in mathematics compared with the international average percentages. It can be seen that higher proportions of Irish pupils reached each of the four Benchmarks than the international averages for all countries, with the difference being greatest at the High Benchmark (41% of Irish pupils having reached this level, and 28% internationally). However, the difference at the Advanced Benchmark was slight and therefore not in keeping with Irish performance generally.

This latter finding is in line with the trend in PISA mathematics surveys of 15-year-olds where high-achieving pupils underperform on the PISA proficiency scale. For example, in the 2003 PISA study (when mathematics was the major domain), 15% of all students internationally achieved the top two proficiency levels, compared with 11% of Irish students, whereas Irish students' overall score on the PISA scale of 503 was around the international mean of 500 (Cosgrove, Shiel, Sofroniou, Zastrutzki, & Shortt, 2005). Gender differences in percentages of Irish pupils reaching each of the TIMSS Benchmarks are relatively small, apart from at the Advanced Benchmark, which was reached by 11% of boys compared with 8% of girls, a difference not present at the international level. In PISA 2003, 13% of Irish males reached the top two proficiency levels, compared with 9% for females. Similarly, in NA 2009, slightly more boys than girls reached the highest proficiency level (12%; 8% at Second class, and 11%; 9% at Sixth class).

Table 8.6: Percentage of Irish pupils, and international median, reaching each International Benchmark, overall and by gender

Benchmark	Irish pupils			International median		
	Overall	Girls	Boys	Overall	Girls	Boys
Advanced	9	8	11	8	8	9
High	41	39	42	31	29	32
Intermediate	77	76	77	61	60	61
Low	94	95	93	82	82	81

Table 8.7 compares, by content and cognitive domains, the percentages of Irish Fourth class pupils reaching each of the four International Benchmarks in mathematics, compared with TIMSS international mean percentages of Fourth grade pupils. Apart from Data Display at the Advanced Benchmark, higher percentages of Irish pupils reached the four Benchmarks in the three content domains than the international average, with the advantage being substantially greater for Number than for the other two domains. This latter finding is in keeping with the results of NAMA 2004 at Fourth class where the lowest mean percent correct scores were in the Shape and Space (48%) and the Measures domains (56%), and the highest in Number (69%). Table 8.7 also shows that, apart from Reasoning at the Advanced Benchmark, higher percentages of Irish pupils reached the four Benchmarks in the three cognitive domains than the international averages, with the advantage being substantially greater for Knowing than for Applying or Reasoning. This finding is also in

keeping with the NAMA 2004 results, where the lowest mean percent correct score was in the Applying and Problem-solving domain (48%), and the highest in Understand and Recall (62%).

Table 8.7: Percentages of Irish pupils, and international mean percentage, reaching each International Benchmark, by content and cognitive domains

International Benchmark	IRL	TIMSS	IRL	TIMSS	IRL	TIMSS
	Number		Geo. Shapes & Measures		Data Display	
Advanced	11	9	10	9	9	10
High	43	32	37	31	38	32
Intermediate	78	62	72	59	74	59
Low	94	83	92	79	93	78
	Knowing		Applying		Reasoning	
Advanced	16	10	10	9	7	9
High	47	32	41	31	32	31
Intermediate	78	61	77	60	68	60
Low	94	81	94	81	91	80

Analysis of a selection of released items

After the initial achievement results were released, 73 items from a total pool of 175 items used in the TIMSS 2011 mathematics assessment were released into the public domain (see http://www.erc.ie/documents/timss_2011_maths_items.pdf for all released items, sample responses, and information on percent correct answers for Ireland and for TIMSS overall). The released items are representative of the distribution of all TIMSS items in terms of content and cognitive domains, as specified by the mathematics framework described earlier. Item-by-item percent correct information for each participating country can also be accessed at: http://timssandpirls.bc.edu/timss2011/international-released-items.html. Item-level analysis of the TIMSS data provides useful information relating to the teaching and learning of mathematics in Third and Fourth classes, as well as factors contributing to the difficulty of the items.

Table 8.8 lists a selection of 35 items from the 73 released items that can be considered to be "out of the ordinary" in terms of Irish performance. The Irish mean scale score for TIMSS 2011 was 527, which is significantly above the international mean scale score of 500. On this basis one would expect the Irish pupils' percent correct score on most mathematics items to be slightly above the international mean, by up to 5%-10%. Therefore, for this section, items for which Irish pupils' percent scores were substantially above the international mean (i.e., difference $\geq +15\%$) and those that were at or below it (i.e., $\leq 0\%$) were considered to be "out of the ordinary". Items with substantial gender differences, particularly where they are not in line with international gender differences in performance, are also included.

Inspection of these 35 "unusual" items in Table 8.8 shows that, in terms of the content dimension, most of the items on which Irish Fourth class pupils did unusually well were in the topic area of Fractions and Decimals (7 items) and most of the 35 items on which they did relatively poorly were, surprisingly, on the topic area of Whole Numbers (5 items). Most items with unusual gender differences (an at least 10% gender gap in Ireland) were also on Whole Numbers (6 items). All of the "unusually high" items were in the Knowing and Applying domains and half of the "unusually low" items were in the Reasoning domain. In terms of International Benchmarks, 28 of the 35 items are at the High and Advanced International Benchmarks with just 7 of them at the Intermediate level and none

at the Low level. These "out of the ordinary" items are discussed further with a particular emphasis on items on which Irish pupils underperformed.

Table 8.8 "Out of the ordinary" TIMSS released mathematics items, by item ID, size of gap and International Benchmark level for item

Content domain (*N released items*)	Topic area	Unusually high IRL - INT ≥ 15% *Item ID* (gap) IBM*	Unusually low IRL – INT ≤ 0% *Item ID (gap) IBM*	Unusual IRL gender gap ≥ 10% *Item ID (gap) IBM*
Number (*40*)	Whole numbers	M05_03 (+31) Adv M07_02 (+19) Adv	M01_03 (0) Adv M01_08 (-4) High M02_04 (-2) Adv M06_02 (-6) High M06_03 (-13) Adv	M01_01A (-10) Inter M01_01B (-11) Adv M01_02 (-11) Adv M02_03 (-21) Adv M02_05 (+10) High M03_01 (-10) Inter
	Fractions & decimals	M02_01 (+15) Inter M02_02 (+24) Adv M03_03 (+28) Inter M03_05 (+19) High M03_06 (+30) Adv M06_05 (+28) Adv M07_01 (+16) Adv		
	No. sentences with whole numbers	M07_05 (+16) Adv	M05_06 (-1) Adv	M06_01 (+13) Inter
	Patterns & relationships	M07_03 (+19) Adv		
Geometric Shapes & Measures (*24*)	Points, lines, & angles	M02_07B (+15) Inter	M07_07 (-12) Adv M02_07A (-6) High	
	Two- & three-dimensional shapes	M03_08 (+20) Inter M05_11 (+16) High M06_08 (+27) High	M03_12 (-5) Adv M01_07 (0) Adv M06_10 (-6) Adv	M06_09 (-10) Adv
Data Display (*9*)	Reading & interpreting			M05_07 (-14) High
	Organising & representing			

*All items are identified by a unique ID (shown at http://www.erc.ie/documents/timss_2011_maths_items.pdf to the right of each item).

Number

This section examines selected items in the TIMSS topic areas of Fractions and Decimals; Whole Numbers; and, Ratio and Proportion.

Fractions and Decimals

As mentioned earlier, Irish Fourth class pupils performed unusually well on items relating to the topic of Fractions and Decimals. This was illustrated earlier by Example Item 7 (*Tom ate ½ a cake*) at the Advanced Benchmark. Irish pupils also performed very well on items involving Decimals, as next illustrated by Example Item 9 (*Write a number between 5 and 6*) (Figure 8.5). Item 9 involves knowing the concept of a decimal to one place. Two-thirds of Irish pupils obtained the correct answer, compared to an international mean of just 48%, a difference of 18%. The inclusion of a specific teaching objective relating to ordering of decimals on the number line in the PSMC and the resulting substantial coverage of it in

classroom teaching and in textbooks may help to explain the much higher score of Irish pupils.

Figure 8.5: Examples of mathematics items related to Fractions and Decimals

Example Item 9: Write a number that is larger than 5 and is smaller than 6.	
Any decimal or fraction between 5 and 6 e.g. 5.2, 5½, 5.27, 5¾	
Item ID: M03_05	**Content Domain**: Number
Topic Area: Fractions and Decimals	**Cognitive Domain**: Knowing
Benchmark: High	
Correct: Ireland: 66% TIMSS: 48%	
Example Item 10: Duncan first travelled 4.8km in a car and then he travelled 1.5km in a bus. How far did Duncan travel?	
6.3 km	
Item ID: M02_01	**Content Domain:** Number
Topic Area: Fractions and Decimals	**Cognitive Domain:** Applying
Benchmark: Intermediate	
Correct: Ireland: 75% TIMSS: 60%	

Another item on Decimals on which Irish pupils did particularly well was on the application of decimals to calculations with units of measurement – Example Item 10 (*Duncan travelled 4.8km*), at the Intermediate Benchmark. This item would be classified under Measures in the PSMC since it involves addition of units of length (km) but comes under the topic area of Fractions and Decimals in the Number domain of the TIMSS framework as it involves decimals. Irish pupils scored highly on this item – 75% correct compared with 60% for the international mean. It is a simple routine one-step problem classified as Applying on the cognitive dimension of the TIMSS framework.

Whole Numbers

On the other hand, Irish performance on many items in the topic area of Whole Numbers was unusually low or had unusually large gender differences. One of these items, Example Item 3 (*Joan had 12 apples*), which relates to the topic of Number Sentences for the Intermediate Benchmark, had unusual gender differences and was discussed earlier. One of the poorest items in terms of Irish performance was Example Item 11 (*Circle factors of 12*), which is at the Advanced Benchmark (Figure 8.6). Only 14% of Irish pupils answered this item correctly, compared to an international mean of 27%. Based on Irish performance in general one would expect the Irish score on this item to exceed 30%. However, the concept of a factor is not formally introduced in the PSMC until Fifth class (in the strand unit Number Theory). Although pupils may be familiar with divisibility from work on multiplication and division with whole numbers in Third and Fourth classes, few would seem to be able to transfer this knowledge to generating lists of factors for numbers and solving problems involving factors.

Another item shown in Figure 8.6 in which Irish pupils did less well than the international mean is Example Item 12 (*Mary cycling to Brandon*) at the Advanced Benchmark. As with the previous item, this item involves a concept, speed, which is not introduced until Sixth class in the PSMC (in the strand unit Time) and so is not covered in Fourth class lessons and textbooks. Speed is also a more complex concept as it represents a ratio of two more basic variables – distance and time (e.g., kilometres per hour). These facts may explain the poor Irish performance (only 35% answered correctly) on this item. The international

mean is also low at 38%, so the absence of concept of speed in the Fourth grade mathematics curriculum may have been a problem for some other countries.

Irish girls (45%) did substantially better than Irish boys (34%) on Example Item 13 (*23 × 19*) whereas the international mean gender difference was only 3%. This task normally involves knowing the steps in a long multiplication procedure, although more able pupils might use reasoning such as 23 × 19 = (23 × 20) – (23 × 1) = 460 – 23 = 437. Given the considerable emphasis on multi-digit multiplication procedures in Irish Fourth class textbooks a better performance might be expected. Performance on this item varied greatly from country to country. While 90% of pupils in Chinese Taipei answered correctly, less than 10% of pupils in a number of countries did so, including Finland (5%), New Zealand (8%) and Poland (6%). This may reflect curriculum coverage or a de-emphasis on teaching formal algorithms.

Figure 8.6: Examples of mathematics items related to Whole Numbers

Example Item 11: Circle each number which is a factor of 12

1	2	3	4	5	6	7	8	9	10	11	12

Item ID: M06_03 Benchmark — **Content Domain:** Number
Topic area: Whole Numbers — **Cognitive Domain:** Knowing
Benchmark: Advanced
Full credit: Ireland: 14% TIMSS: 27%
At least partial credit: Ireland: 27% TIMSS: 44%
(2 points: all six correct numbers - 1, 2, 3, 4, 6, 12; 1 point: Four or five correct numbers)

Example Item 12: Mary left Apton and rode at the same speed for 2 hours. She reached this sign. Mary continues to ride at the same speed to Brandon. How many hours will it take her to ride from the sign to Brandon?

(A) 1 ½ hours (B) 2 hours **(C) 3 hours*** (D) 3 ½ hours

Item ID: M02_04 — **Cognitive Domain:** Reasoning
Topic Area: Whole Numbers — **Content Domain:** Number
Benchmark: Advanced
Correct: Ireland: 35% TIMSS: 38%

Example Item 13: 23 × 19 =

437

Item ID: M02_05 — **Content Domain:** Number
Topic Area: Whole Numbers — **Cognitive Domain:** Knowing
Benchmark: High
Correct: Ireland: 40% TIMSS: 41%
Irish Girls: 45% Irish Boys: 34%

Ratio and Proportion

A particular subsection of the topic area Whole Numbers on which Irish pupils did relatively poorly was that of simple proportions. This includes concepts such as ratio, scale, rate and the procedures of multiplication, division, and unitary method. Included among these items

are some which showed unusual gender differences in favour of boys (see Table 8.8). Four of these items relate to one stimulus, shown in Example Item 14 (*Trading Cards*) (Figure 8.7).

In the stimulus, two ratios are provided as pictorial representations: i.e.

1 animal card = 2 cartoon cards and 2 animal cards = 3 sports cards

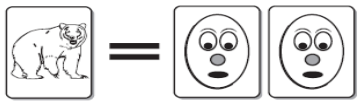
The pupil has to use these ratios to solve the four questions. The first question involved constructing the relationship below and carrying out the appropriate multiplication (normally a one-step problem).

2 cartoon cards for 1 animal card = ? cartoon cards for 5 animal cards

This was generally easy for Irish pupils (73% correct) and in terms of the international mean (62%). However, substantially fewer Irish girls than boys obtained the correct answer (68% of girls, and 78% of boys). The difference in favour of boys at the international level was just 6%.

Figure 8.7: Examples of mathematics items related to Ratio and Proportion (Whole Numbers)

Example Item 14: The town fair had a booth where people could trade cards.



1 animal card is worth 2 cartoon cards.

2 animal cards are worth 3 sports cards.

Some children went to the booth to trade cards

Item IDs: M01_01A, M01_01B, M01_02, M01_03 **Content Domain:** Number
Topic Area: Whole Numbers **Cognitive Domain:** Reasoning
(except M01_01A, which was Applying)

1A. **Becky had 5 animal cards to trade for cartoon cards. How many cartoon cards would she get?**
10 cartoon cards
Ireland: 73% TIMSS: 62%. Irish Boys: 78% Irish Girls: 68%

1B. **Jim had 8 animal cards to trade for sports cards. How many sports cards would he get?**
12 sports cards
Ireland: 35% TIMSS: 31%. Irish Boys: 40% Irish Girls: 29%

2. **Steve had 15 sports cards to trade for animal cards. How many animal cards would he get?**
10 animal cards
Ireland: 27% TIMSS: 25%. Irish Boys: 32% Irish Girls: 23%

3. **Brad had 8 cartoon cards to trade for sports cards. How many sports cards would he get?**
6 sports cards
Ireland: 17% TIMSS: 18% Irish Boys: 22% Irish Girls: 11%

The second question involved constructing the relationship below and carrying out the appropriate operations (normally a two-step problem).

3 sports cards for 2 animal cards = ? sports cards for 8 animal cards

This proved to be considerably more difficult, with only 35% of Irish pupils getting the correct answer and again, Irish boys scoring considerably better than Irish girls (40%, compared with 29%), whereas the advantage for boys at the international level was just 5%.

The next question involved constructing a slightly more complex proportion:

2 animal cards for 3 sports cards = ? animal cards for 15 sports cards

Overall, 27% of Irish pupils obtained the correct answer compared with 25% internationally. Irish boys' performance exceeded that of Irish girls by about 9% (the gender difference at the international level was 4% in favour of boys).

Finally, the fourth element was the most complex, and involved construction of a transitive relationship among the proportions:

IF 3 sports cards = 2 animal cards **AND** 1 animal card = 2 cartoon cards;
THEN ? sports cards = 8 cartoon cards.

This is a multi-step problem involving a higher level of proportional reasoning and understanding than the previous three questions and one that might benefit more from formal classroom experience. This is reflected in the performance figures with just 17% of Irish pupils answering correctly (the same as the international mean). Again, boys' percent correct (22%) exceeded girls' (11%) by over 10%, twice the magnitude of the difference at the international level.

Apart from 1A in Example Item 14, these questions are classified as Reasoning on the cognitive dimension of the TIMSS framework and are at the Advanced Benchmark. The performance of Irish pupils on these items is not in line with their performance on the TIMSS 2011 mathematics assessment in general. As with some earlier items showing this trend, a partial explanation may be found in the PSMC and in textbooks. The topic of Ratio and Proportion is not formally introduced in the PSMC until Sixth class. (In the pre-1999 curriculum a procedure for solving ratio tasks called "unitary method" was taught in Fourth class but was not included in the PSMC for Fourth class). Consequently, the topic is not dealt with in the textbooks and resource materials for Fourth class. However, proportionality is a broadly-based topic affecting a number of other topics including multiplication and division, fractions, decimals, percentages, scale, and conversion of measures, all of which are covered in the PSMC for Third and Fourth classes. There should be some transfer of learning, particularly for the more able pupils, from these topics to proportionality tasks as per the four questions above. There has been considerable research on proportional reasoning (e.g., Hart, 1984; Vergnaud, 1983), indicating that its development takes place over a number of years from the age of eight or nine to 14 or 15 years. In this regard, 11 of the 85 tasks in PISA 2003, which tested 15-year-olds, directly involved proportional reasoning, with percent corrects ranging from 8% to 80% (OECD, 2009).

The relatively weaker performance of Irish Fourth class girls on the four proportionality tasks is more difficult to explain. The context of trading cards may have been a factor, although this type of game does not seem to be a predominantly male activity. Example Item 15 (*In a soccer tournament*) is another item classified as Reasoning in the TIMSS framework, but involving reasoning with additive structures of whole numbers rather than multiplicative or proportional number structures (Figure 8.8). Again, there was a large gender difference in favour of boys (21% gap), and again, potentially gendered content. A possible reason for this large difference is that boys are stereotypically more interested in and more familiar with soccer league tables than girls, possibly giving them an advantage in working out the correct answer (3 + 3 + 3 + 1 + 1, which is 5 games).

Figure 8.8: Example of a Whole Numbers mathematics item with a large gender gap

Example Item 15: In a soccer tournament, teams get: **3 points for a win** **1 point for a draw** **0 points for a loss** **Zedland has 11 points.** **What is the smallest number of games Zedland could have played?** *Five / 5*	
Item ID: M02_03	**Content Domain:** Number
Topic Area: Whole Numbers	**Cognitive Domain:** Reasoning
Benchmark: Advanced	
Correct: Ireland: 39% TIMSS: 27%	Irish Boys: 50% Irish Girls: 29%

Geometric Shapes and Measures

Table 8.8 lists ten released items in the Geometric Shapes and Measures domain which were considered to be unusual in terms of typical Irish Fourth class performance. Some of those items are considered further in this section.

Points, Lines, and Angles

Three of the unusual items are in the topic area of Points, Lines and Angles and two of these, shown in Example Items 16A and 16B (*Write the grid square*) concern the topic of Coordinates in the context of grid maps (Figure 8.9). The topic of Coordinates was considered briefly in section three in relation to Example Item 2 for the Low Benchmark which also involved a grid map context. As mentioned there, Coordinates are not on the Fourth class PSMC but familiarity with grids, particularly in the context of games, may have affected performance. The performance of Irish pupils on the two items shown next is striking in this regard as, relative to international levels, they performed unusually well (79% in Ireland; 63% internationally) on Example Item 16B, but unusually poorly (43% in Ireland; 49% internationally) on Example Item 16A.

In Example Item 16A, pupils are required to identify the coordinates of two specified places on the grid, whereas 16B requires them to identify a place on the grid given its coordinates. As Coordinates do not appear on the Fourth class curriculum Irish pupils would have less experience of the first kind of task but would more likely experience the second kind in some game context (e.g., "go to C3" or "prize is at B5", etc.). This lack of formal teaching on the topic is supported by data from the Teacher Questionnaire. Three-quarters (78%) of Irish pupils were taught by teachers who said they had not yet taught Coordinates, compared to 45% of pupils internationally.

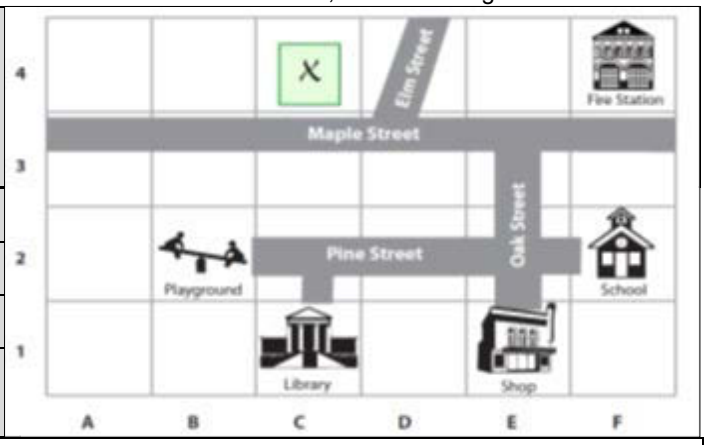
Example Item 17 (*How long is a piece of string?*), which involves estimating the length of a piece of string, proved to be one of the most difficult items on the test for Irish pupils. Only 16% answered correctly, 13% below the international mean. This is unexpected given the strong emphasis on estimation of length in the PSMC for Fourth class. Research suggests that developing estimation skills in measurement among primary school pupils requires considerable learning experiences of a practical nature (Lehrer, 2003). Standard textbooks may be of limited value in this regard. Moreover, National Assessments conducted in 2004 and 2009 indicate that pupils use concrete materials, such as measuring instruments, on a very infrequent basis as they move through the primary school system. More attention could be given to materials and methods of teaching this topic in CPD courses for teachers.

Figure 8.9: Examples of mathematics items related to Points, Lines and Angles

Example Item 16:

A. Complete the table to show where the places are. The first one has been done for you.

Places	Grid Square
Playground	B2
School	F2
Junction of Maple & Oak Streets	E3



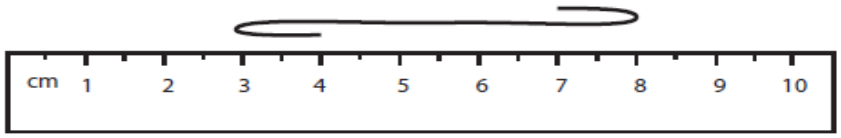
Item ID: M02_07A
Content Domain: Geometric Shapes and Measures
Topic Area: Points, Lines, and Angles **Cognitive Domain:** Knowing
Benchmark: High
Correct: Ireland: 43% TIMSS: 50%

B. Troy lives in a house in square C4. Put an X in the square to show where Troy lives.

Item ID: M02_07B **Content Domain:** Geometric Shapes and Measures
Topic Area: Points, Lines, and Angles **Cognitive Domain:** Applying
Benchmark: Intermediate
Correct: Ireland: 78% TIMSS: 64%

Example Item 17: If the string in the diagram is pulled straight, which of these is closest to its length?

(A) 5 **(B) 7*** (C) 8 (D) 9



Item ID: M07_07 **Content Domain:** Geometric Shapes and Measures
Topic Area: Points, Lines, and Angles **Cognitive Domain:** Applying
Benchmark: Advanced
Correct: Ireland: 16% TIMSS: 29%

Two- and Three-Dimensional Shapes

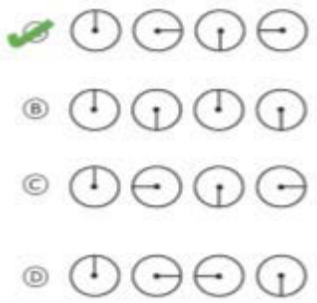
Two of the items on the topic of 2-D and 3-D Shapes were included as examples of Benchmark levels earlier in section three. Example Item 4 (*Name the shapes on the bus*), which assessed recognition of 2-D shapes at the Intermediate Benchmark, proved to be much easier for Irish pupils (72% answered correctly) than for international pupils generally (53%). Recognition of 2-D shapes is easily taught and practised and is given considerable attention in the PSMC and textbooks so this good performance is not surprising. Example Item 8 (*Ina found container patterns*) involved relationships between 3-D shapes and their 2-D nets. It is an Advanced Benchmark item and was more difficult than expected for Irish pupils (only 30% correct), given Irish pupils' performance in general and the international average of 37% correct. It may be due to lack of appropriate manipulative learning experiences in class lessons or in textbook work. Digital learning environments could be used to provide suitable activities on this topic.

Example 18 (*Rotate ¼ turn*) involves rotation in a circle through a specified angle which is not ostensibly on the PSMC, yet Irish pupils scored particularly well on the item with 79% choosing the correct response compared to an international mean of 64% (Figure 8.10). This was probably facilitated by reference in the stem of the item to "¼ turn clockwise", which would be familiar to most pupils, rather than specifying 90° as the rotation, which is not on the curriculum for Fourth class.

This view is supported by the results for a similar item, Example Item 19 (*Rotate 180°*) which specifies a 180° rotation of a flag shape. The performance of Irish pupils on this item (42%) was *below* what would be expected based on the Irish mean performance. Unlike the previous item the required transformation in this item is specified in degrees and there is no familiar analogy such as the clock to help pupils.

Figure 8.10: Examples of mathematics items related to 2-D & 3-D Shapes

Example Item 18. A pattern rule says "Rotate the shape  **¼ turn clockwise each time. What will the pattern look like?**



Item ID: M05_11
Content Domain: Geometric Shapes and Measures
Topic Area: 2-D & 3-D Shapes
Cognitive Domain: Knowing
Benchmark: High
Correct: Ireland: 79% TIMSS: 64%

Example Item 19

Which of the following shows the position of the shape above after a half turn or 180° rotation?

Item ID: M01_07
Content Domain: Geometric Shapes and Measures
Topic Area: 2-D & 3-D Shapes
Cognitive Domain: Knowing
Benchmark: High
Correct: Ireland: 42% TIMSS: 43%

Although not on the present PSMC, rotation as a geometric transformation was on its predecessor, the 1971 curriculum, but was removed as part of the review of that curriculum. In this regard, 66% of Irish pupils were taught by teachers who reported that the topic of reflections and rotations had not yet been taught or had just been introduced. Reflection is on the PSMC for Fourth class and as a result some teachers may have responded positively to the question on whether or not reflections and rotations had been taught. In fact, the performance of Irish pupils on a question which asked them to draw the

line of symmetry on the picture of a kite (item ID code: M06_08, not shown here) was 74%, compared with an international mean of 47%.

Discussion and conclusions

Overall, Irish performance in mathematics in TIMSS could be said to be satisfactory, with a mean score of 527. This is significantly above the international scale centrepoint of 500 and significantly above the mean for 33 other countries, though significantly less than the mean score for 13 countries, including Northern Ireland (562). Another positive outcome is the significant reduction, since the TIMSS 1995 study, in the number of low achievers who fail to reach the Low Benchmark. Further analysis conducted as part of this chapter highlights more specific strengths and weaknesses of Irish pupils' performance.

In section two, the TIMSS framework and test for Fourth grade were compared with the Irish primary school mathematics curriculum (PSMC) for Fourth class in terms of content and cognitive process domains, with adjustments for differences in classification definitions. This analysis showed that the PSMC for Fourth class closely matched the content and cognitive processes tested by TIMSS 2011. The 13 items (of 175) identified as being on the TIMSS test but not on the PSMC for Fourth class related to the following topics – coordinates, rotational symmetry, volume of cuboids, millimetres, speed, factors and multiples, and ratio and proportion. Though not formally on the PSMC for Fourth class, pupils may have acquired some knowledge of these topics as part of classroom enrichment activities or through out of school experiences (e.g., in games and leisure activities). To check for the effects of performance on TIMSS items not covered in particular country curricula, countries were compared on performance based only on the items common to TIMSS and their own curriculum. Results showed that there was very little change in comparative performance across countries compared with performance when all items were included (Mullis, Martin, Foy, & Arora, 2012). This may be due to a number of factors – the general closeness of the TIMSS framework and test to the curricula of the participating countries (40 out 47 countries indicated that at least 75% of the TIMSS test items matched their country curricula); the large number of items used (175 items, or 184 score points considering items with full and partial credits); and the rotated booklet design which meant that different pupils took different item sets with some overlap across them for scaling purposes.

Section three compared Irish and international average performance at each of the four International Benchmarks in mathematics along with exemplar items for each Benchmark. Results show that the percentage of Irish pupils reaching the Advanced Benchmark (9%) is lower than would be expected from overall Irish performance, more so for girls (8%) than for boys (11%). This relatively poor performance of pupils at the upper end of the proficiency scale is mirrored in PISA mathematics with 15-year-olds (Cosgrove et al., 2005). Despite this, approximately 98% of Irish pupils were taught by teachers who, in responding to the TIMSS Teacher Questionnaire, said they were *very confident* or *somewhat confident* that they could provide challenging tasks to more capable pupils. This finding suggests that primary schools need to do more to challenge more mathematically able pupils, particularly girls, and to highlight this need among teachers and teacher educators.

When Irish performance at each Benchmark is broken down by content and cognitive domains it shows that performance at the four Benchmarks is relatively higher for Number (than for Geometric Shapes and Measures or Data Display), and for Knowing (than for Applying or Reasoning). The TIMSS teacher questionnaire revealed that, on average, Irish pupils have teachers who spend 56% of their time for mathematics on Number, compared with 22% on Geometric Shapes and Measures, 12% on Data Display and 10% on other topics. These data suggest that, despite the findings of the 2004 and 2009 National

Assessments of weaknesses in the content domains of Shape and Space, and Measures, and in the cognitive domain of Applying and Problem-solving, the main focus of the mathematics curriculum in Irish primary schools is on Number, when more time may be needed for teaching Geometric Shapes and Measures and problem-solving situations and strategies. These weaknesses persist to second-level as found in PISA (Cosgrove et al., 2005). These deficiencies were the subject of a recommendation in the recent DES policy document setting out a national strategy for literacy and numeracy (DES, 2011):

> Ensure that the curriculum contains additional guidance for teachers on the approaches to teaching and learning advocated in the curriculum in areas such as estimation, shape and space, measures, the use of cooperative group learning and problem-solving approaches (p. 56).

Analyses of a selection of released items in section four expand on the findings of the previous two sections. Among items in the Number domain Irish pupils scored particularly well on those in the topic area of Fractions and Decimals. In the area of Whole Numbers, consideration might be given to beginning formal work on factors and multiples, and on ratio and proportion, in Third and Fourth classes rather than waiting until Fifth and Sixth classes. TIMSS performance across countries on items relating to these areas suggests pupil readiness for learning these more complex concepts. The TIMSS results also suggest that gender appropriateness of contexts and situations used in teaching these topics should be addressed.

In the Geometric Shapes and Measures domain, the mixed performance of Irish pupils on Coordinates and the high relevance of the topic to everyday life suggest that this topic (and the related topic of describing movement between locations on plans and maps, etc.) should be introduced earlier in the mathematics curriculum. The mixed performance in this topic, and perhaps the "Trading Cards" items, reflects the influence of out of school experience on the learning of mathematics. There is a need to capitalise more on such experience in classroom teaching.

Another topic in this domain where mixed performance by Irish pupils was observed is that of symmetry and transformational geometry. Axial symmetry in the form of reflection is on the PSMC, but rotational symmetry is not. Many countries include both topics in their curriculum – as indicated in responses to the TIMSS Teacher Questionnaire. The PSMC is very specific in setting out what pupils in each grade level should learn. This level of detail and lack of practical contexts for the mathematics to be taught, though it may be beneficial for some aspects of curriculum and teaching, does not encourage teachers to use problem-based teaching in which mathematical concepts may be integrated and developed in applied or practical settings. There is a need for a repository of "good" tasks aligned with high quality professional development to support teachers in moving away from over-reliance on textbook activities. It is worth noting in this regard that approximately two-thirds of TIMSS assessment items are embedded in simple applied contexts.

Though Irish performance in mathematics on TIMSS 2011 at Fourth class can be considered to be satisfactory in general, there are some specific weaknesses which have been highlighted in this chapter. Addressing these weaknesses appropriately may not only help Irish pupils to demonstrate improvement in these areas in TIMSS 2015, but – more importantly – lead to a broader and deeper understanding of mathematics by Irish primary pupils than is currently found.

Additional references

This section does not repeat the core references already listed in Chapter 1. These include the three international reports and the Irish national report on PT 2011 and those related to other key studies such as National Assessments and PISA.

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Chapter 9
Science items: Context and curriculum

Clíona Murphy

Introduction

This chapter examines the science performance of Irish pupils in Trends in Mathematics and Science Study (TIMSS) 2011 at a broad level, and provides an in-depth analysis of performance on a subset of released test items. The TIMSS assessment framework is reviewed in the context of the Primary School Science Curriculum (PSSC) (DES/NCCA, 1999). Unlike reading and mathematics, there are no formal national assessments of primary science in Ireland on which to draw. Thus, the chapter draws on previous performance on TIMSS 1995, and from the OECD's Programme for International Student Assessment (PISA), which assesses the reading, mathematics and science skills of 15-year-olds.

Irish pupils have participated in three international assessments of science achievement (including two at primary level), with mixed results. In the International Assessment of Educational Progress in 1988, Irish children aged 9 and 13 years did not perform as well in science-related activities as pupils from other participating countries, and Irish girls had the lowest average science proficiency of any group involved (Lapointe, Mead, & Phillips, 1989). It was suggested that inadequacies in the 1971 curriculum and Irish teachers' lack of confidence affected Irish pupils' performance (INTO, 1987). In contrast, the Third International Mathematics and Science Study (also called TIMSS) in 1995 revealed that whilst Irish 9-year-olds' overall performance in science was above the international average, Irish pupils did not perform particularly well on Physical Science topics (Martin, Mullis, Beaton, Gonzalez, Smith, & Kelly, 1997).

Since Ireland last took part in TIMSS, the Primary School Curriculum has been revised. Regarding science in particular, the PSSC is an extensive expansion of its precursor, Curaclam na Bunscoile (Department of Education, 1971), which predominantly focused on biology and environmental science and in which Physical Science was only an optional component of the Fifth and Sixth class programmes. In addition to developing pupils' physical and biological content knowledge at all class levels, the PSSC also places considerable emphasis on the application and development of pupils' scientific skills. With the implementation of this revised PSSC since TIMSS 1995, one might expect an improvement in pupils' performance in TIMSS 2011.

At post-primary level, Irish 15-year-old students have performed slightly above the OECD average for science in repeated cycles of PISA (Cosgrove, Shiel, Sofroniou, Zastrutzki, & Shortt, 2005; Eivers, Shiel, & Cunningham, 2008; Perkins, Cosgrove, Moran, & Shiel, 2012; Shiel, Cosgrove, Sofroniou, & Kelly, 2001). The aim of PISA is to assess students' knowledge and skills in three domains: scientific literacy, mathematical literacy and reading literacy. Each year one of these areas is the "major" domain examined and the other two are examined in less depth. Science has been the major domain only once – in 2006. Then, Ireland's average score (508) was significantly higher than the OECD average of 500 and Irish students performed best on *identifying scientific issues* items, where their mean score of 516 was significantly higher than the OECD mean (499) (Eivers et al., 2008). Irish students' mean score (506) on *using scientific evidence* was also significantly higher than the OECD mean (500).

However, Irish students' mean score for *explaining phenomena scientifically* (505) was not significantly above the OECD average score of 500. Ireland's mean scores for *knowledge about science* (513) and *knowledge of Earth and space systems* (508) were also significantly higher than the OECD average scores. Their mean scores for *knowledge of living things* and *physical systems*, although higher than the OECD average scores, were not significantly so (Eivers et al., 2008). While PISA assesses post-primary rather than primary level scientific literacy, similar patterns of relative strengths and weaknesses emerged amongst Irish Fourth class pupils' performance in the cognitive and content domains of TIMSS 2011.

Full details of Irish pupils' performance in TIMSS 2011 are provided in the main national report by Eivers and Clerkin (2012), but, broadly, national science achievement is similar to that reported in TIMSS 1995 and in successive PISA cycles. In TIMSS 2011, Ireland performed slightly above average on the science component. Ireland's mean of 516 was significantly above the study centrepoint of 500, ranking 22nd of 50 participating countries. Seventeen countries achieved mean scores that were significantly higher than Ireland's. Boys and girls in Ireland obtained identical mean scores on the overall science assessment.

In the Irish research literature concerns have been expressed about the teaching and learning of primary science. From a teaching perspective, concerns include: inadequate time being devoted to hands-on inquiry-based approaches to science; teachers' lack of competence and confidence in teaching science; poor scientific content and pedagogical knowledge amongst teachers; and insufficient provision of hands-on pedagogical courses at both pre-service and in-service levels (INTO, 1987; Murphy & Smith, 2012; NCCA, 1990; Varley, Murphy, & Veale, 2008; Waldron et al., 2009). From a learning perspective, concerns include: scientific literacy; attainment in science; and infrequent engagement with inquiry-based approaches to science (DES Inspectorate, 2012; Murphy, Murphy, & Kilfeather, 2011; Murphy, Neil, & Beggs, 2007; Murphy, Varley, & Veale, 2012; Smyth, McCoy & Darmody, 2004; Varley, Murphy, & Veale, 2008, 2011). Some of these concerns and their significance in terms of Irish pupils' performance in TIMSS 2011 will be considered later.

In this chapter, Irish pupils' performance on the TIMSS 2011 science assessment is discussed in detail. The next section, section two, compares the TIMSS 2011 science framework with the content strands from the PSSC and discusses a Test-Curriculum Matching Analysis (TCMA) that was conducted to establish the extent of overlap between the assessment and the Irish curriculum. An overview of International Benchmarks is provided in section three, with illustrative exemplar items. Section four begins with an overview of Irish pupils' performance in the three content domains (Life Science, Physical Science, and Earth Science) in TIMSS 2011. This is followed by a detailed analysis of a number of the released science items in which Irish pupils' performance was deemed unusual or "out of the ordinary'. A number of possible factors which may have affected Irish pupils' performance are also considered. Finally, in section five, a brief overview of developments in primary science in Ireland since TIMSS 1995 is presented and the potential impact of these changes on Irish pupils' performance on TIMSS 2011 is considered. Readers should note that this chapter examines only one element of the TIMSS 2011 data. Those who would like more general information about TIMSS or about Ireland's participation in PIRLS and TIMSS in 2011 are referred to Chapter 1 of this volume (Eivers & Clerkin, 2013).

TIMSS 2011 science framework and the Irish PSSC

This section briefly compares the TIMSS 2011 science framework and the Irish PSSC (DES/NCCA, 1999) for Fourth class.

TIMSS science framework and item specifications

TIMSS 2011 assessed pupils' conceptual scientific knowledge and their application of science skills. Each test item addressed both **content** and **cognitive** domains. The content domain assessed the scientific content (or science subject matter) that is taught in school science and the cognitive domain assessed the different types of behaviours or thinking processes that pupils would be expected to engage with during scientific inquiry.

TIMSS 2011 contained three content domains: Life Science, Physical Science and Earth Science. Life Science examined pupils' knowledge of the processes and characteristics of living things (plants, animals and human life). The Physical Science content domain assessed pupils' knowledge of energy and forces (light, heat, electricity, magnetism, forces and sound) and the properties of matter (physical properties of materials, and materials and change). Finally, the Earth Science content domain assessed pupils' conceptual knowledge of the solar system and their knowledge of Earth's physical characteristics and resources.

There were also three cognitive domains in TIMSS 2011: Knowing, Applying and Reasoning. These required pupils to demonstrate their aptitude for applying different scientific skills including inferring, interpreting, analysing, classifying, reasoning and deduction. Table 9.1 shows the percentages of the assessment allocated to each content and cognitive domain in TIMSS 2011.

Table 9.1: Percentages of items assessing the content and cognitive domains in the TIMSS 2011 Fourth grade science assessment

Content domains	Percentages of items
Life Science	45
Physical Science	35
Earth Science	20
Cognitive domains	
Knowing	40
Applying	40
Reasoning	20

Primary School Science Curriculum (Third and Fourth class)

The revised Primary School Curriculum, introduced in 1999, included science as a compulsory subject on the syllabus for all primary school pupils. The content of the PSSC is largely based on the content and cognitive domains found in TIMSS 1995 and is considerably different to its predecessor, Curaclam na Bunscoile (Department of Education, 1971). The PSSC places considerably more emphasis on the development of scientific content knowledge (in biology, physics and chemistry) and on the development of scientific skills at all class levels. This stands in contrast to Curaclam na Bunscoile in which there was a strong emphasis on biological and environmental science, and where physical sciences were only an optional component of the Fifth and Sixth class curriculum.

There are four content strands in the PSSC: Living Things, Energy and Forces, Materials, and Environmental Awareness and Care. Some elements of Earth Science are not areas of content on the PSSC, but are included on the Primary School Geography

Curriculum (PSGC). Some of these are identified and discussed later in sections three and four of this chapter.

The cognitive aspect of the PSSC has 11 "working scientifically" skills: questioning; observing; predicting; investigating and experimenting; estimating and measuring; analysing; sorting and classifying; recognising patterns; interpreting; recording; and communicating.

Comparing the TIMSS science framework and PSSC

Table 9.2 provides a comparison of the TIMSS science framework and the PSSC (and the geography curriculum, where appropriate). Broadly, Living Things in the PSSC equates to Life Science in TIMSS, and Energy and Forces and Materials equate to the TIMSS content area of Physical Science. The TIMSS content area of Earth Science broadly equates to the Environmental Awareness and Care strands of the geography and science curricula, and to Human Environment and Natural Environment strands in geography. The section of the PSSC entitled *Working Scientifically* outlines skills that Irish pupils are expected to be applying and developing while engaging with the science curriculum. The skills correspond broadly to the Knowing, Applying and Reasoning cognitive domains of TIMSS 2011.

Table 9.2: Comparison of TIMSS 2011 framework and Primary Science and Geography Curricula

<table>
<tr><th>TIMSS 2011 content domains and topic areas</th><th colspan="2">Science curriculum strands and strand units</th></tr>
<tr><td rowspan="2">Life Science
Characteristics and life processes of living things
Life cycles, reproduction, and heredity
Interactions with the environment
Ecosystems
Human health</td><td colspan="2">Living Things
Plant and animals
Human life</td></tr>
<tr><td colspan="2">Environmental Awareness and Care
Environmental awareness
Science and the environment
Caring for the environment</td></tr>
<tr><td>Physical Science
Classification and properties of matter
Sources and effects of energy
Forces and motion</td><td>Energy and Forces
Light
Sound
Heat
Electricity and magnetism
Forces</td><td>Materials
Properties of materials
Materials and change</td></tr>
<tr><td rowspan="3">Earth Science
Earth in the solar system
Earth's structure, physical characteristics, and resources
Earth's processes, cycles, and history</td><td colspan="2">Environmental Awareness and Care
(this strand also appears on the geography curriculum)
Environmental awareness and care
Science and the environment
Caring for the environment</td></tr>
<tr><td colspan="2">Geography curriculum strand and strand units</td></tr>
<tr><td>Human Environments
People living and working in the local area and people living and working in a contrasting part of Ireland</td><td>Natural Environments
The local natural environment
Irish land, rivers and seas
Weather climate and atmosphere
Planet Earth in space</td></tr>
</table>

Test-Curriculum Matching Analysis (TCMA)

To examine the extent to which the set of items (or test questions) used in TIMSS 2011 correspond to objectives from the PSSC, a TCMA was conducted. The 175 items from the TIMSS 2011 science assessment were compared with specific objectives from the Third and Fourth class PSSC, or (where appropriate), the geography curriculum for Third and Fourth class. There is a large degree of overlap between the content of the TIMSS science framework and that of the Irish PSSC. Only six of the 175 TIMSS science items could not be matched with objectives from either the science or geography curricula. In other words, almost all content in the TIMSS science assessment was content that an Irish Fourth class pupil would have been expected to cover in school. One of the six non-matched items was amongst the released items, and is discussed later in section four. On this item, Irish pupils performed close to the international average (25%, compared to a TIMSS average of 28% on this item) despite not studying the topic in school.

International Benchmarks of science performance

As with the mathematics and reading assessments, TIMSS 2011 science is reported on a normally-distributed scale with a centrepoint of 500. Ireland's overall national score (516) was significantly higher than the scale centrepoint. As well as test scores, TIMSS 2011 reports pupil achievement at four key points on a scale, known as International Benchmarks:

- Low International Benchmark (400)
- Intermediate International Benchmark (475)
- High International Benchmark (550)
- Advanced International Benchmark (625)

The science items used in TIMSS were anchored on the scale based on their difficulty. Once the items were placed on the scale they were used to produce descriptions of the knowledge and skills that pupils who scored at each of the four Benchmarks should be able to demonstrate (see the TIMSS methods and procedures website - http://timssandpirls.bc.edu/methods/index.html - for more detail). Table 9.3 provides an overview of the percentage of Irish pupils and the international median percentage reaching each of the four International Benchmarks in TIMSS 2011. The table is cumulative; the 7% of pupils in Ireland who reached the Advanced Benchmark are included in the 35% reaching (at least) the High Benchmark, and so on.

Table 9.3: Percentage of pupils reaching the 2011 International Benchmarks for science, Ireland and international median

	Mean	Percent			
		Advanced	High	Intermediate	Low
Ireland	516	7	35	72	92
International median	500	5	32	72	92

As can be seen, while 92% of Irish pupils reached the Low International Benchmark, only 7% reached the Advanced International Benchmark. Similar proportions of Irish Fourth class children reached the Low and Intermediate Benchmarks as the study median. Relative to the international median values, slightly higher proportions of pupils in Ireland reached the High and Advanced Benchmarks. The percentage of Irish pupils reaching each of the four International Benchmarks for science in 2011 was very similar to Irish pupils' performance in TIMSS 1995. Then, 8%, 36%, 70% and 91% of pupils reached the

Advanced, High, Intermediate and Low Benchmarks (respectively), indicating no significant change in Irish pupils' performance since 1995.

The remainder of this section provides a summary description of the skills exemplifying each International Benchmark, and an example of a test item at that Benchmark. The manner in which some items are presented here are – for reasons of space – slightly different to how they were presented to pupils.

As can be seen from Figure 9.1, most Irish pupils were able to answer Example Item 1 (*sailboat*) correctly, as were most pupils internationally. The question required the pupils to demonstrate basic understanding of forces by selecting, from a list of four, which force caused the boat in the picture to sail. As an example of an item at the Low International Benchmark, it is a particularly easy item. The concept of everyday forces in action is an area that is addressed on the Third and Fourth class curriculum and indeed on the First and Second class science curriculum. Therefore, Irish pupils' familiarity with the topic could have had a positive impact on performance here. However, pupils' high performance on this item could also be as a result of their everyday experiences of wind rather than their actual understanding of the forces of gravity, friction or magnetism.

Figure 9.1: Summary description of the Low International Benchmark, and exemplar item

Low International Benchmark

Show some elementary knowledge of Life, Physical and Earth Sciences

Pupils at this Benchmark are expected to:

- demonstrate an ability to read and interpret simple diagrams, complete simple tables and provide written answers to questions that require basic factual information.
- demonstrate knowledge of some simple facts related to human health, and to the behavioural and physical characteristics of animals.
- demonstrate some basic knowledge of energy and the physical properties of matter.

Example Item 1:

The picture shows a boat sailing. Which force causes the boat to move?

A) Gravity
B) Wind *
C) Friction
D) Magnetism

Item ID: S03_01

Content Domain: Physical Science

Topic Area: Forces and motion

Cognitive Domain: Knowing

Correct: Ireland: 93% TIMSS: 90%

Figure 9.2 outlines a description of the Intermediate International Benchmark. The Example Item (*water, ice and steam*) for this Benchmark requires pupils to show basic knowledge of the temperature of ice, water and steam by ordering them according to temperature from coldest to hottest. As can be seen, Irish pupils' performance was roughly on a par with the TIMSS study average (76% and 73% correct, respectively). This is content that is addressed in the Properties of Materials strand unit of the PSSC and frequently features in Irish primary science textbooks. It is evident that a sizeable percentage of Irish pupils possess good knowledge of the differences in temperature of ice, water and steam. Nonetheless, while Irish performance was above the study average, it is worth noting that in six countries, at least 86% answered correctly – including 90% of pupils in the United States.

Figure 9.2: Summary description of the Intermediate International Benchmark, and exemplar item

Intermediate International Benchmark

Have basic understanding of practical situations in science

Pupils at this Benchmark are expected to:

- identify basic information regarding Life, Physical and Earth Sciences

- show their ability to read and interpret information in pictorial diagrams and to apply scientific knowledge to practical situations.

- know some basic facts about the solar system, and show a basic understanding of the physical characteristics and resources of the Earth.

- show some knowledge of the properties of matter and light, electricity and energy, and forces and motion.

- recognise some basic information related to characteristics of living things, their reproductive and life cycles, and their interactions with the environment, and also to show some understanding of human biology and health.

Example Item 2:

Water, ice and steam all have different temperatures. What is the order from coldest to hottest?

A) Ice, water, steam * B) Ice, steam, water C) Steam, ice, water D) Steam, water, ice

Item ID: S02_06 **Content Domain**: Physical Science

Topic Area: Classification & Properties of Matter **Cognitive Domain**: Knowing

Correct: Ireland: 76% TIMSS 73%

Figure 9.3: Summary description of the High International Benchmark, and exemplar item

High International Benchmark

Apply knowledge and understanding of the sciences to explain phenomena in everyday and abstract contexts

Pupils at this Benchmark are expected to...

- display their ability to compare, contrast and infer in order to reach the High Benchmark

- be able to provide succinct descriptive responses that demonstrate their ability to explain phenomena by combining scientific knowledge with information from everyday and abstract contexts

- show some understanding of plant and animal structure, life processes, life cycles and reproduction, of ecosystems, and of organisms' interactions with their environment, including understanding of human responses to outside conditions and activities.

- demonstrate understanding of some properties of matter, electricity and energy, and magnetic and gravitational forces and motion.

- show some knowledge of the solar system, and of Earth's physical characteristics, processes, and resources.

- demonstrate elementary knowledge and skills related to scientific inquiry.

Example Item 3:

Some animals are very rare. For example, there are very few Siberian Tigers. If the only Siberian tigers left are female, what will most likely happen?

A) The females will find another type of male animals to mate with and produce more Siberian tigers

B) The females will mate with each other and produce more Siberian tigers

C) The females will only be able to produce female Siberian tigers

D) The females will not be able to produce more Siberian tigers and they will die out *

Item ID: S07_02 **Content Domain**: Life Science

Topic Area: Life cycles, Reproduction & Heredity **Cognitive Domain**: Reasoning

Correct: Ireland: 55% TIMSS: 53%

Figure 9.3 outlines a description of the skills associated with the High International Benchmark. Two things are worth noting. First, the list of skills is more detailed than for the preceding International Benchmarks. Second, in addition to the skills listed, a pupil at the High International Benchmark is expected to be able to display those skills listed for the two lower International Benchmarks (similarly, those at Intermediate are expected to display Low International Benchmark skills). As can be seen from Example Item 3 (*Siberian tigers*), the question content is more difficult than examples from the Low and Intermediate Benchmarks. In Ireland, and on average across TIMSS participating countries, just over half of pupils answered this item correctly. In addition to demonstrating their scientific knowledge, Example Item 3 required pupils to combine their knowledge of life cycles and reproduction and to deduce what would happen if only female tigers were left on the planet. The pupils are required to display good reasoning and deduction skills in order to answer this question correctly.

Figure 9.4 outlines a description of the skills associated with the Advanced International Benchmark. Example Item 4 (*circuit diagram*) was considerably more difficult than the sample items from the Low, Intermediate or High Benchmarks. In Ireland, only 22% of pupils, a little below the TIMSS average of 27%, answered this item correctly. It required the pupils to combine their knowledge of simple circuits with an ability to interpret the diagram of the circuit in order to say whether or not the bulb in the circuit would light. In addition, it was a constructed-response item, meaning that pupils had to write a reason explaining their answer. Constructed-response items generally have slightly lower percentages of pupils answering correctly, either because the opportunity to guess is removed, or because pupils are less likely to write an answer than to tick a response option.

Figure 9.4: Summary description of the Advanced International Benchmark, and exemplar item

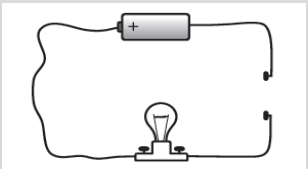
Advanced International Benchmark

Apply knowledge and understanding of scientific processes and relationships and show some knowledge of the process of scientific enquiry

Pupils at this Benchmark are expected to...

- communicate understanding of the characteristics and life processes of organisms, of reproduction and development, ecosystems and organisms' interactions with the environment, and factors relating to human health.
- show an understanding of the properties of light, and relationships among the physical properties of materials.
- apply and communicate their understanding of electricity and energy in practical contexts, and demonstrate an understanding of magnetic and gravitational forces and motion.
- communicate their understanding of the solar system and of Earth's structure, physical characteristics, resources, processes, cycles, and history.
- have a beginning ability to interpret results in the context of a simple experiment, reason and draw conclusions from descriptions and diagrams, and evaluate and support an argument.

Example Item 4:
Gerry connects a battery, a light bulb, and some wire as shown below. Will the bulb light?



A) Yes **B) No***

Explain your answer.

Item ID: S02_08
Content Domain: Physical Science
Topic Area: Sources and effects of energy
Cognitive Domain: Applying
Correct: Ireland: 22% TIMSS: 27%

Item 4 is an unusual item in some regards. While generally difficult, pupils in a cluster of normally low-performing Middle Eastern countries (Bahrain, Oman, Kuwait, Saudi Arabia and Qatar – all of whom offered the test in Arabic) performed above average on this item. In contrast, although generally in the average performance range on TIMSS science, only 7% of pupils in Norway answered correctly.

Analysis of a selection of released items

Out of a total of 175 science items in TIMSS 2011, 72 were released into the public domain in December 2012. Of these 72 items, 30 examined Life Science content, 28 examined Physical Science and the remaining 14 items related to Earth Science content. Amongst the released items there was a representative sample from both content and cognitive domains within each of the International Benchmarks. Accompanying each item was information about the percentage of pupils in each country answering each test item correctly. See http://timssandpirls.bc.edu/timss2011/international-released-items.html for percent correct information for all participating countries or www.erc.ie/pirlstimss for detailed descriptions of how Irish pupils performed (including sample answers) relative to the study average.

For the most part, the TIMSS 2011 participating countries with the highest overall achievement had the highest achievement in all three content domains. However, many countries scored relatively higher or lower than their overall score in one or two content domains (Martin, Mullis, Foy & Stanco, 2012). Ireland was one of only four countries – Finland, Denmark and Romania were the other three – where achievement in each of the three content domains did not differ significantly from overall achievement in science. Irish pupils' overall science mean scale score of 516 was very similar to their mean scale score for Life Science (513), Physical Science (517) and Earth Science (520).

Ireland's overall mean science score was significantly higher than the international centrepoint of 500. Therefore, one would expect that Irish performance on many or most of the test items would generally be slightly higher than the international average. However, Ireland's performance on some items was unusual or "out of the ordinary". An overview of the test items on which Irish pupils' performance was unusually high (defined as at least 10% above the TIMSS international mean) or unusually low (defined as below the TIMSS international mean) is provided in Table 9.4.

Irish pupils achieved a considerably higher percent correct score than the international average percent correct on 17 items, which were evenly spread across the three content domains; six from Physical Science; six from Life Science; and five from the Earth Science domain. Irish participants performed particularly poorly on two items from each of the three content domains. In terms of Benchmarks, of the 17 items on which Irish participants scored very well, six were at the Advanced International Benchmark, five were at the High Benchmark, four were at the Intermediate and two were at the Low Benchmark. With regard to the test items on which Irish participants performed considerably lower than the international average, two items were from the High International Benchmark and four were at the Advanced International Benchmark.

A selection of the 17 items on which Irish participants performed unusually high or low will be considered in the next section. The original versions of the items, as they were presented to pupils, can be viewed on www.erc.ie/pirlstimss, together with examples of correct answers in cases where pupils had to write a response to the question. The item IDs in Table 9.4 indicates the item location within a block of items (e.g., S01_03 is item 3 in block 1). This ID is also shown to the right of each item in their original formats, as presented on www.erc.ie/pirlstimss.

Table 9.4: Items on which Ireland pupils scored unusually higher and unusually lower than the international mean along with the International Benchmark levels

TIMSS content domain *(N total released items)*	Curriculum strand	Unusually high (IRL 10%+ above TIMSS mean)			Unusually low (IRL below TIMSS mean)		
		Item ID	Gap	IBM	Item ID	Gap	IBM
Life Science *(30)*	Living things	S07_07	+13%	Low	S06_02	-19%	High
		S01_03	+15%	Low	S03_04	-10%	Adv
		S05_05	+12%	Inter			
		S02_01	+21%	High			
		S06_03	+13%	High			
		S05_01	+24%	Adv			
Physical Science *(28)*	Energy and forces	S07_06	+14%	Adv	S03_02	-5%	Adv
		S02_07	+16%	Inter			
		S01_07	+16%	Inter			
		S07_09	+10%	High			
		S06_08	+10%	Adv			
	Materials	S07_05	+10%	High	S03_10	-7%	High
Earth Science *(14)*	Natural environments	S03_13	+10%	High	S03_11	-11%	Adv
		S06_12	+10%	Adv	S05_11	-14%	Adv
		S05_03	+13%	Adv			
		S07_10	+17%	Adv			
		S06_10	+14%	Inter			

Life Science

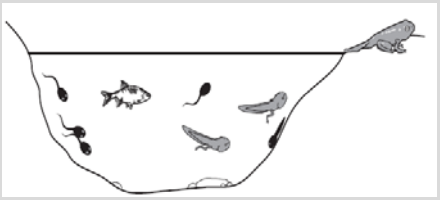
The six test items on which Irish participants performed particularly well in the Life Science domain all related to life cycles, processes and characteristics of animals and human life, and to human health. Figure 9.5 shows three of the six items – Example Items 5 (*tadpoles*), 6 (*wings*), and 7 (*body parts*). On both Item 5 and Item 6, the percent correct obtained by Irish pupils is 12% above the TIMSS study average. The life cycle and characteristics of frogs, butterflies and birds are areas that are frequently taught in the majority of Irish primary schools each year, starting from Junior Infants. They are also topics that feature in many of the Irish primary science textbooks that are commonly used in schools. It would seem possible, therefore, that Ireland's good performance on the two items can be attributed to the frequency in which these topics are taught in schools. Data from the Teacher Questionnaire suggest that only 59% of Irish pupils had been taught the topic of life cycles and reproduction in plants and animals, compared to a study average of 77% of pupils. However, while life cycle and reproduction of *animals* is a topic that is frequently taught in most Irish primary schools, this is not the case for the life cycle and reproduction of *plants*. It would be interesting to see what teachers' responses would have been if this question had been divided into two; one asking about life cycle and reproduction in animals and the second about life cycle and reproduction in plants.

Both Example Items 5 and 6 required pupils to apply basic classification skills and to demonstrate their ability to make inferences. These skills are identified in the PSSC as skills that pupils should be applying and developing while engaging with school science, and it is apparent from Irish pupils' responses to both that they were able to apply these skills in answering these questions.

Figure 9.5: Examples of Life Science items on which Irish pupils performed well

Example Item 5:
Melissa found some tadpoles and fish in a pond as shown above. How did the tadpoles get there?

a) They hatched from eggs laid by fish in the pond
b) They formed from mud at the bottom of the pond
c) They were made from materials dissolved in pond water
d) They developed from eggs laid by frogs in the pond *



Item ID: S05_05 **Content Domain**: Life Science
Topic Area: Life cycles, reproduction & heredity **Cognitive Domain**: Applying
Location PSSC: *Strand*: Living Things. *Strand Unit*: Plants and Animals.
Benchmark: Intermediate
Correct: Ireland: 88% TIMSS: 76%

Example Item 6:
What do birds, bats and butterflies have in common?
a) Feathers b) Hair c) Internal skeleton d) **Wings***

Item ID: S01_03 **Content Domain**: Life Science
Topic Area: Characteristics & life processes of living things **Cognitive Domain**: Applying
Location PSSC: *Strand:* Living Things. *Strand Unit:* Plants and Animals
Benchmark: Low
Correct: Ireland: 95% TIMSS: 83%

Example Item 7:
The table shows three functions carried out by parts of the human body. Write the name of the body part beside its function.

The first one has been done for you.

Function	Body Part
Supports the body	Skeleton [pre-filled]
Pumps blood through the body	*Heart*
Used for thinking	*Brain*

Item ID: S02_01 **Content Domain**: Life Science
Topic Area: Characteristics & life processes of living things **Cognitive Domain**: Knowing
Location PSSC: *Strand:* Living Things. *Strand Unit:* Human Life.
Benchmark: High
Correct: Ireland: 70% TIMSS: 50%
(Credit: **Both** heart and brain named correctly)

Example Item 7 (*body parts*) also relates to the topic area of characteristics and life processes of living things, but assesses the cognitive dimension of Knowing. It is an item classified as at the High International Benchmark. Irish pupils performed very well on the item (70% correct, higher than the international average by a margin of 20%). This can be contrasted with Irish performance on similar items in TIMSS 1995. Then, Irish pupils were slightly above the study average on a question about the human skull and slightly below average on a question about heart functions. Some of the relative improvement in Irish performance might be attributable to elements of the PSSC. A recently published review of the implementation of the PSSC found that pupils demonstrated a relative strength on tasks relating to the strand unit Human Life (DES Inspectorate, 2012). The Inspectorate report suggested that one reason for key concepts in this strand unit being reinforced effectively may be due to the fact that Myself / Human Life is also a strand in the Social, Personal and Health Education element of the Irish curriculum.

The variety, characteristics and processes of humans and animals are included amongst the content objectives in the Living Things strand of the PSSC for all class levels. Similar content was also included in the previous Curaclam na Bunscoile. These are not areas in which Irish teachers report concerns (NCCA, 2008; Murphy & Smith, 2012) and are aspects of the science curriculum in which the pupils report positive attitudes towards and with which they frequently engage (Varley et al., 2008). The functions of the human body and human health are also topics that are addressed in virtually all of the Fourth class primary science textbooks that are currently being used in Irish schools. This would seem to explain Irish pupils' good performance on these items.

Irish pupils performed below the TIMSS average on two items from the Life Science content area (Figure 9.6). The topics for Example Item 8 (*plants use energy*) and Item 9 (*parts of a plant*) are both related to plant processes and structures. The cognitive domain for both items is Knowing. They are classified as at the Intermediate and Advanced International Benchmarks, respectively.

Figure 9.6: Examples of Life Science items on which Irish pupils performed poorly

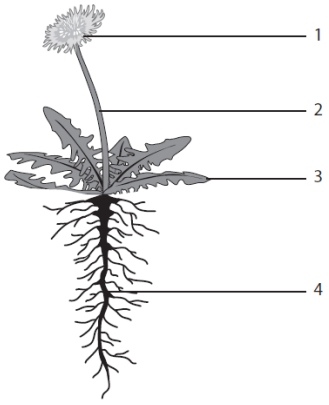
Example Item 8:
Plants use energy directly from the sun. What do they use the energy from the sun for?

A) **To make food*** B) To disperse seeds C) To fertilise the soil D) To prevent insect damage

Item ID: S06_02 **Content Domain**: Life Science
Topic Area: Ecosystems **Cognitive Domain**: Knowing
Location PSSC: *Strand*: Living Things. *Strand Unit*: Plants.
Benchmark: Intermediate
Correct: Ireland: 30% TIMSS: 51%

Example Item 9:
The diagram shows a flowering plant. Four of its parts are numbered. In the table below, write the name of each part, and state its function.

Part	Name	Function
1	*Flower / seeds / petals*	**[e.g.]** *attracts insects to pollinate*
2	*Stem / stalk*	**[e.g.]** *transports water*
3	*Leaves*	**[e.g.]** *makes food for the plant*
4	*Roots*	**[e.g.]** *anchors the plant*



Item ID: S03_04 **Content Domain:** Life Science
Topic Area: Characteristics & life processes of living things
Cognitive Domain: Knowing
Location PSSC: *Strand:* Living Things. *Strand Unit:* Plants.
Benchmark: Advanced
Full credit: Ireland: 10% TIMSS: 21%
At least partial credit: Ireland: 46% TIMSS: 52%

Full credit: Name 4 parts AND 3+ functions. Partial credit: Name 2+ parts AND 1+ functions.
No credit was given for naming the parts correctly without any functions.

In TIMSS 1995, Irish pupils also performed poorly on a similar item relating to the functions of different parts of a flowering plant. Then, 22% of Irish pupils answered correctly, less than half the international average (46%). However, plant structures and processes are areas of content that are included in the 1999 PSSC and were included in the

1971 Curaclam na Bunscoile, suggesting that lack of curriculum coverage does not explain poor performance. Further, these are not areas of curriculum content on which teachers report concerns (NCCA, 2008), and are areas about which Irish pupils hold positive attitudes (Varley et al., 2008).

In relation to TIMSS 2011, to complete Example Item 9 (*parts of a plant*) is quite a complex procedure. Pupils were required to fill in the names of four parts of the plant, and to provide one function for each part. Essentially, that meant the pupil had to retrieve eight pieces of information. This may be one reason why the overall international performance on this item was low – the level of work involved to respond, rather than the complexity of the item content. The percentage of Irish pupils obtaining partial credit for their answers was 46%, 8% lower than the international average. However, a considerably lower percentage (10%) of Irish pupils was awarded full credit for their responses than was the average across all TIMSS countries (21%). Also of note is the fact that a number of generally low-performing countries scored well above average on this item (e.g., Thailand and Bahrain) while some of the overall, very high-performing countries were below average (e.g., only 20% of pupils in Japan and 16% in Hong Kong SAR obtained full credit).

Another explanation for Irish pupils' poor performance on this item perhaps could be due to teaching methodologies. The Inspectorate's evaluation of the implementation of the PSSC for example, found that Irish pupils' weakest performance was on tasks relating to plant and animal life, and suggested that there was evidence that teachers did not understand fully how to implement a scientific approach to the study of plant and animal life and were not sufficiently familiar with the objectives and suggested methodologies underpinning this strand unit in the PSSC (DES Inspectorate, 2012).

Physical Science

Irish pupils performed particularly well on six of the test items in the Physical Science domain and performed particularly poorly on two. Of the six on which Irish pupils performed unusually well, two related to the strand unit Light, one to Electricity, two to Forces, and one to the Properties (and characteristics) of Materials.

Light

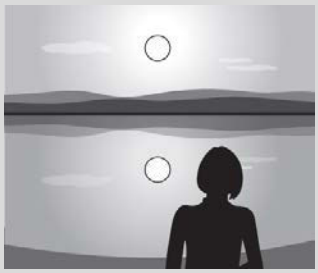
The first of the two items on light (Example Item 10 [*Alice's sunrise*]) tested pupils' knowledge regarding how the moon reflects the light from the sun (Figure 9.7). The second, Example Item 11 (*sunlight contains different colours*) assessed their knowledge of how sunlight is made up of seven different colours. Both of these concepts are included on the PSSC for Fourth class, under the strand unit Light, in the Energy and Forces strand. Most Irish pupils (77%) were taught by teachers who indicated that the topic of light had been taught prior to taking TIMSS 2011, noticeably higher than the 61% of pupils across all TIMSS countries. Further, 62% of Irish pupils were taught by teachers who reported being *very well prepared* to teach the topic, compared to a TIMSS average of 50% of pupils.

Irish pupils performed very well on Items 10 and 11. For *Alice's sunrise,* 91% answered correctly, while 52% were able to name something that showed sunlight is composed of different colours – both percentages were considerably higher than the international average. On a similar type of item relating to light reflection in TIMSS 1995, Irish pupils displayed only an average performance. Irish pupils' possibly improved relative position on understanding of light and reflection might be attributable to the better coverage of Physical Science in the PSSC, relative to Curaclam na Bunscoile.

Figure 9.7: Examples of Physical Science items related to Light

Example Item 10:
Alice watches a sunrise from across a calm lake. She sees a sun in the sky and a sun in the lake as shown below. Why does Alice see a sun in the lake?

a) The sunlight warms that part of the lake
b) The sky spreads sunlight over the lake
c) The sunlight reflects off the lake water *
d) Clouds reflect sunlight into the lake



Item ID: S02_07 **Content Domain:** Physical Science
Topic Area: Source and effects of energy **Cognitive Domain:** Applying
Location PSSC: *Strand*: Energy and Forces. *Strand Unit*: Light.
Benchmark: Intermediate
Correct: Ireland: 91% (girls 93% boys 88%) TIMSS: 76% (girls 75% boys 75%)

Example Item 11:
Name one thing you have seen that shows that sunlight is made up of different colours.

[e.g.] rainbow / prism / soap bubbles / sunrise

Item ID: S07_06 **Content Domain:** Physical Science
Topic Area: Source and effects of energy **Cognitive Domain:** Applying
Location in PSSC: *Strand*: Energy and Forces. *Strand Unit*: Light.
Benchmark: Advanced
Correct: Ireland: 52% TIMSS: 38%
(Credit given for providing a specific, valid example)

Example Item 12:
Which two objects produce their own light?

A) Candle and moon B) Moon and mirror **C) Sun and candle *** D) Mirror and sun

Item ID: S03_02 **Content Domain:** Physical Science
Topic Area: Sources and effects of energy **Cognitive Domain:** Applying
Location in PSSC: *Strand:* Energy and Forces*. Strand Unit:* Light.
Benchmark: Advanced
Correct: Ireland: 45% (girls 36% boys 55%) TIMSS: 50% (girls 46% boys 52%)

In contrast, Irish pupils, particularly girls, did not perform well on Example Item 12 (*Which two objects*). This is an Advanced Benchmark item requiring pupils to draw on their knowledge of sources of light to identify familiar everyday objects that produce their own light. In TIMSS 1995, Irish pupils also performed marginally below the international average on an item relating to identifying objects as sources of light. This suggests that despite the introduction of the PSSC, a sizeable percentage of Irish pupils – and almost two-thirds of Irish girls – remain unable to identify sources of light from a list of familiar objects. While acknowledging that, like many adults, pupils often confuse objects that reflect light with objects that produce light, Irish girls' poor performance on this item is a little worrying, in particular as this concept is meant to be addressed on both First and Second class and Third and Fourth class science curricula. Therefore, all Irish pupils who took part in TIMSS 2011 should have basic familiarity with the underlying concept.

A possible partial explanation might be the terminology used, rather than the content of the question. Pupils may have had some difficulty interpreting the word "produce" in the context of light, and if the question had been reworded to "which of these items are sources

of light", it is possible that performance may have been higher. Another explanation may relate to misconceptions held by the teachers themselves. The Inspectorate's evaluation of the implementation of the PSSC found that the strand with which Irish pupils are encountering most difficulty is Energy and Forces, and the strand unit relating to light, and recommended that additional professional development support was required (DES Inspectorate, 2012). Many research studies have highlighted concerns regarding primary teachers' understanding of key science topics, and show that many primary teachers' ideas regarding science are very similar to the "misconceptions" or "alternative conceptions" commonly recognised in children (Driver, 1983; Harlen & Holroyd, 1997; Jarvis & Pell, 2004). One commonly held "alternative conception" is confusing objects that are reflectors of light with objects that are sources of or produce their own light. As part of TIMSS 2011, teachers were asked about their formal education. On average, 37% of pupils were taught science by a teacher who reported a major in either primary education and science, or a major in science but not primary education, compared to 12% of pupils in Ireland. It may therefore be the case that teachers without requisite subject knowledge of this aspect of light find it difficult to teach it effectively to pupils.

Indeed, the recent DES Inspectorate evaluation of the implementation of the PSSC found that the strand in which Irish pupils are encountering most difficulty is Energy and Forces and that only 51% of the pupils assessed successfully completed tasks relating to the strand unit Light (DES, 2012). The report recommended that additional professional development support, focusing particularly on the strand Energy and Forces, was required. Energy and Forces content from PSSC falls into the Physical Science content domain in TIMSS. It is worth noting that the percentage of Irish pupils whose teachers reported being *very well prepared* to teach Physical Science content (60%) was just below the TIMSS average (62%).

Forces

Irish pupils performed well on Example Item 13 (*object falls to ground*) which required them to apply their knowledge of gravity acting on falling objects to explain what happens when a ball is dropped, a familiar everyday context. Although classified as a High Benchmark item, 71% of pupils in Ireland (and in Northern Ireland) correctly selected gravity as the answer, compared to a TIMSS average of 61% (Figure 9.8).

Figure 9.8: Example of Physical Science item related to Forces

Example Item 13:
What causes an object to fall to the ground when you let it drop from your hand?

A) Magnetism **B) Gravity *** C) Air resistance D) The push from your hand

Item ID: S07_09 **Content Domain:** Physical Science
Topic Area: Forces and motion **Cognitive Domain:** Applying
Location in PSSC: *Strand:* Materials. *Strand Unit:* Forces.
Benchmark: High
Correct: Ireland: 71% TIMSS: 61%

A majority of Irish pupils (73%) had been taught by teachers who reported that they had already covered the topic of forces in science lessons, compared to only 46%, internationally. In addition, 92% of Irish pupils were taught by teachers who indicated that they felt either *very well prepared* or *somewhat prepared* to teach about forces that cause objects to move, perhaps partly because a strong emphasis is placed on this concept in pre-service and in-service programmes.

Electricity

Example Item 14 (*uses of electricity*) addressed scientific content that is included in the electricity strand unit of the PSSC. A far higher percent of pupils answered this item correctly in Ireland than in most other countries. Three-quarters (76%) of pupils in Ireland obtained full credit on this item (TIMSS average: 57%) while 90% obtained at least partial credit (Figure 9.9). One might question whether Irish pupils' good performance on this item is attributable solely to science lessons in school, or whether it is more to do with everyday experience with electrical appliances. However, a number of reasons could strengthen the argument for the positive effect of school science on achievement.

Figure 9.9: Example of Physical Science item related to Electricity

Example Item 14:
Name two things electricity can be used for in daily life.

[e.g.] *For light bulbs / Television / phones*

Item ID: S01_07 **Content Domain:** Physical Science
Topic Area: Sources and effects of energy **Cognitive Domain:** Knowing
Location in PSSC: *Strand:* Energy and Forces. *Strand Unit:* Electricity and Magnetism.
Benchmark: Intermediate
Full credit: Ireland: 76% TIMSS: 57%
At least partial credit: Ireland: 90% TIMSS: 75%
(Full credit: **Two** correct examples. Partial credit: **One** correct example).

First, based on teacher reports, 67% of Irish pupils had participated in lessons on electricity compared to an average of only 51% across all countries. Second, prior to the formal implementation of the PSSC in 2003, teachers were provided with two days of related in-service, of which electricity was a significant element, and it is an area that is addressed on all initial teacher education science programmes in the Republic of Ireland. These pre-service and in-service workshops may have had a positive effect on teachers' competence and confidence in implementing this strand unit of the curriculum.

Finally, as with most aspects of academic achievement, there is a positive correlation between pupils' attitudes towards science and achievement in science (Hattie, 2009). A national survey on Irish pupils' experiences and attitudes towards the 1999 curriculum revealed that almost 60% of the pupils surveyed displayed positive attitudes towards learning about electricity in school (Varley et al., 2008), perhaps suggesting that Irish pupils' own positive attitudes towards learning about electricity may have had a positive impact on their performance.

Properties of Materials

Figure 9.10 shows two items related to the Properties of Materials, on which Irish pupils displayed contrasting performance. On Example Item 15 (*metal and wooden spoons*), Irish pupils performed relatively well (65% correct compared to a TIMSS average of 56%), while on Item 16 (*tables describing materials*) they performed relatively poorly (40% correct compared to a TIMSS average of 47% correct). To answer Item 15, pupils had to use their knowledge about the conduction of heat to infer why the metal spoon would feel hotter than the wooden spoon. Materials that are good conductors of heat is a topic that is covered in the PSSC, and it is included as a topic in many of the Fourth class textbooks currently used in Irish primary schools. Thus, it is not surprising that teacher reports suggest that most (70%) Irish pupils had been taught about the states of matter prior to participating in TIMSS.

Example Item 16 (*tables describing materials*) required pupils to deduce, from a list of properties, that the two materials being described were iron and sugar. Irish girls in particular did not perform well on this item, which assesses pupils' scientific reasoning skills. Irish pupils' poor performance on this item is of concern – materials that are attracted to magnets, solids, liquids and gases, and dissolving are all aspects of the PSSC which the children should have encountered prior to taking TIMSS 2011. Materials that are attracted to magnets is a concept that is addressed from Junior Infants, so one might expect that Fourth class pupils should be able to identify such materials. With regard to states of matter, changes in materials and forming mixtures concepts, teacher reports suggest that most Irish pupils should have encountered most of the topics during science lessons. Again, however, so too had pupils in most other countries.

Figure 9.10: Examples of Physical Science items related to the Properties of Materials

Example Item 15:
A metal spoon and a wooden spoon are used to stir a pot of hot soup. After a few minutes, the metal spoon feels hotter than the wooden spoon. What explains this?

A) Metal is always hotter than wood
B) Metal conducts heat better than wood *
C) Metal conducts electricity better than wood
D) Metal heats up the water better than the wood

Item ID: S07_05 **Content Domain:** Physical Science
Topic Area: Sources and effects of energy **Cognitive Domain:** Applying
Location in PSSC: *Strand:* Energy and Forces. *Strand Unit:* Heat.
Benchmark: High
Correct: Ireland: 65% TIMSS: 56%

Example Item 16:
The table below shows the properties of two materials.

Properties of Material 1	Properties of Material 2
Conducts heat quickly	Conducts heat slowly
Solid	Solid
Does not dissolve in water	Dissolves in water
Attracted to magnets	Not attracted by magnets

Which statement about materials 1 and 2 is most likely to be correct?

A) Material 1 is glass and material 2 is clay
B) Material 1 is copper and material 2 is wood
C) Material 1 is iron and material 2 is sugar *
D) Material 1 is cork and material 2 is gold

Item ID: S03_10 **Content Domain:** Physical Science
Topic Area: Classification & Properties of Matter **Cognitive Domain:** Reasoning
Location in PSSC: *Strand:* Materials. *Strand Unit:* Properties of Materials.
Benchmark: High
Correct : Ireland: 40% (girls 38% boys 41%) TIMSS: 47% (girls 47% boys 47%)

It is possible that part of the item difficulty arises, not from the scientific knowledge being assessed, but from the complex and slightly unusual item layout. Pupils had to focus on a number of variables at the one time in order to answer the question correctly. It would be interesting to establish whether improved performance would result from a restructuring of this question – for example, first identifying iron, and then identifying sugar in a separate

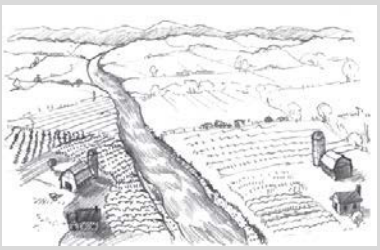
question. This would not necessarily improve Irish pupils' score relative to the TIMSS average, but it might lead to a general increase in the percentage of pupils able to answer correctly.

Earth Science

Eighteen Earth Science items were released after TIMSS 2011, of which three are discussed here. All three contain content included in the geography curriculum, but Example Item 18 (*avoid water wastage*) is also included in the PSSC under the strand Environmental Awareness and Care. Figure 9.11 shows two items on which Irish performance was considerably better than the TIMSS average. Example Item 17 (*farming on a plain*) shows a picture of a river flowing through a wide plain and asks pupils to provide one advantage and one disadvantage of farming in such a location, with scores allocated separately for each. The easy availability of water or reference to good quality soil were among the responses considered appropriate "advantages", and 51% of Irish pupils listed an appropriate advantage, higher than the TIMSS average of 42% of pupils. Almost half (46%) of Irish pupils were able to write a disadvantage (e.g., risk of flooding, or polluted water) – much higher than the 34% internationally who were able to do so.

Figure 9.11: Examples of Earth Science items on which Irish pupils performed well

Example Item 17:
The picture below shows a river flowing across a plain. Farming is carried out on the plain and near the river. There are advantages and disadvantages to farming along a river.



A) Describe one advantage
[e.g.] *They can water their crops easily*
B) Describe one disadvantage
[e.g.] *The river could flood*

Item ID: S03_13 **Content Domain:** Life Science
Topic Area: Earth's structure, physical characteristics & resources **Cognitive Domain:** Applying
Location in PSGC: *Strand*: Natural Environments. *Strand Unit*: The Local Natural Environment.
Benchmark: High
Part A Correct: Ireland: 51% TIMSS: 42%
Part B Correct: Ireland: 46% TIMSS: 34%
(Credit given separately for each part)

Example Item 18:
There is a shortage of fresh water in many parts of the world. Describe two things people can do to avoid wasting water.
[e.g.] *Turn off the taps when you're not using them. / Don't pollute the rivers.*

Item ID: S05_3 **Content Domain:** Earth Science
Topic Area: Earth's structure, physical characteristics & resources **Cognitive Domain:** Applying
Location in PSSC (& PSGC): *Strand:* Environmental Awareness and Care. *Strand Unit:* Caring for the Environment.
Benchmark: Advanced
Full credit: Ireland: 41% TIMSS: 27%
At least partial credit: Ireland: 76% TIMSS: 56%
(Full credit: **Two** correct suggestions. Partial credit: **One** correct suggestion)

The content for Item 17 is addressed in the primary geography curriculum and frequently features in primary geography textbooks for Third and Fourth classes. A higher than average percentage of Irish pupils had been taught about common features of Earth's landscape (e.g., rivers) and relationship to human use (e.g., farming) (85%, compared with a

TIMSS average of 64%). In addition, 73% of Irish pupils were taught by teachers who felt *very well prepared* to teach this aspect of Earth Science, higher than the international average of 58%. Pupils should therefore have been comparatively well prepared for this item. Two other non-school factors may also be relevant. Half (48%) of Irish Fourth class pupils lived in a small town, village, or a remote rural area, compared to a TIMSS average of 38%. As such, direct or indirect experiences of farming practices are more likely to be more common for Irish pupils. Second, pupils in countries such as Ireland with plenty of arable land, rivers, and rainfall might be considered to have a significant advantage over pupils living in arid landscapes when answering this item.

Example Item 18 (*avoid water wastage*), assessed pupils' knowledge of the Earth's structure, physical characteristics, and resources, broadly similar to the PSSC and PSGC strand of Environmental Awareness and Care. Pupils were required to identify two things people can do to avoid wasting water. Over three-quarters (76%) of Irish pupils obtained at least partial credit on this item and 41% obtained full credit (well above the comparable TIMSS averages of 56% and 27%, respectively). Thus, Item 18 offers some support for the Inspectorate's finding that the Environmental Awareness and Care strand was one of two strands on which pupils performed best (DES Inspectorate, 2012).

An objective in the PSSC and PSGC is that children should come to appreciate the need to conserve resources, and the topic is addressed in both science and geography curriculum methodology courses in initial teacher education throughout Ireland. However, it is also likely that it is covered in primary science curricula in most or all TIMSS countries. One reason for Irish participants' higher than average performance on this item may be the education programme from the Sustainable Energy Authority of Ireland (SEAI), which delivers over 740 workshops each year and reaches up to 22,000 5- to 18-year-olds throughout Ireland. The programme engages pupils on the benefits of energy efficiency and renewable energy. Ways of reducing water consumption and avoiding waste of water are areas that are also included in the programme. The additional engagement with this content through the SEAI schools' programme may have been a contributing factor to Irish participants' particularly high performance on this item.

In contrast, Example Item 19 (*Earth rotation*) is an item on which Irish performance is slightly below average (42% correct, compared to a TIMSS average of 53%) (Figure 9.12). The item is part of the TIMSS topic area Earth and the solar system, and is covered in the Irish geography curriculum under the Planet Earth in Space strand unit. It is an item at the Advanced International Benchmark and assesses the cognitive domain of Knowing.

Figure 9.12: Example of an Earth Science item on which Irish pupils performed poorly

Example Item 19:
How often does the Earth rotate on its axis?

A) Once every 12 hours
B) Once every 24 hours *
C) Once every month
D) Once every year

Item ID: S03_11 **Content Domain:** Earth Science
Topic Area: Earth and the solar system **Cognitive Domain:** Knowing
Location in PSGC: *Strand:* Natural Environments*. Strand Unit:* Planet Earth in Space.
Benchmark: Advanced
Correct: Ireland: 42% TIMSS: 53%

The relatively poor Irish performance cannot be attributed to lack of exposure to the topic. While teacher reports indicate that an average of 36% of pupils in TIMSS had not yet been taught about the Earth's solar system, this was true of only 23% pupils in Ireland. Also, 69% of the Irish pupils were taught by teachers who felt *very well prepared* to teach the topic, considerably higher than the international average (55%). A possible explanation is that the solar system is not generally an area that is addressed as part of initial teacher education in the Republic of Ireland. So, although teachers report feeling confident about teaching this aspect of Earth Science, it may be the case that they do not have the requisite pedagogical knowledge.

Discussion and conclusions

As noted earlier, there are no national assessments in primary science in Ireland, and Irish primary pupils have not taken part in any international assessments in science since TIMSS 1995. Since TIMSS 1995, a substantially revised Primary School Science Curriculum (PSSC) has been developed and implemented in Irish schools. The content in the PSSC is largely based on the content and the cognitive domains from TIMSS 1995 and places equal importance on both scientific knowledge and skills development. The PSSC has been formally implemented in Irish primary schools since 2003. Therefore, the Irish pupils who took TIMSS 2011would have been engaging with the PSSC since they started school. While the overall performance of Irish Fourth class primary pupils in TIMSS 2011 is above the international average, it is very similar to their performance in TIMSS 1995, when they had been studying the old (1971) Curaclam na Bunscoile. Broadly, in TIMSS 2011 Irish pupils performed well in Life Science (plant structures and processes aside) and Earth Science topics but did not perform as well in Physical Science topics. In terms of the cognitive domains, Irish pupils did not always display good reasoning skills.

It would appear, therefore, that the PSSC may not be having as big an impact on Irish pupils' achievement as one might have anticipated. Two factors that may have impeded Irish pupils' performance in TIMSS 2011 could have been related to the amount of instructional time that is currently being allocated to science within the primary curriculum and teachers' pedagogical competency. These will be considered in turn.

Instructional time

The TCMA revealed a large degree of overlap between the content of the TIMSS science framework and that of the Irish PSSC, so the actual content of TIMSS should not have been a factor that affected Irish pupils' overall performance. However, the amount of instructional time allocated to science in the Primary School Curriculum in Ireland may have been an issue. As is outlined in Chapter 2 of this volume (Lewis & Archer, 2013), the 4% of instruction time devoted to science in Irish primary schools is far lower than the norm in most countries. With the exception of Austria, no other country that took part in TIMSS 2011 allocated proportionally less time to science than Ireland. Not only is the percentage allocated atypical, but so too the amount of hours allocated. Based on teacher reports, teachers in Ireland spend 63 hours per year teaching science, well below the TIMSS average of 85 hours (Martin et al., 2012).

It is difficult to establish the precise relationship between instructional time and pupil achievement, as many factors influence effective instruction. These factors include quality of curriculum content and quality of approaches to teaching. However, the amount of instructional time devoted to a subject is important and has an impact on achievement (Lavy, 2010; Martin et al., 2012). Therefore, one obvious step towards increasing levels of scientific literacy amongst our primary school pupils is to increase the amount of time allocated to the teaching of science in Irish primary schools.

Developing competency in teaching science

Increasing time allocation for science in schools alone is unlikely to suffice. Additional supports in terms of continuing professional development (CPD) and initial teacher education programmes in developing teachers' competency in teaching science may also be required.

Professional development

Data gathered from Irish primary teachers in TIMSS 2011 suggest that, overall, the percentage of Irish pupils taught by teachers that reported feeling *very well prepared* to teach TIMSS science topics (63%) was similar to the international average (62%). However, when the different content domains were examined, the percentages of Irish pupils with teachers who felt *very well prepared* to teach Life Science topics and Physical Science topics were lower than the TIMSS averages, while the percentage with teachers *very well prepared* to teach Earth Science was higher than the TIMSS average (Table 9.5).

Table 9.5: Percentages of teachers who felt *very well prepared* to teach TIMSS science topics

	Overall	Life Science	Physical Science	Earth Science
Ireland	63	65	60	63
TIMSS	62	70	62	53

Irish studies have highlighted primary teachers' concerns regarding their perceived lack of pedagogical and conceptual knowledge of science (Murphy & Smith 2012; Smith 2012; Waldron et al., 2009; NCCA, 2008; Varley et al., 2008). A recent DES Inspectorate study found evidence that many teachers did not appear to have a thorough understanding of how to implement a more inquiry-based scientific approach towards studying plant and animal life and recommended the need for teachers to become more familiar with the objectives of and approaches underpinning the PSSC (DES Inspectorate, 2012). Prior to the formal implementation of the PSSC in 2003, Irish primary teachers received only two days' in-service training to support them in implementing the revised science curriculum. All teachers, regardless of their level of knowledge or experience, participated in workshops with similar content. Since then, no compulsory professional development in science has been provided to teachers by the DES. In TIMSS 2011, the percentage of Irish pupils who had been taught by teachers who had taken professional development courses in the two years prior to the assessment was, in all five areas examined, considerably lower than the international average (Table 9.6) (see also Clerkin, 2013).

Table 9.6: Percentages of pupils taught by teachers who had undertaken various forms of professional development in the two years prior to PT 2011

	Science Content	Science Pedagogy / Instruction	Science Curriculum	Integrating IT into Science	Science Assessment
Ireland	23	16	24	17	9
TIMSS	35	34	34	28	27

Indeed, the Irish Council for Science, Technology and Innovation (2005) indicated that professional development for Irish primary teachers is not as advanced as that in other countries. Smith (2012) argues that it is time therefore to develop professional development programmes that move away from the "once-off", "one size fits all" models of in-service towards a more long-term in-depth approach that would provide teachers with the necessary subject and pedagogical knowledge to support their pupils in genuine engagement with all

aspects of the science curriculum. Pedagogy in the content and cognitive domains on which Irish pupils consistently perform poorly, for example the strand unit Plants and Animals, the strand Energy and Forces, and the application and development of the Working Scientifically and Design and Make skills, are areas that should be addressed by these CPD programmes.

Data collected as part of TIMSS 2011 indicate that the vast majority (81%) of Irish pupils were taught by teachers who had a major in primary education but no specialism in science. It is quite possible therefore that despite indicating that they felt competent about teaching science topics, perhaps many of these teachers did not have the requisite knowledge and skills to facilitate the successful implementation of the PSSC. Recent research has found that professional development focusing on scientific content has a significant positive effect on pupil achievement (Blank & de las Alas, 2009; Jarvis & Pell, 2004). It would seem important therefore, that future CPD programmes should also provide opportunities for teachers to develop their own scientific content knowledge.

Initial teacher education

Just over half (54%) of the Irish children who participated in TIMSS 2011 were taught by teachers who had been teaching for less than 10 years. These teachers would not have attended the two science in-service days that were provided by the DES in 2003. However, during their undergraduate degree programmes, they would have taken compulsory curriculum science methodology courses aimed at developing their pedagogical knowledge of science. The amount of time allocated for these courses within the three year B.Ed. degree varied considerably from college to college (ranging from 12 to 40 hours over the course of the entire degree) (Waldron et al., 2009). It is difficult to see how student teachers could develop adequate conceptual and pedagogical knowledge of science solely from the small amount of time devoted to science education on their degree programmes. Murphy and Smith (2012) found that, while there was an increase in student teachers' scientific content knowledge at the end of a 40-hour curriculum science methodology course, high percentages of student teachers still revealed inaccurate conceptions within the science disciplines. It is questionable whether student teachers whose only exposure to science pedagogy was through these short initial teacher education courses would have the requisite knowledge to facilitate successful implementation of the PSSC.

Since September 2012, all Bachelor of Education degree programmes in the Republic of Ireland have moved from a three- to a four-year programme. Additional time has been allocated for science pedagogy courses in all four-year B.Ed. programmes. However, as mentioned above, research has indicated that many pre-service primary teachers leave their initial teacher education with scientific misconceptions. This indicates that, in addition to courses in science pedagogy, initial teacher education programmes should offer courses that will support student teachers' *conceptual learning* in science. In one of the four-year B.Ed. programmes a new four-year subject specialism in science education has been developed and is being offered to B.Ed. students. The development of students' scientific conceptual knowledge is one area that is being addressed within this subject specialism. It will be interesting to see whether the increased time being allocated to science and science pedagogy within the undergraduate B.Ed. programmes will have a significant impact on the teaching and learning of primary science.

To conclude, while Irish pupils performed above the international average in TIMSS 2011, their performance was similar to that of TIMSS 1995, despite the introduction of the PSSC. If Ireland's performance in future assessments is to be improved, and more importantly, if Ireland is to develop scientific knowledge among primary school pupils, additional professional development, improved initial teacher education and additional allocation of time for teaching science in primary schools are required.

Additional References

This section does not repeat the core references already listed in Chapter 1. These include the three international reports and the Irish national report on PT 2011 and those related to other key studies such as National Assessments and PISA.

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Chapter 10
Understanding achievement in PIRLS and TIMSS 2011

Jude Cosgrove and Ann-Marie Creaven

Introduction

The achievement results from PIRLS and TIMSS 2011 (PT 2011) (Eivers & Clerkin, 2012; Martin, Mullis, Foy, & Stanco, 2012; Mullis, Martin, Foy, & Arora, 2012; Mullis, Martin, Foy, & Drucker, 2012) show that there are large differences within countries between the scores of individual pupils, and also that performance varies across the three domains (reading, mathematics and science). In individual countries/education systems, some of these differences can be associated with school and class characteristics, while others relate to pupil characteristics.

This chapter uses multilevel analyses to explore some of the factors that may account for variation in reading, mathematics and science achievement in Ireland. An advantage of PT 2011 in some countries, including Ireland, is that the same pupils were assessed in all three domains, allowing direct comparisons to be made between them. A detailed literature review of how (and why) background characteristics are related to achievement is outside the scope of this chapter: instead, readers are referred to general reviews on/overviews of the topic. The analyses focus on achievement differences within Ireland, rather than relative to other countries.[1] As noted in Chapter 1 of this volume (Eivers & Clerkin, 2013), it should be borne in mind that causality cannot be inferred from the associations between background characteristics and achievement.

The remainder of this chapter is divided into 11 sections. First, we provide an overview of multilevel modelling: what it is, and why it is used in the present analyses. Second, we describe the school, teacher/classroom and pupil characteristics that have been selected for analysis. Third, we compare the dataset used in modelling with the larger PT 2011 sample. Fourth, we explore the manner in which variation in achievement is divided into between-school/class, and pupil levels. This gives an indication of the extent to which schools/classes differ with respect to achievement, and will be referred to when interpreting the results. Fifth, we present and compare the results of the models for reading, mathematics and science, highlighting characteristics that appear to be important in explaining achievement differences across all three domains, and others which may have domain-specific relationships with achievement.

Sixth, we explore interactions between gender and other pupil characteristics in their associations with achievement. Seventh, we examine whether or not the strength of the relationships between pupil-level characteristics and achievement are constant across classes/schools. The next three sections follow up on three specific findings in the models that merit closer examination: these are the "social context effect" (the extent to which the socioeconomic environment of the school/class is associated with achievement after accounting for pupil characteristics), the relationship between books in the home and achievement, and variation between schools in the incidences of bullying reported by

[1] In any case, detailed international comparisons were not possible, since the international databases were unavailable at the time of writing. The PIRLS and TIMSS international databases were released in early 2013, and a joint database for both will be released in late 2013 (see www.iea.nl/current_studies.html).

students. Finally, conclusions draw together findings, and offer suggestions for further research. More detailed information on the data underlying the models is provided in the appendices at the end of the chapter. Readers should note that this chapter examines only a subset of the PT 2011 data. Those who would like more general information about PT 2011 are referred to Chapter 1.

What is multilevel modelling and why do it?

Multilevel models are statistical models that describe the relationship between an outcome (in this case, achievement in PT 2011) and background characteristics that vary at more than one level. In this chapter, the multilevel models that are described can be seen as an extension of linear multiple regression models. They are particularly useful for analysing survey results where data are organised at more than one level (i.e., nested data, such as pupils in schools). Also, because multilevel models allow us to divide the variation in achievement into individual and group levels, we can describe the extent to which schools differ with respect to a given outcome, and then proceed to examine the extent to which different school and pupil characteristics take account of the variation in achievement.

There are two main reasons for using multilevel modelling for PT 2011 achievement. First, multiple regression techniques treat individuals as independent observations, which is not the case with survey data that comes from grouped or clustered data, such as pupils in schools. One consequence of ignoring nested structures is that the standard errors will be underestimated, leading to an overstatement of statistical significance. Standard errors for the group-level predictor variables (e.g., school characteristics) will be most affected by ignoring grouping. Second, the extent to which group-level characteristics are associated with achievement, over and above individual pupil-level characteristics, is of interest. A specific example of this is the social context effect, whereby the socioeconomic environment of the school may have a relationship with achievement over and above individual pupil characteristics (see, for example, Sofroniou, Archer and Weir's [2004] study on the social context effect in Irish primary and post-primary schools).

Many of the techniques that are associated with multiple linear regression also apply to the analyses presented in this chapter. Two are described here since they are important in interpreting the results that are presented. First, we want to examine the relationships between achievement and several background characteristics simultaneously. This is important, since bivariate analyses (examining relationships between achievement scores and one background variable at a time) fail to take the relationships among (covariances between) various background characteristics into account. For example, we might observe large achievement differences between pupils in urban and rural schools, but much of this difference could well be due to differences in the background characteristics of pupils that attend these schools, rather than attributable to the schools' locations, *per se*. In this chapter, we explore covariance by showing how achievement varies for some specific characteristics before and after adjusting for the other variables in the model; we also examine the amount of variation in achievement that is explained by various combinations of background characteristics. Second, we examine whether or not background characteristics interact with one another. For example, the relationship between enjoyment of reading and reading achievement might be different for boys and girls, in which case we would say that an *interaction* exists between pupil gender and enjoyment of reading with regard to achievement.

There is a specific feature of multilevel models that is examined in this chapter – that is, whether a pupil-level slope varies randomly across schools or not. This refers to whether or not the strength of the relationship between a pupil characteristic and achievement is the same across schools, or whether it is significantly stronger in some schools than others.

Inset 10.1 describes some concepts and terms that are needed to interpret the results of the models. A more detailed description of the procedures used to develop and finalise the models is in Chapter 8 of the PISA 2009 national report (Perkins, Cosgrove, Moran, & Shiel, 2012).[2]

Inset 10.1: Concepts and terms used in Chapter 10

Standard error: As noted in Chapter 1, PT 2011 results are estimates from a sample of pupils, so there is some error associated with the results. In the analyses presented in this chapter, the standard error takes account of both sampling and measurement error (the latter arising due to the fact that each pupil attempted a sub-set of the PT 2011 test items, rather than all items).

Explanatory (independent) variable: This refers to a variable or measure that may account for some of the variation in the outcome variable (i.e. achievement). This is a strictly statistical term – a variable does not 'explain' variation in achievement in a direct or causal sense.

Intercept: The intercept is the estimated achievement score of a pupil who has a value of zero on all categorical explanatory variables and a mean value on all of the continuous explanatory variables.

Dummy indicators, dummy variables, and reference groups: A dummy indicator or a dummy variable always has a value of either 0 or 1. For example, in the models presented in this chapter, gender is a dummy indicator with 0 for boy and 1 for girl. Other variables whose values fall into categories have been recoded as dummy variables, with one of the categories acting as the reference group.

In the fictitious example of job satisfaction shown below, the expected score for male employees is 490, and for female employees it is 505 (490+15). Response options to a statement regarding feeling supported by supervisor are *agree*, *don't know*, and *disagree*. *Don't know* is the reference group. Respondents who *agree* that they feel supported have an expected job satisfaction score that is 8 points higher than respondents who *don't know*, while individuals who *disagree* have an expected score that is 5 points lower than respondents who *don't know*.

Fictitious example: Extract from a multilevel model of job satisfaction

Intercept		490.0
Gender (male)	Female	15.0
Years in current position (5 to 10 years)	Less than 1 year	-45.0
	One to 4 years	-28.0
	11 years or more	32.0
	Missing years in current position	-19.0
Feels supported by supervisor (don't know)	Agree	8.0
	Disagree	-5.0

Missing indicator*:* A missing indicator is a type of dummy indicator, and is used for variables where there is some missing data. In these instances, we recode the missing values of the original variable to 0 (for categorical measures) or the mean (for continuous measures), and the missing indicator takes a value of 1 if a pupil is missing data on that measure. In the example extract, some individuals were missing years in current position. Their expected job satisfaction score is 19 points lower than respondents for whom these data exist.

Standardised variables: Standardising here refers to setting a continuous variable to have a specific mean and standard deviation. It is done to facilitate the interpretation of the parameter estimates (i.e., the estimate of change in achievement associated with each explanatory variable or each category within an explanatory variable). Continuous explanatory variables have been standardised to have a mean of 0 and a standard deviation of 1, so the parameter estimate

[2] For more detailed information on the theory and techniques associated with multilevel modelling, see Raudenbush and Bryk (2002), Raudenbush, Bryk, Cheong, and Congdon (2004), or Snijders and Bosker (2012).

equals the expected change in the pupil score associated with a one-standard deviation increase in the continuous variable. Also, as outlined in Chapter 1, pupils in Ireland did not achieve the same mean and standard deviation for reading, mathematics and science. Therefore, to facilitate comparisons across models, we have standardised the achievement scores for all three domains to have a mean of 500 and a standard deviation of 100.

Between-school/class variance: This is the proportion of total variation in achievement that is between groups (classes/schools). The higher the proportion (expressed in this chapter as a percentage), the more schools differ with respect to average achievement. In Ireland, between-group variance in achievement tends to be low relative to other countries. It is useful to compare the between-school variance associated with each of the three domains, since this can provide an indication of whether schools differ more with respect to (say) mathematics achievement than reading achievement.

Explained variance: This is the amount of achievement variation that is explained by the variables in the model. It gives an indication of the model's explanatory power. Usually, in models like the ones presented in this chapter, most of the variance in achievement is *not* explained, meaning that a majority of the achievement differences between pupils remains unaccounted for.

Variables examined

The variables included in the models are drawn from four sources described in Chapter 1; the *Learning to Read Survey* (Parent Questionnaire), the Pupil Questionnaire, the Teacher Questionnaire, and the School Questionnaire. These variables are shown in Table 10.1, and include pupil-level variables (e.g., gender), school-level variables (e.g., school size), and domain-specific variables (e.g., liking mathematics at pupil-level, and perceived shortage of science teachers at the school level).[3] These variables are described in detail in Table A1 in Appendix A.

In selecting background variables to include in the analyses described in this chapter, priority was given to those that were deemed to (i) have clear meaning, policy and research relevance, (ii) have good measurement properties, (iii) have low rates (generally less than 5%) of missing data and (iv) be sufficiently general to facilitate comparisons across reading, mathematics and science.

When interpreting the results it should be borne in mind that, in some cases, there are few pupils in sub-groups (see Tables B1 and C1 in Appendices B and C). For example, just 5% of pupils have a mother whose highest level of education is primary level, while 53% have a TV in their bedroom. This is important since characteristics that apply to a large sub-set of pupils might imply quite a different policy response to those that apply to a smaller sub-set.

The measure of bullying used in the present chapter is not the same as the international bullying scale discussed in Chapter 3 (Clerkin & Creaven, 2013). As the aim was to capture both *frequent* and *multiple forms of* bullying in our measure (see Minton, 2010),

[3] Because PIRLS and TIMSS 2011 are international studies, some variables are measured differently than they might be in national surveys of educational achievement. For example, in PT 2011, age starting school is coded as 5 years or younger/6 years and older. Just over 90% of pupils' parents in Ireland reported that they started school at 5 or younger, so it would have been desirable to have a measure that further sub-divided the "5 or younger" group.

bullying is treated here as a binary variable. Pupils were categorised as bullied if they were bullied *once a week or more* by at least two of the six types of bullying presented to pupils.

In the PT 2011 dataset used for multilevel modelling, 78.9% of pupils experienced none of the six forms of bullying at least once a week, 11.2% experienced one, 5.2% experienced two, 2.2% experienced three, and 2.6% experienced four or more; 10% were therefore classified as experiencing two or more forms of bullying at least once a week. A categorical version of this variable may have been desirable (e.g., none, low, medium, high), but as relatively few pupils experienced high levels of bullying, the binary version of the measure was used. In any case, there is high concordance between the classification using the binary measure and the international measure of bullying ($\chi^2 = 2223.41$, $df = 2$, $p < .001$).

Finally, it may be noted that the top two categories for books in the home (101-200 books, and more than 200 books) were collapsed into a single category (more than 100 books) in order to reduce the overall number of categories for this variable.

Table 10.1: Pupil and school/class characteristics used in modelling achievement in PT 2011

Pupil-level variables	**School/class-level variables**
Reading, mathematics and science achievement	School enrolment size
Gender	Urban-rural status
Age	DEIS status
Home language*	School language of instruction
Test language	Proportion of parents with third-level education
Books at home*[a]	Average number of full time equivalent jobs per household
Children's books at home	Proportion of pupils with another first language
TV in bedroom	Proportion of female pupils
Computer in bedroom	Average pupil age in years
Own iPhone	Perceived problems with absenteeism/lateness*
Parents set aside time for homework daily*	Perceived parental support*
Experiences two or more types bullying at least weekly[b]	Class size
Age starting school	School emphasis on academic success scale
Mother's education*	Safe and orderly school climate scale
Father's education*	
Number of jobs in the household*[c]	
Parent – time spent reading per week	
Parent – perceived importance of reading*	
Domain-specific pupil variables	**Domain-specific school/class variables**
Pupil frequency of reading for enjoyment*	Teacher specialisation in English*
Pupil perceived importance of reading*	Teacher specialisation in mathematics*
Pupil perceived importance of mathematics*	Teacher specialisation in science*
Pupil liking of mathematics*	Perceived shortage of reading teachers*
Pupil perceived importance of science*	Perceived shortage of mathematics teachers*
Pupil liking of science*	Perceived shortage of science teachers*
Missing indicator for Parent Questionnaire	Hours of instruction per week – English*
	Hours of instruction per week – mathematics*
	Hours of instruction per week – science*

Note: Further detail on these variables is available in Table A1, Appendix A.

*Variable has a missing indicator to preserve cases in the dataset.

[a]Books at home represents pupil-reported number of books in the home. Parent-report data on books in the home are also available, but this variable was not included in the multilevel models: it was felt that pupils' reports formed the more relevant measure here.

[b]A nationally-derived binary variable contrasting children who experience two or more (of six) types of bullying at least once a week with those who experience fewer and/or less frequent bullying behaviours.

[C]Continuous variable representing the number of full-time jobs held in the household (with part-time jobs classified as 0.5).

Schools, classes and pupils included in the analyses

Achievement scores for all three domains were available for 4348 of pupils in Ireland who took part in PT 2011. However, the analyses in the present chapter are based on 4044 pupils.[4] As shown in Table 10.2, there are no notable differences between the pupils with achievement data on all three domains, and the sub-set included in the multilevel models, indicating that the reduced dataset is unbiased and representative of the full PT 2011 sample.

Table 10.2: Complete combined PIRLS/TIMSS dataset compared with the dataset used in modelling achievement in PT 2011

Characteristic	All PIRLS/TIMSS pupils	Pupils in the multilevel model dataset
N pupils	4348*	4044
N classes	221	211
Pupil gender	%	%
Girls	49.4	49.2
Boys	50.6	50.8
School DEIS status	%	%
In DEIS Band 1 school	7.6	7.8
In DEIS Band 2 school	6.8	7.0
In DEIS Rural school	4.5	4.2
Not in DEIS school	81.0	81.0
School gender composition	%	%
Mixed school	73.4	74.0
All-boys school	9.4	9.2
All-girls school	12.2	12.5
Girls and infant boys school	5.0	4.3
School size	%	%
Small school	31.8	30.9
Medium school	26.5	27.5
Large school	41.6	41.6
School Location	%	%
City/large town	46.9	47.8
Small town/village	27.2	26.1
Rural community	25.9	26.1
School language	%	%
English medium school	92.5	92.2
Irish medium school	7.5	7.8
Reading achievement mean	552.6	554.7
Reading achievement sd	74.4	73.7
Mathematics achievement mean	528.7	530.6
Mathematics achievement sd	77.6	77.0
Science achievement mean	517.5	519.3
Science achievement sd	79.1	78.5

Note. All percentages apply to pupils. The achievement estimates in the table are not standardised, as they are in Table 10.1, and subsequent tables showing the results of the models.

*The number of pupils with an achievement score on all three of PIRLS, TIMSS mathematics and TIMSS science.

[4] In all, 94.5% of sampled pupils participated in TIMSS, and 93.8% of sampled pupils participated in PIRLS (see Table 1.5 of the national report [Eivers & Clerkin, 2012]). Of these, 4348 pupils, or 90.1% of all sampled pupils, have data for both studies. The pupils in the dataset used in multilevel modelling (4044 in all) represent 83.8% of all sampled pupils, or 93.0% of pupils in the combined PIRLS/TIMSS dataset. There are 304 fewer pupils in the multilevel dataset because these cases were missing a majority of questionnaire data.

To what extent do schools, classes, and pupils differ in achievement?

How PT 2011 sampled schools, classes and pupils is relevant to the interpretation of between-school or between-class differences in achievement. The 151 schools that participated were relatively evenly divided between those with one or two Fourth grade classes (automatically selected) and those with more than two such classes (from which two classes were randomly selected).

The sampling design introduces some complexities when deciding how best to group the data for multilevel modelling. If we use school as the cluster variable, we cannot include teacher/class variables in the model. However, if we use class as a cluster variable, we risk confounding school and class "effects". A three-level model (pupil, class, and school) is not desirable, since in schools where only one class was selected, the school level is the same as the class level. If, on the other hand, the variation in achievement is partitioned in a similar manner between classes as it is between schools, then using class as the cluster variable is the most appropriate way to analyse the data. Here, we examine the manner in which variation in achievement is partitioned between schools, classes and pupils, and compare two-level (school and pupil, class and pupil) and three-level (school, class, and pupil) models.

As shown in Table 10.3, between-cluster or between-group variance is quite low for all three domains, whether school or class is used as the cluster variable. Between-cluster variation is lowest for reading, and highest for science, with between-cluster differences for mathematics lying in between. Moreover, in a three-level model, only a very small amount of the variance lies between classes. This indicates that it is appropriate to conduct a two-level model analysis with class/school as the cluster variable, thereby allowing the inclusion of teacher/class characteristics. From here on, the two-level models refer to pupil and school levels, where "school level" is shorthand for "school/class level".

Table 10.3: Total, between- and within-school/class variation in reading, mathematics and science achievement, two versus three levels

Model/level	Reading	Mathematics	Science
Two levels – classes and schools	%	%	%
Pupils	86.6	82.5	78.2
Classes/schools	13.4	17.5	21.8
Total	100.0	100.0	100.0
Two levels – schools	%	%	%
Pupils	87.8	82.2	78.2
Schools	12.2	17.8	21.8
Total	100.0	100.0	100.0
Three levels – all schools	%	%	%
Pupils	87.4	82.1	78.0
Classes	1.5	0.5	0.9
Schools	11.1	17.3	21.1
Total	100.0	100.0	100.0
Three levels – schools with two classes	%	%	%
Pupils	83.1	83.2	79.9
Classes	4.0	2.0	3.1
Schools	12.9	14.9	16.9
Total	100.0	100.0	100.0

Results for the models of reading, mathematics and science

Table 10.4 presents a summary of the two-level models for reading, mathematics and science, and Tables D1, D2 and D3 in Appendix D show the detailed results for each domain, including the results of significance tests. Gender interactions were found in all three models. The parameter estimates for gender cannot be interpreted without also taking the parameter estimates for the interaction terms and related main effects into account; and significance tests for the main effects (e.g., gender, books in the home) should not be reported in the presence of an interaction effect. Gender interactions are explored in detail later in this chapter.

For those unfamiliar with data as presented in Table 10.4, the following examples may help:

1. Pupils flagged "Yes" for having a TV in their bedroom have an expected **reading** achievement score that is 14 points lower than pupils flagged "No".
2. Each additional full-time job in a household is associated with a **science** score increase of 8 points over the *intercept* score.

When examining the achievement differences shown in Table 10.4, readers should bear in mind that the standard deviation for reading, mathematics and science achievement is 100 points. Thus, for example, the modelled mathematics achievement difference of 41 points between pupils who experienced bullying and pupils who did not is equivalent to roughly two-fifths of a standard deviation.

Variables associated with achievement: All domains

Pupil-level variables

As shown in Table 10.4, seven variables were associated with achievement in all three domains. Having a greater number of books in general, as well as children's books in the home, was positively associated with achievement in reading, mathematics, and science. Pupils who had a TV in their bedroom had lower achievement scores than pupils who did not, and pupils who reported that they owned an iPhone also had lower achievement scores than pupils who did not own one. Frequently being bullied (in this model, experiencing two or more types of bullying at least once weekly) was associated with lower achievement in reading, mathematics, and science. In terms of socioeconomic characteristics, maternal education level was positively associated with achievement, as was the number of full-time jobs held by the pupils' parents. The results for books in the home and maternal education need also to be interpreted with reference to the gender interactions found (as will be described in a later section).

School-level variables

Only one school-level variable was significant in all three models: the average age of pupils in the school was positively associated with achievement; that is, the older the average age of pupils in the school, the higher the achievement scores of individual pupils. However, the effects of age were stronger for mathematics and science than for reading. For reading, a one-year increase in average age was associated with an achievement increase of 36 points, for mathematics, an increase of 59 points, and for science, an increase of 72 points.

Individual pupil age (rather than average pupil age at the school/class level) was not significant in any of the three models.[5]

Table 10.4: Summary of models of achievement in reading, mathematics and science

		Reading	Mathematics	Science
Intercept		466.46	496.83	464.10
Pupil-level variables (reference group)				
Gender (Boy)	Girl	-17.25	-37.42	-33.45
Books at home (26-100 books)	10 books or fewer	-51.64	-57.22	-57.14
	11 to 25 books	-20.40	-29.50	-25.33
	More than 100 books	14.94	13.21	15.89
Children's books at home (26-50 books)	10 books or fewer	**-18.05**	**-22.68**	**-26.71**
	11 to 25 books	**-6.03**	**-2.36**	**-7.53**
	51 to 100 books	**14.35**	**11.33**	**8.73**
	More than 100 books	**25.50**	**16.09**	**12.50**
TV in bedroom (No)	Yes	**-14.03**	**-13.19**	**-14.33**
Own iPhone (No)	Yes	**-31.52**	**-39.58**	**-30.36**
Parents make sure that time is made for homework daily (Less often)		**19.03**	x	**14.86**
Experiences at least 2 types of bullying behaviour at least weekly (No)		**-42.44**	**-41.14**	**-37.04**
Age starting school (5 or younger)	6 or older	23.72	x	**24.12**
Mother's education (Upper secondary, PLC or apprenticeship)	Primary	-20.93	**-16.29**	**-14.20**
	Lower secondary	-12.19	**-7.762**	**-9.67**
	Third level	4.08	**11.10**	**11.52**
Total number of full-time jobs or equivalent (Part-time=0.5)		**12.36**	**12.17**	**8.04**
Additional domain-specific variables (reference group)				
Frequency of reading for enjoyment (Weekly/monthly)	Daily	16.94	x	x
	Never	11.73	x	x
Likes maths/science (Disagree)	Agree		**20.63**	**20.43**
Interactions				
Gender and books at home	Gender*10 books or fewer	**35.26**	**28.60**	**36.44**
	Gender*11 to 25 books	**15.02**	**19.29**	**20.17**
	Gender*more than 100 books	**9.15**	**21.68**	**22.13**
Gender and mother's education	Gender*primary	**-12.22**	x	x
	Gender*lower secondary	**14.37**	x	x
	Gender*third level	**18.12**	x	x
Gender and frequency of reading for enjoyment	Gender*daily	**3.38**	x	x
	Gender*never	**-26.22**	x	x
School-level variables (reference group)		x		
School enrolment size (Medium)	Small	x	**18.51**	**23.64**
	Large	x	**1.00**	**10.85**
School language (English)	Irish	**17.69**	x	x
Average pupil age in years		**36.36**	**59.33**	**71.96**
School emphasis on academic success scale		**5.80**	x	x
Parental support (Medium)	Low	x	**-11.41**	x
	High	x	**14.20**	x

Legend

x	Not in model
	Variable is in an interaction
	Significant p ≤ .05
	Significant p ≤ .01
	Significant p ≤ .001

[5] Even though individual pupil age was not associated with achievement, secondary analyses confirmed that when pupil age *was* included in the models, average pupil age was still significantly positively associated with achievement. This confirms the presence of a contextual effect for age.

Variables associated with achievement: Domain-specific

Pupil-level variables

Although a number of variables were associated with achievement in all three domains, some domain-specific associations were also found. An older school starting age was associated with higher achievement in reading and science, but not in mathematics (even after school average age is taken into account). Pupils' age at the time of the PT 2011 assessment was not associated with achievement in any domain, even when examined on its own during the process of developing the models.

Parents ensuring that time was set aside for homework on a daily basis (rather than less often) was associated with higher reading and science performance, but not with mathematics performance. Frequency of reading (which interacted with pupil gender) was associated with reading achievement, while liking of mathematics was associated with mathematics achievement, and liking of science was associated with science achievement.[6]

School-level variables

Some domain-specific school-level associations with achievement were also found. School enrolment size was associated with achievement in mathematics and science. Pupils in smaller schools had a 19-point advantage in mathematics and a 24-point advantage in science compared with those in medium-sized schools. Pupils in large schools also demonstrated a slight advantage over those in medium-sized schools. For mathematics, there was only a one-point advantage for larger schools compared with medium-sized schools, with an 11-point advantage for science.

School emphasis on academic success was associated with an increase in reading achievement (specifically, a five-point increase in achievement with a one-standard deviation increase on this scale), with no effect observed for either mathematics or science. Likewise, attending an Irish-medium school was associated with an 18-point advantage in reading achievement, with no significant differences observed for mathematics or science.

Teacher-reported level of parental support for pupil achievement was associated with mathematics achievement only. Pupils in schools rated high on parental support had a 14-point advantage over pupils in schools with medium levels of parental support. Pupils in schools where parental support was rated as low scored 11 points lower than pupils did in the medium-support schools.

No school-level variables were associated uniquely with science achievement.

Gender interactions in the models

Most pupil-level variables were related to achievement in the same manner for boys and girls. However, a significant interaction between gender and books in the home was observed for reading, mathematics, and science.

No other variables interacted with gender in their associations with mathematics and science. In contrast, significant interactions between gender and two other variables were found for reading: frequency of reading for enjoyment, and maternal education. Since they are quite detailed, interactions are described in a later section.

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[6] We did not specifically test for significance of associations between these domain-specific variables *across domains* (e.g., we did not examine the association between frequency of reading and mathematics/science achievement).

Variables absent from the models

Some variables associated with achievement in other studies and tested in these models (as shown in Table 10.1), were *not* significantly associated with achievement in PT 2011. At the pupil level, father's education was significantly associated with achievement in all three domains when tested on its own, but was no longer a significant predictor when other pupil characteristics were included in the models. This confirms a stronger association between mother's education and achievement, when other characteristics are taken into account. Also, when tested on its own, the language spoken by pupils at home, if other than English or Irish, was associated with lower achievement (ranging from 19 points in mathematics to 38 points in reading), but was no longer significant in the presence of the other pupil variables. Other pupil-level characteristics that were not associated with achievement in the PT 2011 models were the presence of a computer in the pupil's bedroom, pupils' perceptions of the importance of reading, mathematics, or science, and parental perceived importance of reading.

At the school level, DEIS status was significantly associated with achievement in all three domains when tested on its own, but not when pupil characteristics were included in the models. It is also of note that other indicators of school-level socioeconomic status (e.g., the proportion of parents with a third-level education, and the average number of full-time equivalent jobs held by parents of PT 2011 pupils in the school) were not associated with achievement in the final PT 2011 models. Similarly, principals' perceived problems with pupil absenteeism or lateness was associated with lower achievement when tested on its own (with score differences ranging from 36 to 49 points, depending on the domain), but not in the presence of other variables in the final models.

For some characteristics, associations with achievement were weak or non-significant even when tested on their own. The number of teacher-reported instructional hours devoted to each subject was not associated with pupil achievement in the corresponding domain, nor was teachers' reported specialisation in English, mathematics, or science. Perceived shortage of teachers was not associated with achievement, nor was the scale measuring safe and orderly school climate. Although school size was associated with achievement in mathematics and science, class size was not associated with achievement in any domain.

How much variance in achievement is explained by the models?

Table 10.5 shows the percentage of variance explained by the models shown in Table 10.4. Across all three domains, just over one-quarter of variance is explained (ranging from 26.4% for mathematics, and 27.1% for science, to 27.6% for reading), implying that most of the variation in achievement remains unexplained.[7]

All three models explain a greater proportion of between-school than within-school variation: explained between-school variation ranges from 55.3% for science, and 58.3% for mathematics, to 73.9% for reading. The explained between-school variance is also a function of the amount of variance between schools/classes (Table 10.3), which is lower for reading than for mathematics or science. On their own, the school-level variables do not explain much of the total variation in achievement (ranging from about 4% to 8%) (Table 10.5). These co-vary to some extent with the pupil-level characteristics, as can be seen by

[7] The explained variance is calculated on the basis of the null (or empty) model *plus* missing indicators compared to the final model. That is, we include the achievement variance associated with missing data in the "error" or "unexplained" parts of the models.

comparing the complete model with the pupil-level-variables-only model, in Table 10.5. For example, the model for mathematics explains 26.4% of total variance. Pupil-level variables explain 25.2% of variance, implying that school-level variables explain just 1.2% of variation in achievement over pupil variables. Of the explained variance, a large majority is attributable to pupil gender, parent background and home environment.

Table 10.5: Percentage of variance explained by the models

Model/level	Reading	Mathematics	Science
Complete model	%	%	%
Between	73.9	58.3	55.3
Within	21.7	20.7	20.2
Total	27.6	26.4	27.1
Pupil-level variables only	%	%	%
Between	64.7	44.4	42.7
Within	21.9	21.6	20.3
Total	26.7	25.2	24.7
School-level variables only	%	%	%
Between	34.8	46.7	24.0
Within*	-0.4	-0.3	-0.1
Total	3.6	7.9	5.2
Gender, parent background[a] and home environment[b]	%	%	%
Between	63.2	41.0	37.6
Within	19.4	17.5	18.1
Total	24.3	21.1	21.9
Pupil in school[c]	%	%	%
Between	12.5	16.5	14.9
Within	3.6	5.3	5.2
Total	4.6	7.3	7.4
Pupil engagement/interest in the domain[d]	%	%	%
Between	9.7	-1.3	2.9
Within	3.0	1.1	0.8
Total	3.7	0.7	1.3

Note. Explained variance is estimated on the basis of models with fixed slopes.

*Small negative changes in explained variance associated with the inclusion of the school-level variables only should not be interpreted as a disimprovement in model fit – rather, there is some error around these estimates and these values should be interpreted as no change in model fit.

[a]Mother's education, household employment status.

[b]Books at home, children's books at home, TV in bedroom, own iPhone, parents set aside time for homework.

[c]Age starting school, experience of bullying.

[d]Frequency of reading, liking mathematics, or liking science.

Exploring gender interactions

As noted in the previous section, three pupil-level variables interacted with gender in their association with achievement; these were books at home (for all three domains), frequency of reading for enjoyment (for reading only), and mother's education (for reading only). Figures 10.1a, 10.1b and 10.1c show the expected reading scores of boys and girls for the different categories of books in the home, frequency of reading, and mother's education, respectively (while Table D4 shows the data underlying the figures).

Figure 10.1a: Interaction for reading: Gender and books in the home

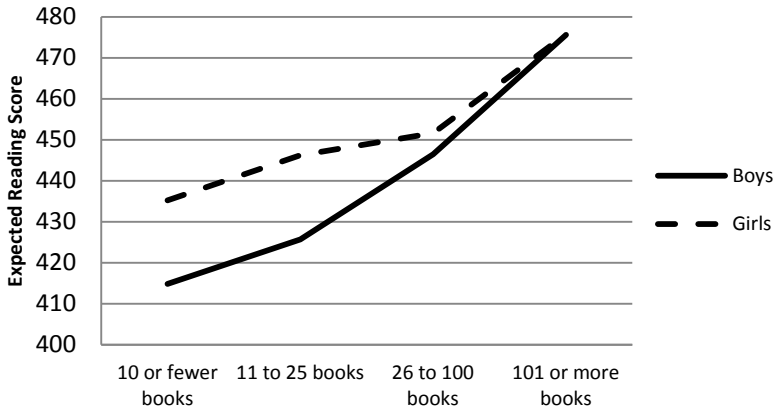


Figure 10.1b: Interaction for reading: Gender and frequency of child's reading for enjoyment

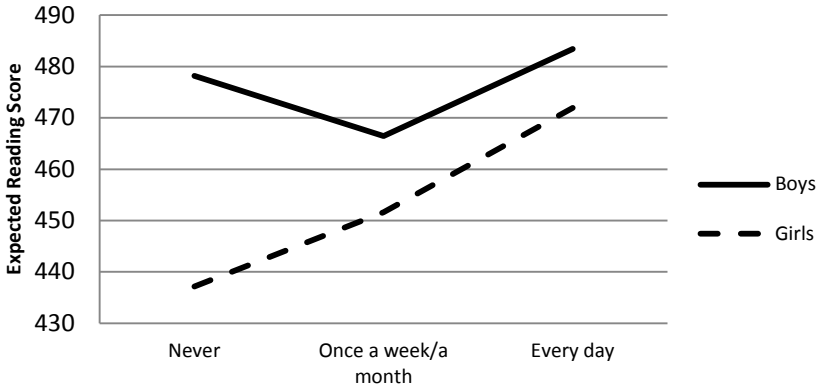


Figure 10.1c: Interaction for reading: Gender and mother's education

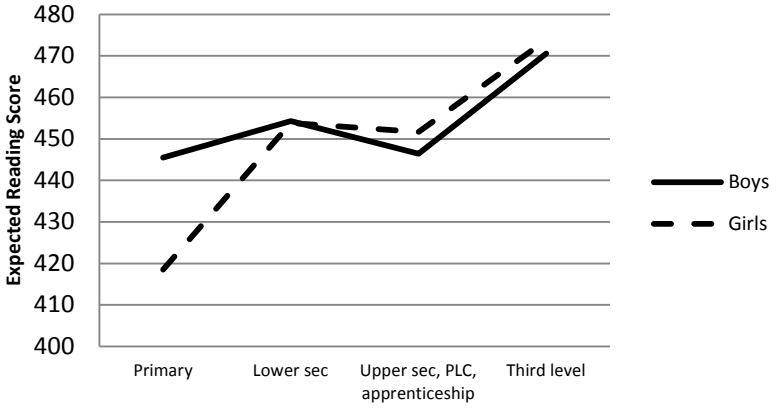


Figure 10.1a shows that there is a stronger association of books in the home with achievement for boys than for girls. Boys reporting the lowest category of books in the home had reading achievement scores that were approximately 20 points below those of girls in the same group, with the achievement gap narrowing with increasing numbers of books. Boys also reported fewer books in their home than girls, on average (Table D4).

In contrast with the stronger association with achievement for boys in relation to books in the home, the associations with reading achievement for both frequency of reading and mother's education were stronger for girls. As shown in Figure 10.1b, more frequent reading was associated with higher reading achievement for girls, with little effect of reading frequency for boys. For mother's education, both boys and girls who had mothers with the

highest level of education had higher reading achievement than those children whose mothers were in the *lowest* education category (Figure 10.1c). However, within this lowest category, girls had reading achievement scores that were more than 20 points behind those of boys, suggesting that low maternal education is associated with more of an achievement disadvantage for girls than boys.

Figures 10.2 and 10.3 show the expected mathematics and science scores of boys and girls for the different categories of books in the home (while Table D5 shows the data underlying the figure). Consistent with the findings for reading (Figure 10.1a), there are stronger associations for boys than for girls. Girls and boys with few books in the home score similarly in mathematics and science. However, at moderately high levels of books in the home, boys have higher scores than girls in both domains.

Exploratory analyses confirmed that the interactions between gender and books in the home occur independently of the other variables in the models for mathematics and science. That is, we compared the parameter estimates for a simple model that included *only* gender, books, and the gender-books interaction with the final model; parameter estimates for the simple model and the final model were almost the same for both mathematics and science. In the case of reading, secondary analysis suggests that although an interaction between books and gender in its relationship with achievement occurs independently of the other variables in the model, the size of the interaction effect increases with the inclusion of maternal education, frequency of reading, and their interaction terms. This suggests that, in the case of reading, there may be a rather complex set of two- or three-way interactions occurring, involving gender, books, frequency of reading, and maternal education. This is not explored further in the present chapter.

Figure 10.2: Interaction for mathematics: Gender and books in the home

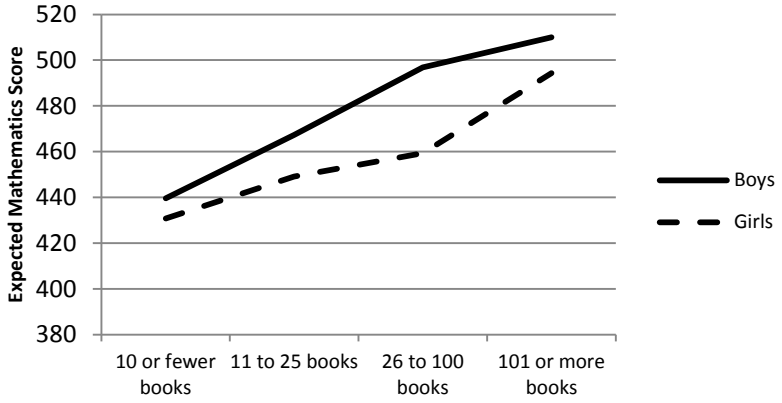
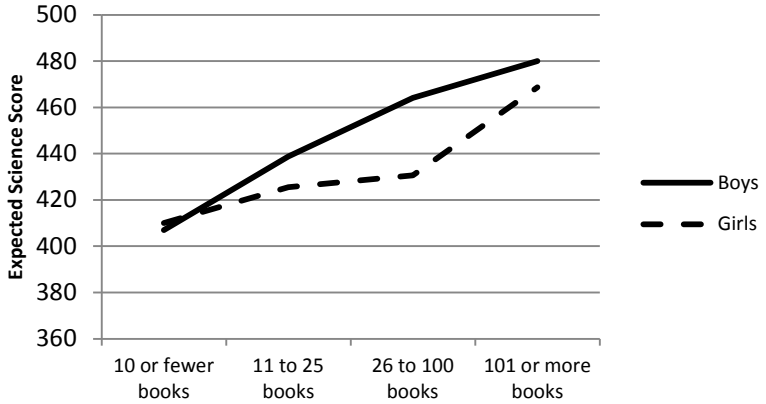


Figure 10.3: Interaction for science: Gender and books in the home



Variation in the strength of the relationship between pupil characteristics and achievement

The associations between most pupil characteristics and achievement were consistent from school to school. However, four variables did vary significantly in their associations with achievement across schools. These were age starting school (for reading only), being bullied (for mathematics and science), number of jobs per household (mathematics), and setting aside time for homework (science).

With respect to age starting school, Table 10.6 shows a strong negative correlation between the intercept and the slope, meaning that the relationship between age starting school and reading achievement is *stronger* in schools with *lower* average reading achievement. There are no significant associations between the intercepts and slopes for being bullied and achievement in mathematics and science. This indicates that, although the relationship between being bullied and achievement differs from school to school, it does not differ in a consistent manner.

The slope for number of jobs in the household has a strong positive correlation with school average mathematics achievement, meaning that the relationship is *weaker* in schools with lower average achievement. Finally, there is a strong negative correlation between setting time aside for homework (for all subjects) and achievement in science (i.e., the relationship is *stronger* in schools with lower average achievement).

Table 10.6: Pearson correlation coefficients between intercepts and slopes for pupil-level variables with significant slope variation, all domains

	Reading	Mathematics	Science
Age starting school	-.87**[a]	-	-
Bullied	-	.02#[b]	-.02#[d]
Number of jobs in household	-	.57**[c]	-
Parents set aside time for homework daily	-	-	-.74**[e]

Note: **$p < .001$, # indicates no significant correlation between intercept and slope for that variable.

[a]Based on 146 classes.
[b]Based on 163 classes.
[c]Based on 211 classes.
[d]Based on 163 classes.
[e]Based on 195 classes.

The relationships between these pupil characteristics and achievement are illustrated in Figure 10.4, in order to provide a visual representation of the information shown in Table 10.6. The graphs in Figure 10.4 were generated on the basis of a random sample of 25% of class groups, since including all 211 groups would have resulted in very over-crowded graphs.

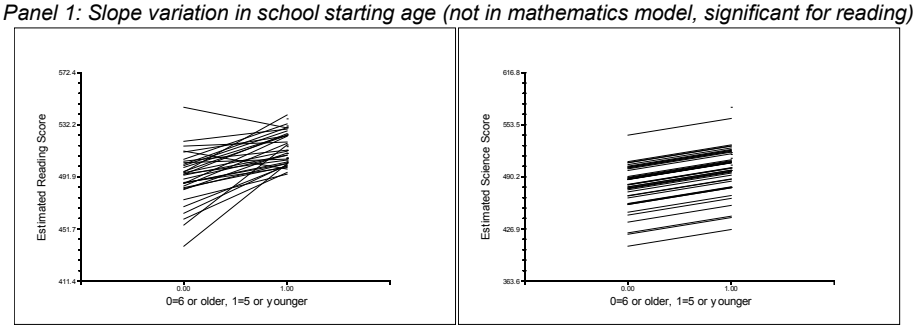
In Panel 1, a fanning-in of lines can be observed from the left to the right of the graph for reading. This implies that with higher average school reading achievement, the relationship with school starting age is weaker. The graph for school starting age and science achievement shows a series of parallel lines, which illustrates that the strength of the relationship is the same across schools, regardless of their average science achievement.

Panel 2 illustrates the slopes for frequent bullying, which vary across schools in the models for mathematics and science, but not reading. Although the lines are not parallel for mathematics and science, there is no discernible pattern (such as was evident in the graph for reading and school starting age).

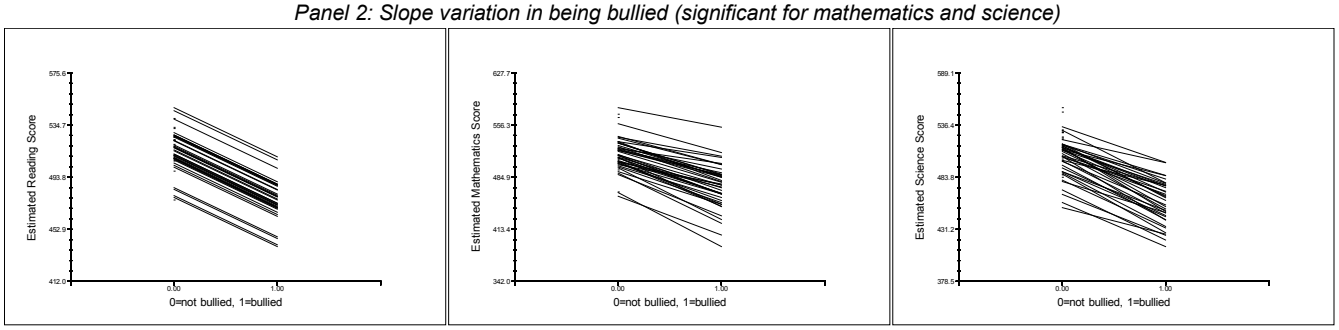
Panel 3 shows slope variation associated with the number of full-time jobs held by pupils' parents and achievement in all three domains. For reading and science, these are fixed or parallel. In contrast, they cross over for mathematics, with slightly steeper lines (implying greater variation between schools) for schools with higher average achievement.

Figure 10.4: Graphs of slope variation in pupil-level variables that are significant in one or more models

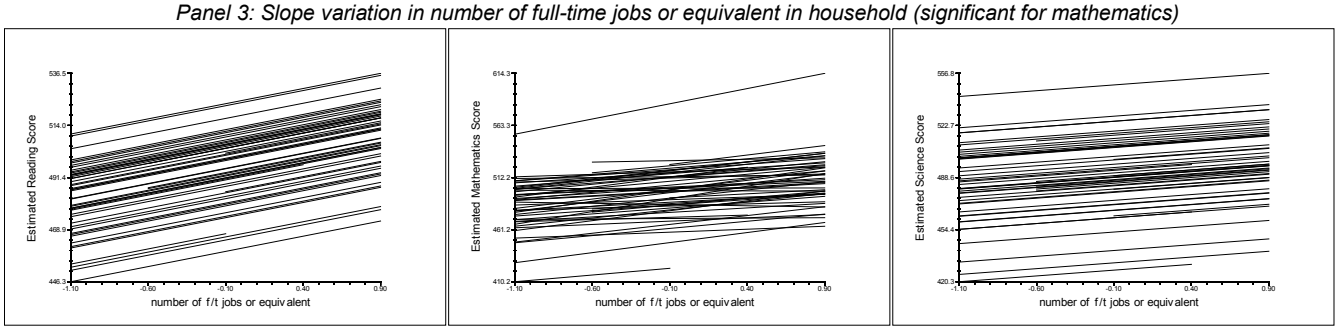
Panel 1: Slope variation in school starting age (not in mathematics model, significant for reading)



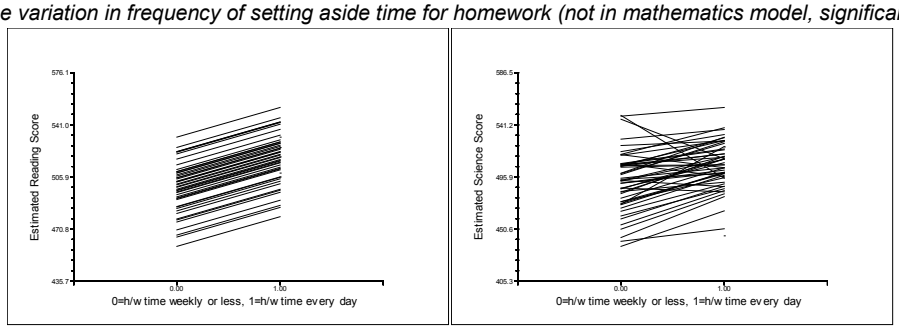
Panel 2: Slope variation in being bullied (significant for mathematics and science)



Panel 3: Slope variation in number of full-time jobs or equivalent in household (significant for mathematics)



Panel 4: Slope variation in frequency of setting aside time for homework (not in mathematics model, significant for science)



Note. Graphs are based on a random sample of 25% of classes.

Panel 4 illustrates the slopes associated with frequency of setting time aside for homework, for reading and science achievement. For reading, the lines are parallel, indicating no slope variation, but for science, a fan-pattern is evident, similar to the one for reading in Panel 1. This indicates that for higher average school science achievement, the relationship with setting aside time for homework is weaker.

Further examination of the (lack of) social context effect

Previous studies have observed a social context effect for achievement, whereby pupil achievement is adversely affected by the presence of high densities of pupils from disadvantaged backgrounds. Within multilevel analysis, a strict definition of the social context effect is the finding of a statistically significant relationship between individual-level socioeconomic characteristics *and* the cluster-level (or school-level) aggregates of these same characteristics. Our analyses emphasise DEIS as the school-level measure of socioeconomic characteristics rather than pupil-level aggregates since (i) DEIS is of wide interest and policy relevance and (ii) those school aggregates that *were* initially included (e.g., proportion of parents with university education; average number of full time equivalent jobs per household) became non-significant in the presence of the DEIS indicator. The presence of a social context effect is widely acknowledged, both in Ireland (e.g., McCoy, Quail & Smyth, 2012; Perkins et al., 2012) and internationally (e.g., Chiu & McBride-Chang, 2006; OECD, 2010). In Ireland, Sofroniou et al. (2004) found that primary school pupils' reading and mathematics scores decreased relative to the proportion of pupils in the school whose families held a medical card, even controlling for the individual pupils' own medical card possession. However, the PT 2011 results indicated that, over and above pupil characteristics, school socioeconomic characteristics are *not* significantly associated with achievement. In fact, the only variable at the school level that was consistently related to achievement was pupil average age. As this contrasts with the findings of these earlier studies, it merits further examination. We examined two possibilities: first, that a social context effect was being obscured by grouping pupils by class rather than school for the analyses, and second, that DEIS status (an important index of socioeconomic disadvantage) is associated with achievement when pupil-level disadvantage is *not* included in the models.

Possible dilution of the social context effect

It is possible that grouping pupils by class for the analyses may have "diluted" the social context effect. However, this is somewhat unlikely, given that between-class variance, overall, is quite low (Table 10.3). Nonetheless, to examine this possibility, the final models were re-analysed using school rather than class as the cluster variable.[8] The results are shown in Table E1 (Appendix E) and are very similar to those shown in Table 10.4. This suggests that using class rather than school as the cluster variable has no substantive effect on the significance of school-level socioeconomic variables for the PT 2011 models.

Table E2 (Appendix E) shows the variance explained by the models shown in Table E1, which is very similar to that explained by the models in Table 10.4 (and shown in Table 10.5). Furthermore, Table E2 indicates that the addition of schools' DEIS status explains very little additional variation in achievement – just 0.3% for reading, 0.7% for mathematics, and 1.1% for science. The results suggest that the absence of a social context effect, at least for DEIS status, is not attributable to the use of class as the cluster variable.

[8] In the case of mathematics, parental support was omitted from the model, since this was a measure derived from the Teacher Questionnaire, and as such, is a class- rather than school-level variable.

DEIS status and achievement, with and without accounting for pupil characteristics

An alternative explanation is that more detailed pupil-level model specification (in comparison with some previous studies) results in a diminished effect for school-level socioeconomic characteristics (in this case, school DEIS status). The present study includes a wide range of pupil characteristics. In comparison, the study by Sofroniou et al. (2004), for example, included only gender and medical card possession at the pupil level. It is possible therefore that the present study represents a more detailed understanding of how the social context effect may operate at the individual pupil level. To investigate this, we examined the associations between DEIS and achievement, with and without accounting for (i) pupils' gender and socioeconomic characteristics and (ii) pupils' home environments. Four models were estimated and compared as follows, for each of the three domains:

Model 1: School DEIS status only.

Model 2: School DEIS status with pupil gender and socioeconomic background (i.e., mother's education, and number of full-time jobs in the household).

Model 3: School DEIS status with pupil home environment (i.e., books in the home, children's books in the home, having a TV in the pupil's bedroom, pupil owning an iPhone, and parents ensuring that time is set aside for homework on a daily basis).

Model 4: School DEIS status, pupil gender and socioeconomic background, and pupil home environment (i.e., Models 2 and 3 combined).

Table 10.7 shows the parameter estimates associated with DEIS status when considered on its own, and in conjunction with pupil gender and socioeconomic characteristics, and their home environments.

Table 10.7: Parameter estimates for school DEIS status, with and without adjustments for pupils' gender and socioeconomic characteristics, and pupils' home environments

	Reading		Mathematics		Science	
DEIS on its own (Model 1)	Estimate	SE	Estimate	SE	Estimate	SE
DEIS Urban 1	-70.62	12.69	-81.47	13.55	-81.24	14.60
DEIS Urban 2	-67.47	8.80	-77.78	15.42	-90.34	17.94
DEIS Rural	-0.90	9.54	-18.63	17.73	-15.44	18.08
DEIS with gender and socioeconomic background (Model 2)	Estimate	SE	Estimate	SE	Estimate	SE
DEIS Urban 1	-39.92	9.281	-55.90	11.980	-57.852	13.360
DEIS Urban 2	-43.70	9.336	-63.17	16.160	-76.134	18.519
DEIS Rural	5.584	8.269	-9.23	14.517	-7.155	14.656
DEIS with home environment (Model 3)	Estimate	SE	Estimate	SE	Estimate	SE
DEIS Urban 1	-21.63	9.991	-36.02	12.376	-35.48	12.733
DEIS Urban 2	-37.17	10.408	-47.66	17.536	-60.96	19.036
DEIS Rural	11.83	8.599	-6.29	17.369	-2.61	17.568
Model 4 (Model 2 + Model 3)	Estimate	SE	Estimate	SE	Estimate	SE
DEIS Urban 1	-14.76	8.862	-26.72	11.214	-28.02	12.208
DEIS Urban 2	-33.12	10.280	-45.95	16.356	-59.33	18.452
DEIS Rural	13.52	7.764	-0.41	14.542	2.21	14.757

Model 1 suggests that there are substantial differences between DEIS Urban Band 1 and Band 2 schools and non-DEIS schools in average achievement. Pupils in Band 1 schools have an expected reading score that is 71 points or over two-thirds of a standard deviation lower than that of pupils in non-DEIS schools; similarly, pupils in Urban Band 2 schools have an expected score that is 67 points lower. In contrast, there is no difference in the expected reading achievement of pupils in rural DEIS schools and pupils in non-DEIS schools (with an estimate of just -0.9 points). That is, pupils in DEIS Band 1 and Band 2 schools have significantly lower achievement than those in non-DEIS schools, with no significant difference between rural DEIS and non-DEIS pupils.

Comparing these results with the estimates for DEIS when pupil characteristics are taken into account, it can be seen that the achievement differences for the latter models are considerably smaller. Taking mathematics as an example, the unadjusted achievement difference between pupils in non-DEIS schools and pupils in Band 1 Urban schools is -81 points. This decreases to -56 points when pupil gender and socioeconomic background are taken into account, and to -36 points when home environment is taken into account. It decreases further to -27 points when gender, socioeconomic background, *and* home environment are taken into account. A comparison of Models 2 and 3 shows that pupils' home environments are at least as important as their socioeconomic backgrounds in explaining achievement differences between DEIS and non-DEIS schools. Model 4 suggests that there is a good deal of covariance between Models 2 and 3, that is, more socioeconomic disadvantage tends to be associated with less positive home environments. It can be inferred from the results presented here and in Table 10.4 that the achievement differences that still remain between urban DEIS and non-DEIS schools are due largely to pupils' reports of being bullied and differences in engagement in reading, and enjoyment of mathematics and science. Table 10.7 also indicates that disadvantage operates differently in rural and non-rural DEIS schools in terms of its associations with achievement, both with and without taking account of pupils' characteristics.

Table E3 (Appendix E) shows that over and above pupil gender, socioeconomic background and home environment, school DEIS status explains just 0.9% of additional variation in reading achievement, 1.5% in the case of mathematics, and 2.2% in the case of science. Over and above gender and socioeconomic background *only*, school DEIS status explains 3.6% of variation in reading achievement, 3.7% in mathematics achievement, and 4.6% in science achievement. Therefore, the size of the social context effect is dependent upon which pupil-level characteristics are included in the models, and appears larger when gender and socioeconomic background, but not home environment, are taken into account. This latter finding provides support to the hypothesis that the inclusion of a wider range of pupil characteristics results in a reduction in the social context effect.

Further examination of books in the home: Pupils' and parents' reports

This section provides more detail on the association between books in the home and achievement. It should be noted that self-reports are subjective measures – that is, we do not have information on the *actual* number of books in the pupils' homes. PT 2011 collected estimates from both pupils and parents on the number of books in their home, but only the pupil-reported data were used in the multilevel models.[9] The pupil- and parent-reports were

[9] Analyses using the *parent*-reported books in the home variable indicated that it was not associated with achievement in any domain. This suggests that the association between books in the home and achievement may be contingent on the pupils' perception of the books, or that the method by which pupils were asked the

only moderately inter-correlated ($r = +.50$, $p < .001$), indicating that pupils and parents did not always agree on the number of books in their home.

The distribution of pupil- and parent-reported books in the home, overall and by gender, is shown in Table 10.8, while the cross-tabulation of pupil- and parent-reported books in the home is shown in Table 10.9. To examine agreement between pupil- and parent-reported books in the home, a difference score was computed (i.e., a score indicating the difference between pupil- and parent-reported books in the home).

Overall, less than 40% of pupil-parent reports were in agreement on the number of books in the home. Pupil-parent reports were in agreement for girls more often than for boys (Table 10.10). The parents of boys were more likely to report greater number of books in the home relative to their children, compared to the parents of girls. Chi-square analyses confirm that these discrepancies between pupil- and parent-reported books in the home differed significantly for boys and for girls ($\chi^2 = 65.48$, $df = 8$, $p < .001$). One interpretation of the results is that girls are more likely to perceive the books that are in their home, which is why they are more likely to agree with their parents on the quantity of books. Conversely, it is possible that boys are not engaging with the reading material in their homes, and this is why parents report greater number of books in the home relative to their sons.

Table 10.8: Frequencies of categories of books in the home: Pupil and parent reports

Overall (%)	0-10		11-25		26-100		101-200		200+	
Books in the home (pupil)	9.9		22.4		34.2		18.5		14.9	
Books in the home (parent)	9.8		16.9		33.4		18.3		21.6	
By gender (%)	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
Books in the home (pupil)	6.3	13.5	19.0	25.6	36.5	32.0	21.5	15.6	16.7	13.2
Books in the home (parent)	9.3	10.2	16.6	17.3	33.1	33.7	18.5	18.1	22.5	20.8

Table 10.9: Cross-tabulation of books in the home (pupil by parent reports)

Books in the home (pupil)	Books in the home (parent)					Total %
	0-10	11-25	26-100	101-200	200+	
None or few (0-10)	3.0	2.6	2.4	0.9	0.3	9.1
One shelf (11-25)	3.4	6.4	8.4	2.2	1.6	21.9
One bookcase (26-100)	2.1	5.8	15.4	6.4	5.1	34.7
Two bookcases (101-200)	0.8	1.7	5.0	5.4	5.9	18.9
Three+ bookcases (200+)	0.4	0.5	2.0	3.4	8.9	15.3
Total %	9.7	17.0	33.3	18.2	21.8	100.0

Note. The percentages shown include only cases with responses for both parents' and pupils' reports of books. As such, they differ slightly from those in Table 10.8.

Table 10.10: Pupil-parent agreement on books in the home

	Pupils report more books	Agreement	Parents report more books
Overall (%)	25.2	39.2	35.6
Girls	27.8	41.6	30.6
Boys	22.6	36.8	40.7

question generated more accurate responses (children were given schematic images of books on shelves to help them estimate the number, while parents were not).

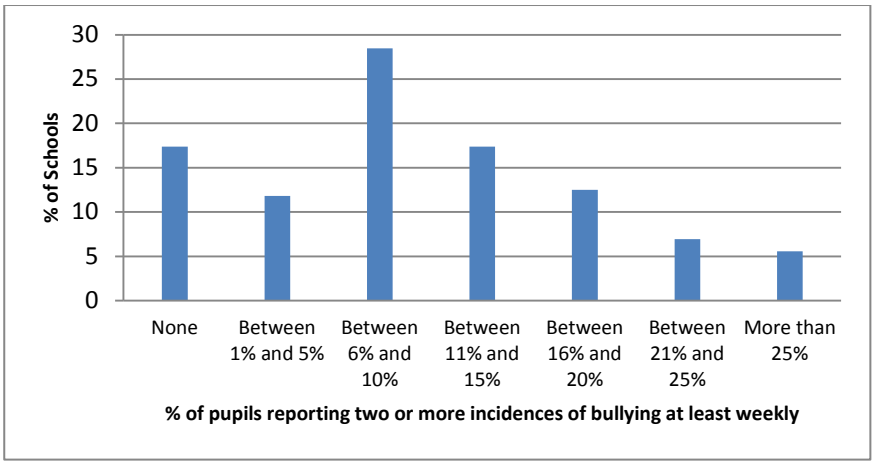
Between-school variation in bullying

Bullying has consistently been shown to have adverse effects on the social, emotional, physical and educational well-being of children (e.g., Harel-Fisch et al., 2011). The incidence of bullying (as measured by the PT 2011 *Students Bullied at School Scale*) was low in Ireland relative to other countries who took part in PT 2011. Pupils' reports of bullying emerged as being significantly associated with lower achievement in all three domains, in Ireland and internationally (Martin et al., 2012; Mullis, Martin, Foy, & Arora, 2012; Mullis, Martin, Foy, & Drucker, 2012). Chapter 3 in this volume (Clerkin & Creaven, 2013), provides further information on this scale, and highlights some variation in the frequencies of different types of bullying behaviours between pupils in Ireland.

In this chapter, as noted earlier, a modified, dichotomous version of the scale was used, with emphases on frequent and multiple forms of bullying. The present results confirm that bullying is an issue in relation to achievement. Pupils' reports of frequent bullying emerged as being significantly associated with achievement in all three domains. Pupils who reported that they had been bullied scored around two-fifths of a standard deviation lower than pupils who did not report this, after taking other variables in the models into account. The strength of the relationship between bullying and achievement also varied across schools for mathematics and science, but not for reading.

Analysis of the distribution of pupils' reports of bullying across schools indicates wide variation. For example, in 25 schools (17.4% of schools included in the analyses) *no* pupils reported two or more incidences of bullying at least weekly, while these rates exceeded 20% in 19 schools (12.5% of the sample) (Figure 10.5). This finding may be relevant to the interpretation of the random slopes for bullying for mathematics and science shown in Figure 10.4. That is, it may be the case that the relationship between bullying and achievement is stronger in schools where incidences of bullying are higher; however, this issue is not explored further here.

Figure 10.5: Percentages of schools with varying incidences of pupils reporting two or more incidences of bullying at least weekly



Summary and conclusions

This chapter examined the achievements of Fourth class pupils in PT 2011 through three multilevel models, one for each of reading, mathematics and science. The analyses grouped the data into two levels – school and class combined, and pupil. The objectives of the analyses were to identify those combinations of background characteristics that best explained variation in achievement, and to describe commonalities and differences in the variables associated with achievement in reading, mathematics and science.

An initial examination of between-school/class variance indicated that schools/classes in the Irish PT 2011 sample do not differ much with respect to achievement. About 13% of the variation in reading achievement was between schools or classes, and this was slightly higher for mathematics (18%) and science (22%). International comparative data on between-school differences were not available at the time of writing.

A wide range of background characteristics from the PT 2011 Irish database was examined (Table 10.2 in this chapter lists all of the characteristics considered). At the pupil level, these included gender, age starting primary school, home language, books and children's books at home, having a TV and computer in the bedroom, owning an iPhone, experiencing bullying in school on a frequent basis, parental education, and number of parental full-time jobs. At the cluster level, some of the measures (DEIS status, average parental education and employment status, and proportion of pupils with a first language other than English or Irish) were included specifically to test for the presence of a social context effect. Variables that are domain-specific were also included at both pupil and cluster levels (e.g., pupils' perceived importance of reading, mathematics and science; class hours of instruction per week in English, mathematics and science).

Results indicated that several pupil-level variables were associated with achievement in all three domains: these were books and children's books at home, maternal (but not paternal) education, number of full-time jobs in pupils' households (all positively associated), and having a TV in the bedroom, owning an iPhone, and experiencing bullying on a "frequent" basis (all negatively related to achievement). Just one school-level variable was significantly associated with achievement in all three domains – school average age (the older the average age, the higher the expected achievement scores).

Some characteristics showed statistically significant associations with achievement in one or two, but not all three of the domains. Overall, results suggest that the models for reading and science achievement are similar to one another but somewhat different to the model for mathematics. Parents setting time aside for homework and school starting age were both positively associated with achievement in reading and science (but not mathematics). Engaging in frequent reading for enjoyment was positively associated with reading achievement, while liking mathematics and science were positively associated with achievement in the two corresponding domains. In the case of mathematics and science, pupils in smaller schools had higher achievement scores, relative to medium and large schools. Also, pupils in Irish-medium schools had significantly higher reading scores than pupils in English-medium schools, but there was no difference between these two school types for mathematics and science achievement. The scale measuring school emphasis on academic success had a small positive association with achievement in reading only, while level of parental support was weakly, though significantly, associated with mathematics achievement only.

It is noteworthy that most of the school- or class-level characteristics were not significantly associated with achievement in any domain, once account was taken of the pupil demographic and socioeconomic characteristics, as well as to bullying and engagement with the domain in question. Significant school-level variables explained only very small and

substantively trivial amounts of variation in achievement over and above pupil characteristics, though it should be recalled that schools do not differ greatly to one another in average achievement in the first place. None of the measures relating to the socioeconomic context (DEIS status, average parental education, average employment status, EAL status of pupils) retained a significant association with achievement, over and above the pupil characteristics in the model.

This contrasts quite strongly with previous research on the social context effect (e.g. McCoy et al., 2012; Perkins et al., 2012). Earlier, we contrasted these results with those conducted by Sofroniou et al. (2004) who analysed the social context effect using data from the 1998 National Assessments of Mathematics and the 1999 National Assessments of English at primary level. Aside from the differences in the survey designs and contents between PT 2011 and the National Assessments, it is possible that the inclusion of a range of pupil characteristics in the models described here account for some of the observed social context effect, since the analyses in Sofroniou et al. included only gender and medical card status at the pupil level. It is also possible that a "real" reduction in the social context effect (and hence socioeconomic inequity) has occurred in the intervening period between the collection of the data used by Sofroniou et al. (1998/1999) and PT 2011. To address these two possibilities, the Educational Research Centre will be exploring the National Assessments datasets further, initially by replicating the analyses conducted by Sofroniou et al. on the 1998/1999 data with the 2004 and 2009 National Assessments datasets.

Specific to DEIS, though, it is worth noting that the nature of educational disadvantage and its relationship to achievement in rural DEIS schools has been examined by Weir, Archer and Millar (2009), who have found that the relationship between socioeconomic characteristics and achievement in reading and mathematics in rural and urban schools is different, both quantitatively and qualitatively. Results presented here are consistent with Weir et al. (2009) in that they show that, once adjustments are made for pupil background, children in rural DEIS schools do slightly better on reading than their non-DEIS counterparts. Rural disadvantage is an area of current and ongoing investigation by the Educational Research Centre.

It should be borne in mind also that the DEIS measures of socioeconomic disadvantage were based on data collected in 2005. Hence, there is a possibility that these measures are now becoming outdated, at least in some schools, which may have experienced changes in their pupils' intake characteristics due, for example, to changes in the socio-demographic characteristics of the schools' local communities.

Perhaps more important than the up-to-dateness of the socioeconomic measures associated with DEIS is the fact that this classification is both an indicator of socioeconomic disadvantage *and* a means whereby schools (and pupils) receive specific, targeted supports. That we failed to find a significant association between school DEIS status and achievement in our final models could in part be due to improvements in the achievements of children in DEIS schools as the interventions and supports begin to take effect. Indeed, Weir, Archer, Flaherty and Gilleece (2011) found significant improvements in the reading and mathematics test scores of pupils in DEIS primary schools in comparisons of standardised test results administered in 2007 and 2010.

Interactions between gender and books in the home in their relationships with achievement make the interpretation of gender differences in achievement difficult. These gender interactions occur largely independently of the other variables in the models; that is, the stronger association between books in the home and achievement for boys than for girls is not contingent upon the other variables in the models. In the case of reading, the issue is complicated by the presence of two further gender interactions with frequency of reading for

enjoyment and maternal education. Preliminary secondary analyses also suggest that more complex two- or three-way interactions may underlie the results for reading. Further examination of the gender interactions for reading is therefore warranted.

With respect to the measure of books in the home more generally, we noted that boys, on average, reported fewer books in their homes than girls. Comparisons with parents' reports of the numbers of books in the home indicates that girls' reports of books agreed with parents' reports more frequently than did boys' reports. Thus, it may be the case that it is the *perception* of the numbers of books in the home that is underpinning the gender-books interactions, or there could be a gender bias in the reporting of books in the home that is arising for some other reason. In either case, we recommend further examination of the relationships between books in the home and the achievement of boys and girls. One possible useful source is the comparative data from the PT 2011 international dataset, since this would provide information on the extent to which the findings may or may not be considered unique to Ireland. This is of potential importance, given the widespread use and interpretation of high numbers of books in the home as an indicator of an educationally-supportive home climate in both national and international surveys of pupil achievement, in the absence, in our view, of a sufficient reflection on what the indicator is actually capturing. An example of this is the results of a comparative study of books in the home (Evans, Kelley, Sikora, & Treiman, 2010), whose results were widely cited in the media on their publication. Their abstract (p. 171) states:

> Children growing up in homes with many books get 3 years more schooling than children from bookless homes, independent of their parents' education, occupation, and [social] class. This is as great an advantage as having university educated rather than unschooled parents, and twice the advantage of having a professional rather than an unskilled father. It holds equally in rich nations and in poor; in the past and in the present; under Communism, capitalism, and Apartheid; and most strongly in China. Data are from representative national samples in 27 nations…

The PISA 2009 dataset could also be explored further with the books in the home issue in mind, since an interaction similar to that found in the present study was observed in multilevel analyses of PISA 2009 reading (Perkins et al., 2012). Finally, it should be noted that the measure of books in the home does not take electronic reading resources (such as e-books or e-readers) into account; nor does it take account of how patterns of reading may have changed alongside developments in digital communications technology (see, for example, OECD [2013]), indicating a clear need to develop and enhance indicators of educationally-supportive home environments for use in future educational surveys.

Related to this, we found substantively important negative associations with pupils having a TV in their bedroom (consistent with Eivers et al., 2010 and Gilleece, Shiel, Clerkin, & Millar, 2012) and owning an iPhone. Moreover, we noted that 53% of pupils had a TV in their bedroom, and 12% reported owning an iPhone, indicating that the issue is quite widespread. This underlines the need for further and ongoing research that keeps abreast of technological developments and changes in children's leisure activities in order to help inform parents about practices that may benefit their children's education.

We found that Irish-medium schools out-performed their English-medium counterparts in reading (but not mathematics or science) by about one-sixth of a standard deviation, after adjusting for the other variables in the model. This is largely consistent with findings from the National Assessment of Irish Reading and Mathematics in Irish-Medium Schools (Gilleece et al., 2012), where pupils in scoileanna lán-Ghaeilge outperformed the NA 2009 pupils in reading by 17 points (or one-third of a standard deviation), and pupils in

Gaeltacht schools outperformed NA 2009 pupils by 3 points (just under one-tenth of a standard deviation) (achievement differences not adjusted for any background characteristics; reading achievement in scoileanna lán-Gaeilge was about what would be expected based on SES, and below what would be expected for mathematics). In mathematics, achievement differences were in the order of one-sixth of a standard deviation. The PT 2011 sample was not explicitly designed to facilitate detailed comparisons of achievement by language of instruction; however, it may be the case that bilingualism, a common feature of many pupils in Irish-medium schools, provides an advantage in reading. For a review of some previous research on this issue, see Chapter 1 of Gilleece et al. (2012).

The detection of random slopes for some of the pupil-level variables in the models has potential policy implications, but these findings would need to be corroborated with other data sources to help interpretation. That the relationship between bullying and achievement varies across schools (as does the incidence of bullying) implies that some schools are highly successful in promoting a safe and respectful environment, while others may struggle to do so, and that in some schools, there is a stronger negative association between bullying and achievement than in others. These may be for reasons relating to the characteristics of pupils in the school, or factors outside of the school (see also Clerkin & Creaven's [2013] analyses in Chapter 3, describing variation in bullying across sub-groups of pupils). In any case, the association between bullying and achievement was found to be substantial in the present study in all three domains, and it is recommended that further research be carried out in this area, drawing on other datasets, including data from the Growing Up in Ireland study (which collected both quantitative and qualitative information) and PISA (which collected quantitative information on bullying from 15-year-old students in 2006 and 2009). It would seem important to include explicit measures of cyber bullying in any analyses or review of this issue, since the PT 2011 bullying measure did not include it as an explicit component of the scale.

Random slopes for school starting age were also found in the case of reading and science whereby the lower the school average achievement, the stronger the (positive) association between age and achievement. This finding should be interpreted with respect to the fact that school average age was also positively associated with achievement in all three domains (individual pupil age was not). In a broad sense, these findings suggest that school policies on enrolment age merit review, particularly in light of the national Early Childhood Care and Education scheme, which has been available since 2010. As part of this, a review of research on those characteristics that are relevant to differences in school readiness between children would be useful, in order to guide policy and practice.

Overall, the models explain only a little over one-quarter of the variation in achievement in reading, mathematics and science, meaning that a majority of the achievement differences between pupils remains unaccounted for. This is important, since it implies that quantitative analysis techniques based on cross-sectional designs may only go so far in addressing questions as to what makes a difference with respect to pupils' achievement. Longitudinal data, where a cohort of children is tracked over time, and whose achievement is measured at at least two time-points, offers a better way to address this question, but at present, there is a dearth of Irish longitudinal educational survey data. However, the availability of the second wave of the GUI data has the potential to add to our general understanding of changes in achievement over time, since 9-year-olds, assessed in September 2007-June 2008, were again assessed in August 2011-March 2012 (see www.growingup.ie).

It is also relevant to note that cross-sectional survey data cannot adequately or fully capture the more complex and subtle aspects relating to school and class climate, and the processes underlying teaching and learning in classrooms. This indicates a need to supplement quantitative findings with high-quality observational or interview data to inform

policy and practice in these areas. In other words, that the models failed to find significant associations with measures relating to school climate, teacher or class characteristics does not suggest that they are unimportant; rather that multilevel modelling can only go so far in informing us about these issues. Finally, one can always expect some tension between the aims and design of an international survey and its correspondence to characteristics of national education systems. Some of the teacher measures, in particular teacher specialisation in reading, mathematics or science, are of less relevance in the Irish context than may be the case in other countries that took part in TIMSS and PIRLS and which do have specialist teacher education programmes for primary level teaching.

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This section does not repeat the core references already listed in Chapter 1. These include the three international reports on PT 2011 and the Irish national report and those related to other key studies such as National Assessments and PISA.

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Appendix A

Table A1. Pupil and school/class characteristics used in modelling achievement in PT 2011

Name	Source	Type	Description
Pupil-level variables			
Reading, mathematics and science achievement	Test	Continuous	Each domain with five imputed scores/plausible values, standardised to have a combined mean of 500 and sd of 100
Gender	Pupil Tracking Form	Categorical	0=boy, 1=girl
Age	Pupil Tracking Form	Continuous	Mean=10.35, SD=0.41
Home language*	Pupil & Parent Questionnaires	Categorical	0=Other, 1=English, with Irish coded as missing (due to small numbers of pupils in this group)
Test language	Test	Categorical	0=English, 1=Irish (does not apply to PIRLS)
Books at home*	Pupil Questionnaire	Categorical, dummy variables	10 books or fewer, 11-25 books, 26-100 books, More than 100 books, with 26-100 books as the reference group
Children's books at home	Parent Questionnaire	Categorical, dummy variables	10 books or fewer, 11-25 books, 26-50 books, 50-100 books, more than 100 books, with 26-50 books as the reference group
TV in bedroom	Pupil Questionnaire	Categorical	0=no, 1=yes
Computer in bedroom	Pupil Questionnaire	Categorical	0=no, 1=yes
Own iPhone	Pupil Questionnaire	Categorical	0=no, 1=yes
Parents set aside time for homework*	Pupil Questionnaire	Categorical	0=less than daily basis, 1=on daily basis
Experiences bullying	Pupil Questionnaire	Categorical	0=no, 1=yes, based on experiencing two or more of six forms of bullying at least weekly
Age started school	Parent Questionnaire	Categorical	0=6 or older, 1=5 or younger
Mother's education*	Parent Questionnaire	Categorical, dummy variables	Primary, lower secondary, upper secondary or PLC/apprenticeship, third level, with upper secondary or PLC/apprenticeship as the reference group
Father's education*	Parent Questionnaire	Categorical, dummy variables	Primary, lower secondary, upper secondary or PLC/apprenticeship, third level, with upper secondary or PLC/apprenticeship as the reference group
Number of jobs in household*	Parent Questionnaire	Continuous	Mean=1.13, SD=0.66; part-time employment status coded as 0.5
Parents - time spent reading per week	Parent Questionnaire	Categorical, dummy variables	Less than one hour a week, 1-10 hours a week, more than 10 hours a week, with 1-10 hours a week as the reference group
Parents - perceived importance of reading*	Parent Questionnaire	Categorical	0=disagree/strongly disagree that reading is important, 1=agree/strongly agree that reading is important

Table A1: Pupil and school/class characteristics used in modelling achievement in PT 2011 (continued)

Domain-specific pupil variables			
Pupil - frequency of reading for enjoyment*	Pupil Questionnaire	Categorical, dummy variables	Never, once a week or once a month, every day, with once a week or once a month as the reference group
Pupil - perceived importance of reading*	Pupil Questionnaire	Categorical	0=disagree/strongly disagree that reading is important, 1=agree/strongly agree that reading is important
Pupil - perceived importance of mathematics*	Pupil Questionnaire	Categorical	0=disagree/strongly disagree that mathematics is important, 1=agree/strongly agree that mathematics is important
Pupil - liking of mathematics*	Pupil Questionnaire	Categorical	0=disagree/strongly disagree that they like mathematics, 1=agree/strongly agree that they like mathematics
Pupil - perceived importance of science*	Pupil Questionnaire	Categorical	0=disagree/strongly disagree that science is important, 1=agree/strongly agree that science is important
Pupil - liking of mathematics*	Pupil Questionnaire	Categorical	0=disagree/strongly disagree that they like science 1=agree/strongly agree that they like science
Missing indicator for parent questionnaire	N/A	Categorical	0=not returned, 1=returned
School/class-level variables			
School size	PT 2011 Sampling Datafile	Categorical, dummy variables	Twenty or fewer eligible pupils, 21 to 34 eligible pupils, 35 or more eligible pupils, with 21 to 34 eligible pupils as the reference group.
Urban-rural status	PT 2011 Sampling Datafile	Categorical, dummy variables	City or large town (population 10,000 or more), small town or village (population 1,000 up to 10,000), rural community (population less than 1,000), with small town or village as the reference group
DEIS status	PT 2011 Sampling Datafile	Categorical, dummy variables	DEIS band 1, DEIS band 2, DEIS rural, not under DEIS, with not under DEIS as the reference group
School language of instruction	PT 2011 Sampling Datafile	Categorical, dummy variables	0=English, 1=Irish
Proportion of parents with university education	Parent Questionnaire	Continuous	Mean=0.32, SD=0.19
Average number of full time equivalent jobs per household	Parent Questionnaire	Continuous	Mean=1.09, SD=0.25
Proportion of pupils with another first language	Pupil and Parent Questionnaires	Continuous	Mean=0.06, SD=0.08
Proportion of female pupils	Pupil Questionnaire	Continuous	Mean=0.48, SD=0.29
Average pupil age in years	Pupil Questionnaire	Continuous	Mean=10.35, SD=0.14

*Variable has a missing indicator to preserve cases in the dataset.

Table A1: Pupil and school/class characteristics used in modelling achievement in PT 2011 (continued)

School/class-level variables (continued)			
Absenteeism/Lateness*	School Questionnaire	Categorical	0=absenteeism/lateness not perceived to be a problem, 1=absenteeism/lateness is perceived to be a problem
Parental support*	Teacher Questionnaire	Categorical, dummy variables	Low, medium, high, with medium as the reference group
Class size	Teacher Questionnaire	Categorical, dummy variables	10 or fewer pupils, 11 to 20 pupils, 21 to 30 pupils, 31 to 35 pupils, with 21 to 30 pupils as the reference group
School emphasis on academic success scale	Teacher Questionnaire	Continuous	Mean=0.00, SD=1.000
Safe and orderly school climate scale	Teacher Questionnaire	Continuous	Mean=0.00, SD=1.000
Domain-specific school/class variables			
Teacher specialisation in English*	Teacher Questionnaire	Categorical	0=no, 1=yes
Teacher specialisation in mathematics*	Teacher Questionnaire	Categorical	0=no, 1=yes
Teacher specialisation in science*	Teacher Questionnaire	Categorical	0=no, 1=yes
Perceived shortage of reading teachers*	School Questionnaire	Categorical	0=no, 1=yes
Perceived shortage of mathematics teachers*	School Questionnaire	Categorical	0=no, 1=yes
Perceived shortage of science teachers*	School Questionnaire	Categorical	0=no, 1=yes
Hours of instruction per week – English*	Teacher Questionnaire	Categorical, dummy variables	Up to four hours, four to six hours, more than six hours, with four to six hours as the reference group
Hours of instruction per week – mathematics*	Teacher Questionnaire	Categorical, dummy variables	Up to three hours, three to four hours, more than four hours, with three to four hours as the reference group
Hours of instruction per week – science*	Teacher Questionnaire	Categorical, dummy variables	Up to one hour, one hour to 90 minutes, more than 90 minutes, with one hour to 90 minutes as the reference group

*Variable has a missing indicator to preserve cases in the dataset.

Appendix B

Table B1: Distributions (percentages) for binary categorical variables used in modelling achievement in PT 2011

Level/variable	Percent coded "0"	Percent coded "1"
Pupil-level variables		
Gender	50.8	49.2
Home language*	94.3	5.7
Test language (TIMSS only)	96.1	3.9
TV in bedroom	47.3	52.7
Computer in bedroom	81.0	19.0
Own iPhone	87.7	12.3
Parents set aside time for homework*	17.8	82.2
Experiences bullying	89.7	10.3
Age started school	9.1	90.9
Parents - perceived importance of reading*	14.3	85.7
Pupil - perceived importance of reading*	7.3	92.7
Pupil - perceived importance of mathematics*	4.1	95.9
Pupil - liking of mathematics*	23.9	76.1
Pupil - perceived importance of science*	11.2	88.8
Pupil - liking of science*	13.4	86.6
Missing indicator for parent questionnaire	95.6	4.4
School/class-level variables		
School language of instruction	92.2	7.8
Absenteeism/lateness*	91.1	8.9
Teacher specialisation in English*	83.8	16.2
Teacher specialisation in mathematics*	94.6	5.4
Teacher specialisation in science*	94.1	5.9
Perceived shortage of reading teachers*	93.0	7.0
Perceived shortage of mathematics teachers*	94.0	6.0
Perceived shortage of science teachers*	82.9	17.1

*Variable has a missing indicator to preserve cases in the dataset.

Appendix C

Table C1: Distributions (percentages) across non-binary categorical variables used in modelling achievement in PT 2011

Level/variable	Categories			
Pupil level				
	10 or fewer	11 to 25	26 to 100	More than 100
Books at home*	9.9	22.4	34.3	33.4
	10 or fewer	11 to 25	26 to 50	More than 50
Children's books at home	5.9	14.5	30.4	49.2
	Primary	Lower secondary	Upper secondary, PLC or apprenticeship	Third level
Mother's education*	5.0	12.0	32.9	50.1
	Primary	Lower secondary	Upper secondary, PLC or apprenticeship	Third level
Father's education*	9.6	19.4	30.9	40.1
	Less than 1 hour	1-10 hours	More than 10 hours	
Parents - time spent reading per week	11.5	68.4	20.1	
	Never	Once a week to once a month	Every day	
Pupil - frequency of reading*	42.3	47.6	10.1	
School level				
	DEIS band 1	DEIS band 2	DEIS rural	Not under DEIS
DEIS status	8.5	7.1	3.8	80.6
	10 or fewer	11 to 20	21 to 30	31 to 35
Class size	13.3	20.4	57.3	9.0
	Small	Medium	Large	
School size	20.9	20.8	58.3	
	City or large town	Small town or village	Rural community	
Urban/rural location	55.5	25.1	19.4	
	Low	Medium	High	
Parental support	6.7	33.5	59.8	
	Up to 4 hours	4-6 hours	More than 6 hours	
Hours of instruction per week - English*	35.1	42.0	22.9	
	Up to 3 hours	3-4 hours	More than 4 hours	
Hours of instruction per week – mathematics*	17.6	41.4	41.0	
	Up to 1 hour	1 hour-90 minutes	More than 90 minutes	
Hours of instruction per week - science*	77.7	10.5	11.8	

*Variable has a missing indicator to preserve cases in the dataset.

Appendix D

Table D1: Model of reading achievement

	Parameter estimate	*SE*	*Test statistic**	*df*	*p*
Intercept	466.46	13.43	34.75	207	<.001
Pupil-level variables					
Missing parent questionnaire	-17.25	14.20	-1.22	166	.226
Gender (Boy-Girl)	-14.83	8.19			
Books at home					
10 books or fewer-26 to 100 books	-51.64	8.19			
11 to 25 books-26 to 100 books	-20.40	7.86			
101 or more books-26 to 100 books	14.94	7.35			
Missing books at home	-46.90	14.44			
Children's books at home					
10 books or fewer-26 to 50 books	-18.05	7.78	67.79	4	<.001
11 to 25 books-26 to 50 books	-6.03	7.57			
51 to 100 books-26 to 50 books	14.35	7.25			
More than 100 books-26 to 50 books	25.50	7.03			
TV in bedroom (No-Yes)	-14.03	3.91	-3.59	93	.001
Own iPhone (No-Yes)	-31.52	5.12	-6.15	2218	<.001
Parents make sure that time is made for homework					
Weekly or less often-Every day	19.03	4.39	41.93	2	<.001
Missing make time for homework	-25.62	14.24			
Experiences 2 or more types of bullying behaviour at least weekly (No-Yes)	-42.44	6.25	-6.80	89	<.001
Age starting school (6 or older-5 or younger)**	23.72	9.85	2.41	182	.017
Mother's education					
Primary-Upper secondary, PLC or apprenticeship	-20.93	14.50			
Lower secondary-Upper secondary, PLC or apprenticeship	-12.19	7.85			
Third level-Upper secondary, PLC or apprenticeship	4.08	7.09			
Missing mother's education	5.84	11.78			
Household employment status					
Total number of full-time jobs or equivalent (Part-time=0.5)	12.36	3.71	44.94	2	<.001
Missing household employment status	-14.72	9.95			
Additional domain-specific variables					
Frequency of reading for enjoyment					
Daily-weekly/monthly	16.94	5.61			
Never-weekly/monthly	11.73	8.30			
Missing reading for enjoyment	-34.12	17.89			
Interactions					
Gender and Books at home					
Gender*10 books or fewer	35.26	10.65	14.00	3	.003
Gender*11 to 25 books	15.02	8.80			
Gender*more than 100 books	9.15	8.88			
Gender and mother's education					
Gender*primary	-12.22	18.32	14.00	3	.003
Gender*lower secondary	14.37	11.05			
Gender*third level	18.12	10.53			
Gender and frequency of reading for enjoyment					
Gender*daily	3.38	7.12	9.22	2	.010
Gender*never	-26.22	12.71			
School-level variables					
School language (English-Irish)	17.69	5.99	2.95	207	.004
Average pupil age in years	36.36	13.44	2.71	207	.008
School emphasis on academic success scale	5.80	2.07	2.80	207	.006

Note. Significance tests are not included for variables that are included in interactions.

*The test statistic is a *t*-test for variables measured using a single item, and is a deviance difference test (Chi-square test) for variables measured by more than one item.

**This pupil-level measure varies randomly across schools in its relationship to achievement.

Table D2: Model of mathematics achievement

	Parameter estimate	*SE*	*Test statistic**	*df*	*p*
Intercept	496.84	8.47	58.65	204	<.001
Pupil-level variables					
Missing parent questionnaire	-32.74	10.15	-3.23	248	<.001
Gender (Boy-Girl)	-37.42	6.45			
Books at home					
10 books or fewer-26 to 100 books	-57.22	8.10			
11 to 25 books-26 to 100 books	-29.50	6.60			
101 or more books-26 to 100 books	13.21	6.65			
Missing books at home	-69.39	14.39			
Children's books at home					
10 books or fewer-26 to 50 books	-22.68	8.36	42.33	4	<.001
11 to 25 books-26 to 50 books	-2.361	5.87			
51 to 100 books-26 to 50 books	11.33	5.28			
More than 100 books-26 to 50 books	16.09	5.10			
TV in bedroom (No-Yes)	-13.19	3.91	-3.38	415	.001
Own iPhone (No-Yes)	-39.58	4.60	-8.60	4013	<.001
Experiences 2 or more types of bullying behaviour at least weekly (No-Yes)*	-41.14	6.35	-6.48	58	<.001
Mother's education					
Primary-Upper secondary, PLC or apprenticeship	-16.28	9.64	32.37	4	<.001
Lower secondary-Upper secondary, PLC or apprenticeship	-7.76	5.48			
Third level-Upper secondary, PLC or apprenticeship	11.10	4.34			
Missing mother's education	-4.48	12.32			
Household employment status**					
Total number of full-time jobs or equivalent (Part-time=0.5)	12.17	2.86	38.13	2	< .001
Missing household employment status	-8.32	8.80			
Additional domain-specific variables					
Liking mathematics					
Disagree-agree	20.63	4.12	55.13	2	<.001
Missing liking mathematics	-11.07	12.57			
Interactions					
Gender and books at home					
Gender*10 books or fewer	28.60	12.36	17.90	3	.005
Gender*11 to 25 books	19.29	8.39			
Gender*More than 100 books	21.68	8.65			
School-level variables					
School enrolment size					
Small-Medium	18.51	8.30	10.61	2	.005
Large-Medium	10.00	5.95			
Average pupil age in years	59.33	21.014	2.82	204	.006
Parental support					
Low parental support	-11.41	11.52	12.12	3	.007
High parental support	14.20	6.42			
Missing parental support	-6.94	21.77			

Note. Significance tests are not included for variables that are included in interactions.

*The test statistic is a *t*-test for variables measured using a single item, and is a deviance difference test (Chi-square test) for variables measured by more than one item.

**This pupil-level measure varies randomly across schools in its relationship to achievement.

Table D3: Model of science achievement

	Parameter estimate	*SE*	*Test statistic**	*df*	*p*
Intercept	464.11	14.54	31.92	24	<.001
Pupil-level variables					
Missing parent questionnaire	-18.31	13.73	-1.33	45	.189
Gender (Boy-Girl)	-33.45	8.357			
Books at home					
10 books or fewer-26 to 100 books	-57.14	8.37			
11 to 25 books-26 to 100 books	-25.33	7.05			
101 or more books-26 to 100 books	15.89	6.80			
Missing books at home	-61.07	14.19			
Children's books at home					
10 books or fewer-26 to 50 books	-26.71	7.68	44.43	4	<.001
11 to 25 books-26 to 50 books	-7.53	5.25			
51 to 100 books-26 to 50 books	8.73	5.42			
More than 100 books-26 to 50 books	12.50	5.37			
TV in bedroom (No-Yes)	-14.33	4.33	-3.31	51	.002
Own iPhone (No-Yes)	-30.36	5.06	-6.01	99	<.001
Parents make sure that time is made for homework**					
Weekly or less often-Daily	14.86	5.39	39.13	2	<.001
Missing make time for homework	-39.37	13.72			
Experiences bullying behaviour at least once a week (No-Yes)*	-37.04	5.47	-6.77	370	<.001
Age starting school (6 or older-5 or younger)	24.12	10.07	2.40	27	.024
Mother's education					
Primary-Upper secondary, PLC or apprenticeship	-14.20	9.27	40.28	4	<.001
Lower secondary-Upper secondary, PLC or apprenticeship	-9.67	5.48			
Third level-Upper secondary, PLC or apprenticeship	11.52	4.47			
Missing mother's education	-12.71	9.63			
Household employment status					
Total number of full-time jobs or equivalent (Part-time=0.5)	8.04	3.62	26.13	2	<.001
Missing household employment status	-8.90	9.08			
Additional domain-specific variables					
Liking science					
Disagree-agree	20.43	4.84	65.36	2	<.001
Missing liking science	-46.28	12.74			
Interactions					
Gender and books at home					
Gender*10 books or fewer	36.44	12.18	23.73	3	<.001
Gender*11 to 25 books	20.17	9.53			
Gender*More than 100 books	22.13	8.61			
School-level variables					
School enrolment size					
Small-medium	23.64	9.59	15.25	2	<.001
Large-medium	10.85	7.15			
Average pupil age in years	71.96	22.37	3.22	207	.002

Note. Significance tests are not included for variables that are included in interactions.

*The test statistic is a *t*-test for variables measured using a single item, and is a deviance difference test (Chi-square test) for variables measured by more than one item.

**This pupil-level measure varies randomly across schools in its relationship to achievement.

Table D4: Gender interactions for reading

	Boys		Girls	
Number of books	% in group	Score estimate	% in group	Score estimate
10 books or fewer	13.5	414.8	6.3	435.3
11 to 25 books	25.6	425.7	19.0	446.3
26 to 100 books	45.3	446.5	53.2	451.6
101 or more books	15.6	475.6	21.5	475.7
Mother's education	% in group	Score estimate	% in group	Score estimate
Primary	4.4	445.5	5.2	418.5
Lower secondary	11.8	454.3	11.0	453.8
Upper secondary, PLC, or apprenticeship	37.4	446.5	34.6	451.6
Third level	46.4	470.5	49.2	473.8
Frequency of reading	% in group	Score estimate	% in group	Score estimate
Never	14.4	478.2	5.6	437.1
Once a week or once a month	49.1	466.5	46.1	451.6
Every day	36.5	483.4	48.3	472.0

Note. Score estimates are based on the intercept plus the relevant parameters in Table D1.

Table D5: Gender interactions for mathematics and science

	Mathematics				Science			
	Boys		Girls		Boys		Girls	
Number of books	% in group	Score estimate	% in group	Score estimate	% in group	Score estimate	% in group	Score estimate
10 books or fewer	13.5	439.62	6.3	430.79	13.5	406.97	6.3	409.96
11 to 25 books	25.6	467.33	19.0	449.21	25.6	438.78	19.0	425.49
26 to 100 books	45.3	496.84	53.2	459.41	45.3	464.11	53.2	430.66
101 or more books	15.6	510.05	21.5	494.31	15.6	479.99	21.5	468.67

Note. Score estimates are based on the intercept plus the relevant parameters in Tables D2 and D3.

Appendix E

Table E1: Summary of models of achievement in reading, mathematics and science, with school as the cluster variable

		Reading	*Maths*	*Science*
Intercept		466.963	504.17	464.35
Pupil-level variables				
Gender (Boy)	Girl	-14.71	-37.59	-34.01
Books at home (26 to 100 books)	10 books or fewer	-51.20	-58.19	-57.41
	11 to 25 books	-20.28	-29.00	-25.06
	101 or more books	14.95	12.96	15.73
Children's books at home (26 to 50 books)	10 books or fewer	-17.83	-22.09	-25.17
	11 to 25 books	-5.91	-2.04	-7.19
	51 to 100 books	14.15	10.75	8.31
	More than 100 books	25.21	16.46	12.63
TV in bedroom (No)	Yes	-14.04	-13.67	-14.02
Own iPhone (No)	Yes	-32.10	-39.44	-30.54
Parents make sure that time is made for homework (Weekly/less often)		19.17		14.58
Experiences bullying behaviour at least once a week (No-yes)		-42.81	-41.32	-36.67
Age starting school (6 or older-5 or younger)		22.85		23.30
Mother's education Upper secondary, PLC or apprenticeship	Primary	-22.01	-17.76	-15.01
	Lower secondary	-11.89	-8.62	-10.03
	Third level	4.32	11.31	11.66
Total number of full-time jobs or equivalent (part-time=0.5)		12.40	12.02	7.87
Additional domain-specific variables				
Frequency of reading for enjoyment-Weekly/monthly	Daily	16.94		
	Never	12.12		
Likes maths/science (Agree)	Disagree		20.49	20.48
Interactions				
Gender and books at home	Gender*10 books or fewer	35.59	30.19	38.21
	Gender*11 to 25 books	14.53	17.74	19.22
	Gender*more than 100	9.21	21.60	22.09
Gender and mother's education	Gender*primary	-10.67		
	Gender*lower secondary	13.61		
	Gender*third level	17.82		
Gender and frequency of reading for enjoyment	Gender*daily	3.09		
	Gender*never	-26.56		
School-level variables				
School enrolment size (Medium)	Small		21.28	23.61
	Large		9.24	10.97
School language (English)	Gaeilge	17.06		
Average pupil age in years		24.84	57.12	62.81
School emphasis on academic success scale		5.28		

Note. Parental support is not included in the model for mathematics as it is a teacher-level variable. Parameter estimates can be compared with those in Table 10.4.

Table E2: Percentages of variance explained in final models of reading, mathematics and science, using school as the cluster variable, and with and without school DEIS status

Model/level	*Reading*	*Mathematics*	*Science*
Model (shown in Table D1)	%	%	%
Between	77.7	51.3	53.4
Within	21.7	20.6	20.1
Total	27.4	25.5	26.6
Model with DEIS status	%	%	%
Between	81.1	56.0	58.8
Within	21.7	20.6	20.0
Total	27.7	26.2	27.7

Table E3: Percentages of variance explained by models with DEIS status only, DEIS with pupil gender and socioeconomic background, DEIS with pupil home environment, and DEIS with pupil gender and socioeconomic background *and* pupil home environment

Model/level	*Reading*	*Mathematics*	*Science*
DEIS only (Model 1)	%	%	%
Between	43.8	37.7	34.8
Within*	-0.2	-0.1	-0.1
Total	5.1	6.6	7.5
School DEIS status with pupil gender and socioeconomic background (Model 2)	%	%	%
Between	65.1	46.3	42.9
Within	10.2	8.2	7.5
Total	16.9	15.0	15.2
School DEIS status with pupil home environment (Model 3)	%	%	%
Between	77.4	54.2	52.4
Within	20.5	18.6	19.3
Total	27.4	25.0	26.5
School DEIS status, pupil gender and socioeconomic background, and pupil home environment (Model 4)	%	%	%
Between	79.8	56.9	54.5
Within	22.5	21.7	21.6
Total	29.5	27.9	28.8
Variance explained by DEIS over pupil gender and socioeconomic background	%	%	%
Between	22.5	21.1	21.4
Within*	1.0	-0.1	-0.1
Total	3.6	3.7	4.6
Variance explained by DEIS over pupil home environment	%	%	%
Between	11.3	10.9	12.0
Within*	-0.2	-0.1	-0.1
Total	1.2	1.9	2.6
Variance explained by DEIS over pupil gender and socioeconomic background, *and* pupil home environment	%	%	%
Between	8.7	8.8	10.5
Within*	-0.2	-0.1	-0.1
Total	0.9	1.5	2.2

*Small negative changes in explained variance associated with the inclusion of the school-level variables only should not be interpreted as a disimprovement in model fit – rather, there is some error around these estimates and these values should be interpreted as no change in model fit.

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