PISA 2009: The Performance and Progress of 15-year-olds in Ireland

Summary Report

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Preface

The Programme for International Student Assessment (PISA) is an international assessment of the knowledge and skills of 15-year-olds in reading, mathematics and science, sponsored by the Organisation for Economic Co-operation and Development (OECD). It takes place in three-yearly cycles, the first of which was in 2000. In each cycle, one of the knowledge domains is designated as the main focus of the assessment. In the first cycle, reading was the main focus, in 2003 mathematics, and in 2006 science. Reading became the main focus again in 2009, allowing a detailed examination of changes since 2000 in student reading performance and attitudes towards reading. Students in 65 countries (including all 33 OECD countries) participated in PISA 2009, which was implemented in March/April in Ireland. A new element was the implementation of an Electronic Reading Assessment (ERA) in 19 countries, including Ireland. This assessment, which focuses on students' understanding of digital texts, was administered to a subsample of the students who participated in the paper-based assessment. Results of the ERA will be published in June 2011.

Several reports based on previous PISA cycles have been published. National reports for PISA 2000, 2003 and 2006 (Shiel, Cosgrove, Sofroniou & Kelly, 2001; Cosgrove, Shiel, Sofroniou, Zastrutski & Shortt, 2005; Eivers, Shiel & Cunningham, 2008) are available at www.erc.ie/pisa. Teachers' guides to reading literacy (Cosgrove, Sofroniou, Kelly & Shiel, 2003), mathematical literacy (Shiel, Perkins, Close & Oldham, 2007) and scientific literacy (Eivers, Shiel & Pybus, 2008) have also been published in Ireland and are also available at www.erc.ie/pisa. Readers can access a range of reports based on PISA that have been published by the OECD at www.pisa.oecd.org. This report summarises the key findings for Ireland in PISA 2009 and is published at the same time as the OECD's initial report on PISA 2009, which appears in five volumes (OECD, 2010a; 2010b; 2010c; 2010d; 2010e). A more in-depth report on the 2009 PISA results for Ireland will be published in late 2011.

This report consists of seven chapters. Chapter 1 provides a background to the study and outlines the key features of the PISA survey design. Chapter 2 describes the reading achievement of students in Ireland and compares their performance to the OECD average and to that of students in other countries. A comparison of the reading achievement of students in 2009 and 2000 is also provided. Student achievement in mathematics and science is presented in Chapter 3. Chapter 4 examines student- and school-level factors that are associated with achievement. Chapter 5 looks at students' reading engagement and approaches to learning and Chapter 6 examines students' access to and use of ICTs. Finally, Chapter 7 suggests some interpretations of the changes in student achievement in Ireland since earlier PISA cycles.

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List of Abbreviations

DEIS	Delivering Equality of Opportunity in Schools
ERA	Electronic Reading Assessment
ESCS	Economic, Social and Cultural Status
ICCS	International Civic and Citizenship Education Study
ICT	Information and Communications Technology
OECD	Organisation for Economic Co-operation and Development
PISA	Programme for International Student Assessment
SD	Standard Deviation
SEN	Special Educational Needs
SES	Socioeconomic Status
SSP	School Support Programme (under DEIS – see above)
TALIS	Teaching and Learning International Survey

Where the terms 'significantly higher' and 'significantly lower' are used in this report, they denote statistically significant differences, which may or may not be substantive.

Executive Summary

The Programme for International Student Assessment (PISA) is a project of member states of the Organisation for Economic Co-operation and Development (OECD). PISA assesses the knowledge and skills of 15-year-olds in reading, mathematics and science in three-yearly cycles, with one subject area ('domain') designated as the main focus in each cycle. PISA aims to assess students' preparedness for the reading, mathematical and scientific demands of future education and adult life and therefore focuses on 'real-life' tasks rather than on specific curricular knowledge. In addition to reporting on student performance within and across cycles[1], the survey provides information on school and student factors associated with performance. Reading literacy was the main focus of PISA 2009, with 65 countries/economies, including all OECD-member states, taking part. In Ireland, 3,937 students in 144 post-primary schools participated when the assessment took place in spring 2009. PISA is the largest international survey of education and policymakers use the results not only to inform educational policy but also economic policy since the study is based on a 'knowledge economy' model.

Reading Literacy

Ireland's mean score on reading literacy in 2009 was 495.6 points[2], which is not significantly different from the OECD average (493.4). Ireland's overall rank is 21st among 65 participating countries[3] and 17th of 34 OECD countries[4]. The highest-performing countries on reading were Shanghai-China, Korea, Finland, Hong Kong-China, Singapore, Canada, New Zealand and Japan. Countries with mean scores not significantly different from Ireland's included the United States, France, Germany and the United Kingdom. Female students in Ireland had a mean score that was some 39.2 points higher than males – the same as the OECD average gender difference. In Ireland, just over one in six students (17.2%) achieved below Level 2 on the PISA reading proficiency scale (i.e., below the minimum level regarded as necessary for future education and adult life), compared to an OECD average of 18.8%. Hence, over one in six students in Ireland is estimated to have poor reading skills, with twice as many males (23.2%) as females (11.3%) in this group. Just 7.0% of students in Ireland achieved at or above Level 5 (denoting strong reading performance) compared with an OECD average of 7.6%. Students in Ireland achieved a mean score that was significantly above the corresponding OECD average on one of the five reading subscales – reflect and evaluate.

Ireland's mean score in 2009 is some 31 points (about one-third of a standard deviation) lower than in 2000, when reading was also a major assessment domain. This decline is the largest across all 39 countries that participated in both PISA 2000 and PISA 2009[5], resulting in Ireland's rank falling from 5th to 17th among such countries. The performance of students in Ireland declined uniformly across all ability

[1] PISA compares performance between major domains (e.g., reading literacy in 2000 and 2009), and between major and minor domains (mathematics between 2003 and 2009; science between 2006 and 2009).
[2] The OECD country average of 500, and the OECD standard deviation of 100 were set in 2000 (reading literacy), 2003 (mathematics) and 2006 (science), i.e., when each domain was first a major domain.
[3] Like mean achievement scores, ranks are estimates, with 'true' ranks falling into an interval around estimated ranks.
[4] Thirty-three OECD member countries and accession candidate Estonia.
[5] Ireland's performance on reading fell by 11.2 points between 2000 and 2003 (from 526.7 to 515.5), while there was a slight increase between 2003 and 2006 (from 515.5 to 517.3). Therefore, the 31-point drop in reading performance from 2000 to 2009 includes the 9.4-point drop between 2000 and 2006.

levels and so cannot be attributed to one particular group such as very high or very low achievers doing poorly. The percentage of lowest-performing students (those scoring below proficiency Level 2) increased from 11.0% to 17.2%, an increase that was more marked in males (10% more) than in females (3% more). Conversely, the percentage of highest performing students in Ireland (those scoring at or above Level 5) halved from 14.2% in 2000 to 7.0% in 2009. There has also been an increase in the gender difference in Ireland, from 28.7 points (in favour of females) to 39.2 points and, as noted above, the gender difference in Ireland is now the same as the OECD average difference. The decrease between 2000 and 2009 was greater for males (37 points) than for females (27 points).

Mathematics

Ireland's mean mathematics score in 2009 was 487.1 – a score that is significantly below the corresponding OECD average of 495.7. Ireland ranked 32nd among 65 participating countries and 26th of 34 OECD countries. Highest-achieving countries included Shanghai-China, Singapore, Hong Kong-China, Korea, Chinese Taipei and Finland. Countries with mean scores not significantly different from the OECD average included Austria, Poland and France. The mean scores of Portugal, Spain and the United States were below the OECD average, and not significantly different from Ireland's. Male students in Ireland achieved a mean score of 490.9, while females achieved a mean of 483.3. The difference of 7.5 points is not statistically significant. In Ireland, 20.8% of students scored at or below Level 1 (indicating very low performance), compared with an OECD average of 22.0%. Just 6.7% of students were classified as high achievers, scoring at or above Level 5, compared to an OECD average of 12.7%.

Ireland's performance in mathematics declined by 16 points (or one-sixth of a standard deviation) since 2003 – the second largest decline among countries participating in both years[6] – while its rank dropped from 20th to 26th among such countries. The decline between 2003 and 2009 was greater for males (19 points) than for females (12 points).The decline in mathematics was fairly uniform across the student range of ability, with a slightly more pronounced decline at the upper end of the achievement distribution, where 6.7% scored at or above Level 5, compared with 11.4% in 2003.

Science

In Ireland, the mean score on science was 508 in both 2006 and 2009, indicating no change in performance. Moreover, Ireland's mean science score is still significantly above the OECD average. Ireland's overall rank is 20th out of 65 countries and 14th of 34 OECD countries, and has climbed two places from 20th to 18th among countries participating in both years. Similar to previous PISA cycles, gender differences in science remain small and non-significant across OECD countries and in Ireland. The percentage of students in Ireland in 2009 that scored at or above Level 5 (8.7%) was about the same as the OECD average (8.5%), while marginally fewer students in Ireland (15.2%) than on average across OECD countries (18.0%) achieved at or below Level 1. High-scoring countries include Shanghai-China, Finland, Hong Kong-China, Singapore, Japan, Korea and New Zealand. Although not significantly different from

[6] Ireland's performance in mathematics declined slightly from 502.8 in 2003 to 501.5 in 2006. Therefore, the majority of the decline in mathematics between 2003 and 2009 occurred between 2006 and 2009 (over 14 of the 16 points).

the OECD average, the mean score of the United States is also not significantly different from that of Ireland.

Characteristics Related to Achievement

Several factors relate to performance on PISA. Here, the focus is on factors associated with reading literacy and outcomes relating to Information and Communication Technologies (ICTs).

- Forty-two percent of students in Ireland reported that they never engaged in reading for enjoyment (compared to 37.4% on average across OECD countries), while 15.8% reported reading for enjoyment for more than one hour a day. The mean score of students who read for enjoyment for more than one hour per day was almost 100 points higher than that of students who did not read for enjoyment. Males (47.5%) were more strongly represented among non-readers than females (36.2%). There were significantly more non-readers in 2009 (41.9%) than in 2000 (33.4%). Other countries also had a significant increase in the percentage of students not reading for enjoyment. For example, in Finland, this increased from 22.4% in 2000 to 33.0% in 2009.
- Students in Ireland achieved mean scores that were above the corresponding OECD averages on scales measuring perceived usefulness of strategies for understanding and remembering information in texts and strategies for summarising information, with females in Ireland achieving higher average scores on both scales. In Ireland, the correlation between summarising and reading performance (0.42) was marginally stronger than that between understanding and remembering information and reading performance (0.36).
- A measure of socioeconomic status, the PISA index of economic, social and cultural status (ESCS)[7], was associated with reading performance. Students in Ireland in the top third of the ESCS distribution had a mean reading score that was 76 points higher than students in the bottom third. Similarly, on an aspect of home educational resources (number of books in the home), students with 0-10 books in the home had a mean score that was 115 points lower than students with over 500 books. There was a small increase in student-level ESCS between 2000 and 2009 but no change in home educational resources.
- Both Irish-born ('native') students (92.0% of all students, mean = 501.9) and non-Irish-born ('migrant') students[8] who spoke English or Irish at home (4.5%, 499.7) had significantly higher mean reading scores than migrant students who spoke other languages at home (3.5%, 442.7). Both native students (91.7%[9], mean = 501.9) and second-generation migrant students (1.4%, 508.2) had higher mean reading scores than first-generation migrants (6.8%, 465.7).
- Although students in Ireland reported relatively high levels of access to ICT resources at home, and average levels at school compared to students in other OECD countries, they underused those resources in both locations. For example, 92.5% reported that they never or hardly ever posted their work on a school website, while 75.2% reported that they never or hardly ever used

[7] The ESCS measure is a composite that includes parental occupation, parental education, home educational climate, material and cultural possessions in the home, and number of books in the home.
[8] The OECD defines migrant students as students born in Ireland with both parents born outside Ireland (second-generation migrants) and those students who were born outside Ireland with both parents also born outside Ireland (first-generation migrants).
[9] Unlike the previous variable, based on both immigrant and language status, this is a standalone variable. The valid percent is slightly lower due to a lower level of missingness on this variable.

e-mail at school. Students in Ireland had a mean score on a scale of self-confidence in performing higher-level ICT tasks that was significantly below the OECD average.

- School-level variables associated with reading achievement include school average ESCS (with higher-ESCS schools doing better), and school sector/ gender composition (with girls' secondary schools outperforming all other school types). However, the latter finding should be interpreted with respect to variation in socioeconomic composition across school types.

Interpreting Changes in Performance on PISA

In reflecting on the findings relating to change arising from PISA, two questions arise. First, are the declines recorded for students in Ireland in performance on tests of reading (between 2000 and 2009) and mathematics (between 2003 and 2009) indicative of real declines in the knowledge and skills of students? Or, is it possible that factors associated with the administration of PISA in 2009 and/or linking data from one administration to another have resulted in an inadequate assessment of the knowledge and skills of students, in which case the declines would be artefacts of the assessment, rather than real declines in achievement? The available evidence provides some support for both positions.

First, factors that may have contributed to a real decline in student achievement in the Irish education system during the past decade are considered:

- Demographic changes that include an increase in the percentage of students with an immigrant background from 2.3% in 2000 to 8.3% in 2009, and an increase in the percentage of students who speak a language other than English/Irish from 0.9% in 2000 to 3.6% in 2009 may have impacted on student achievement levels. Whereas in 2000, migrant students who spoke another language obtained a higher mean score than those who spoke English/Irish, by 2009, migrant students who spoke another language did significantly less well than speakers of English/Irish, reflecting changes in the size and composition of migrant groups between the two assessments. Other demographic changes between 2000 and 2009 include an increase in the proportion of students with special educational needs sitting PISA (which cannot be accurately quantified) and a decline in the percentage of early school leavers before age 15 (from 2.1% to 1.5%). All of these changes can be expected to have made some contribution to lower average scores reported in 2009.
- Changes in the way 15-year-old students were distributed in post-primary schools may also have impacted on student scores. The percentage of 15-year-olds in Transition Year increased from 16.0% in 2000 to 24.0% in 2009, while the percentage in Fifth Year dropped from 18.6% to 14.4%, with both changes reaching statistical significance. The largest within grade-level decline in reading (50 points) occurred for students in Fifth Year between 2000 and 2009, while the largest decline in mathematics (33 points) occurred for students in Transition Year between 2003 and 2009. The decline in reading in Fifth Year may be due to a shift of more able students from Fifth Year to Transition Year, while the decline in mathematics in Transition Year may reflect a mismatch between students' mathematical experiences in Transition Year and the requirements of the PISA mathematics test.
- Changes in the curriculum experiences of students might be expected to impact on their achievements. Although the experiences of students who sat

PISA in 2009 differed from those who sat the assessment on earlier occasions, this does not seem to have affected performance. The majority of PISA 2009 students would have experienced aspects of the revised Primary School English Curriculum introduced in 2001-2002, and the revised Primary School Mathematics Curriculum introduced in 2002-2003. While there is some evidence from Inspectorate reports that teachers experienced difficulties in the early stages of implementing these curricula, results of national assessments of reading and mathematics conducted in 1998/99 and 2004 did not show any changes in average performance. Although a new mathematics curriculum, Project Maths, was introduced into schools from 2008 onwards, at the time of PISA 2009 it had only been implemented in 24 pilot schools, and these contributed just 35 students (all of them in Fifth Year) to the PISA 2009 sample. Given the very small numbers, it can be concluded that Project Maths did not influence the performance of students in Ireland. The introduction of science as a subject in primary schools in 2003-2004 and the implementation of the revised Junior Certificate Science Syllabus at post-primary level from 2003 onwards may have mitigated the effects of changes in demographics that might otherwise have lowered performance in science in PISA 2009.

To address the second issue – that the decline in performance on PISA cannot be taken as proof of a decline in students' actual achievements – evidence relating to factors that may indicate changes in the administration of PISA in 2009, and/or problems in scaling achievement, are considered.

- Differences in samples or in response rates from one administration to another would likely be reflected in student performance. In all PISA cycles to date, Ireland fully met the sampling requirements and response rates established by the OECD. While Ireland participated in two international studies in 2009 (the International Civic and Citizenship Education Study as well as PISA), a review of the two samples indicated that both were representative of the population of schools in 2009, and were similar to the PISA 2000 sample in terms of key school-level characteristics such as socioeconomic status and sector/gender composition. The inclusion in 2009 of an additional implicit stratifying variable – school socioeconomic status – was not found to have negatively impacted the quality of the PISA sample. However, the 2009 sample was found to include eight 'low-scoring' schools – schools with average reading and mathematics achievement scores that were considerably lower than the lowest school mean scores in 2000. The presence of these schools in the 2009 sample may be attributed to random sampling fluctuation or to some other factor or set of factors.
- A procedural change introduced in Ireland in PISA 2009 with the potential to affect students' performance was the involvement of teachers in some participating schools in test administration.[10] Prior to this, all PISA testing in Ireland had been supervised by external administrators. Quality monitoring, conducted by the international PISA contractor, verified no substantial differences in test administration between teachers and external administrators in a subset of schools. Students administered the PISA tests by teachers in their school achieved a mean score that was five points lower than that of students administered the test by external administrators. However, the

[10] Tests could not be administered by the students' own English, mathematics or science teachers.

difference could be accounted for by differences in school average socioeconomic status.

- Survey fatigue could have impacted on the way in which schools and students responded to the PISA test administration in 2009. Post-primary schools were involved in three international studies in the 2007-08 and 2008-09 school years. Given the limited pool of such schools, some were selected for studies in both school years, and this may have induced survey fatigue, at least among school staff. At a more general level, students themselves may not have engaged with the 2009 PISA assessment to the same extent that their counterparts engaged with earlier assessments. However, while there is evidence of greater levels of skipping test items in 2009, it is not clear if this can be attributed to disengagement with the test, an inability to attempt particular items, or some combination of these.
- It is likely that issues about the construction of achievement scales and establishing links (trends) across cycles contributed to the low scores of students in Ireland, particularly in reading. In scaling achievement data, PISA operates a backwards linking system, such that performance in 2009 is linked to 2006, which, in turn, is linked to 2003, and so on. One implication of this is that the 9 score-point decrease in reading literacy between 2000 and 2006 contributed to the 31-point decline observed between 2000 and 2009. In contrast, a decline of only 2 points between 2003 and 2006 was carried forward to Ireland's mathematics score in 2009 (i.e., most of the decline occurred between 2006 and 2009). In 2012, when the reading link will be back to 2009 only, earlier declines in achievement (which may have been due to changes in test booklet design) are unlikely to be taken into account.
- While percent correct scores for students in Ireland in reading literacy and mathematics were lower in PISA 2009 than in earlier PISA cycles, the approach taken to scaling the data, which assumes that test items have the same measurement properties across countries, and establishing trends (through a series of backwards links) poses problems. In other words, while there has been a decline in achievement, scaling seems to have overestimated the size of the decline, in particular for reading. This is compounded by the small number of link items used to establish the reading trend, and inconsistencies between the difficulty levels of link items (which were relatively easy) and non-link and new test items (which were considerably more difficult). The assumption in the process of constructing achievement scores that new items are measuring the same thing as the link items has resulted in an under-estimate of student achievement, since it was found that on 65% of reading items, student percent correct scores were higher than PISA reading scores would have predicted, and this is particularly marked in the case of the new reading items.

This report makes an initial attempt to unravel changes in the performance of students in Ireland across PISA cycles. Once international student-level item data for PISA 2009 become available, it will be possible to examine changes in performance in Ireland in more detail in the broader international context. Finally, in interpreting the outcomes of PISA 2009, it might be noted that we are unaware of corroborating evidence of large and significant declines in student achievement in post-primary schools over the past decade. Until such evidence becomes available, and the outcomes of PISA 2009 have been examined in greater detail, it would seem important to adopt a measured approach if taking actions based on those outcomes.

Chapter 1: Overview of PISA

What is PISA?

The Programme for International Student Assessment (PISA) is a project of the Organisation for Economic Co-operation and Development (OECD). PISA assesses the knowledge and skills of 15-year-olds in reading, mathematics and science in three-yearly cycles, with one subject area ('domain') designated as the main focus of the assessment in each cycle. The first cycle, in which reading was the main focus, took place in 2000. In 2003, mathematics was the main focus, while in 2006 it was science. Reading was the main focus once again in 2009. PISA aims to assess students' preparedness for the reading, mathematical and scientific demands of future education and adult life and, therefore, focuses on 'real-life' tasks rather than specific curriculum knowledge.

In 2009, students in 65 countries/economies, including Ireland, participated in the assessment (Table 1.1), making PISA 2009 the largest international survey of education to date.

Table 1.1: Countries participating in PISA 2009

OECD Countries		Partner Countries/Economies	
Australia	Korea	Albania	Liechtenstein
Austria	Luxembourg	Argentina	Lithuania
Belgium	Mexico	Azerbaijan	Macao-China
Canada	Netherlands	Brazil	Montenegro, Republic of
Chile*	New Zealand	Bulgaria	Panama
Czech Republic	Norway	China (Shanghai)	Peru
Denmark	Poland	Chinese Taipei	Qatar
Finland	Portugal	Colombia	Romania
France	Slovak Republic	Croatia	Russian Federation
Germany	Slovenia*	Dubai	Serbia, Republic of
Greece	Spain	Estonia*	Singapore
Hungary	Sweden	Hong Kong-China	Thailand
Iceland	Switzerland	Indonesia	Trinidad and Tobago
Ireland	Turkey	Jordan	Tunisia
Israel*	United Kingdom	Kazakhstan	Uruguay
Italy	United States	Kyrgyzstan	
Japan		Latvia	

*Chile, Israel and Slovenia joined the OECD in 2010. Estonia is an accession candidate country.

Who Takes Part in PISA?

In Ireland, 160 schools were randomly selected and invited to participate in PISA 2009. Before selection, schools, following classification by type (secondary, community/comprehensive, vocational), size, gender composition and socioeconomic composition, were selected in such a way as to ensure a nationally representative mix. Of the schools selected, 144 participated, giving a weighted school response rate of 88.4%. Sampling weights were applied to the data to ensure that the final sample reflects the population from which it was drawn. In the second stage of sampling, up to 35 15-year-old students in each selected school were chosen at random to participate in PISA, from a list of all 15-year-olds in the school. Just over 4% of selected students did not participate in the test due to special educational needs, limited experience of the language of instruction or because they were not age-

eligible. After refusals and absences were taken into account, 3,937 students completed the assessment, giving a weighted student response rate of 83.8%. Both the school and student response rates in Ireland exceeded the response rate standards set by the OECD (85% and 80%, respectively). Of the students who participated in Ireland, 59.1% were in Third Year, 24.0% in Transition Year, 14.4% in Fifth Year, and 2.5% in First[11] or Second Year.

Five of the participating schools were Irish medium. These were provided with both English and Irish versions of all materials except the reading test which was offered only in English. Students in these schools chose on the day of the assessment which versions of the test booklet and student questionnaire to complete.

Administration of the Assessment

The PISA assessment was administered to students in Ireland during March and April 2009. In 112 schools the assessment was administered to students by a teacher in their school. External test administrators administered the assessment in 32 schools. All test administrators received training in accordance with international procedures and standards prior to the administration of the assessment.

PISA uses a rotated test design meaning that each student was presented with a booklet containing just a portion of the questions that make up the entire item pool. Thirteen booklets were used and all contained reading items, while mathematics and science items appeared in nine of the booklets. Each booklet took two hours to complete. Students and principals also completed questionnaires which collected information on student and school characteristics that could be used to put student achievement in context. Up to 15 students in each school were also selected at random to participate in the Electronic Reading Assessment (ERA). This assessment was administered on computers after the paper-and-pencil test and lasted one hour. The ERA also used a rotated test design. Generally, schools completed the print assessment in the morning and the ERA in the afternoon of the same day. Results from the ERA will be published in June 2011.

In Ireland, teachers of Third Year English were asked to complete a questionnaire which gathered information on instructional practices and the implementation of the Junior Certificate English syllabus. Results arising from this questionnaire will be published in early 2011.

What does PISA Measure?

The PISA assessments are guided by frameworks which define the areas to be assessed. The frameworks for reading, mathematics and science are outlined in the sections that follow. The full PISA 2009 framework (OECD, 2009) and sample test items can be downloaded from www.pisa.oecd.org.

Framework for Reading Literacy

For PISA 2009 reading literacy is defined as 'understanding, using, reflecting on and engaging with written texts, in order to achieve one's goals, to develop one's knowledge and potential, and to participate in society' (OECD, 2009, p. 25). This definition builds on that used in PISA 2000 by including engagement in reading and metacognition as components of reading literacy. Reading engagement is measured

[11] Two First Year students participated. These students were amalgamated with Second Year students for reporting purposes.

using two constructs: engagement with texts (both print and electronic) for enjoyment, and classroom reading engagement. Metacognition in reading refers to the awareness of, and ability to use, a variety of appropriate strategies when processing texts in a goal-oriented manner. It was assessed in PISA by asking students to evaluate the quality and usefulness of a number of reading comprehension strategies.

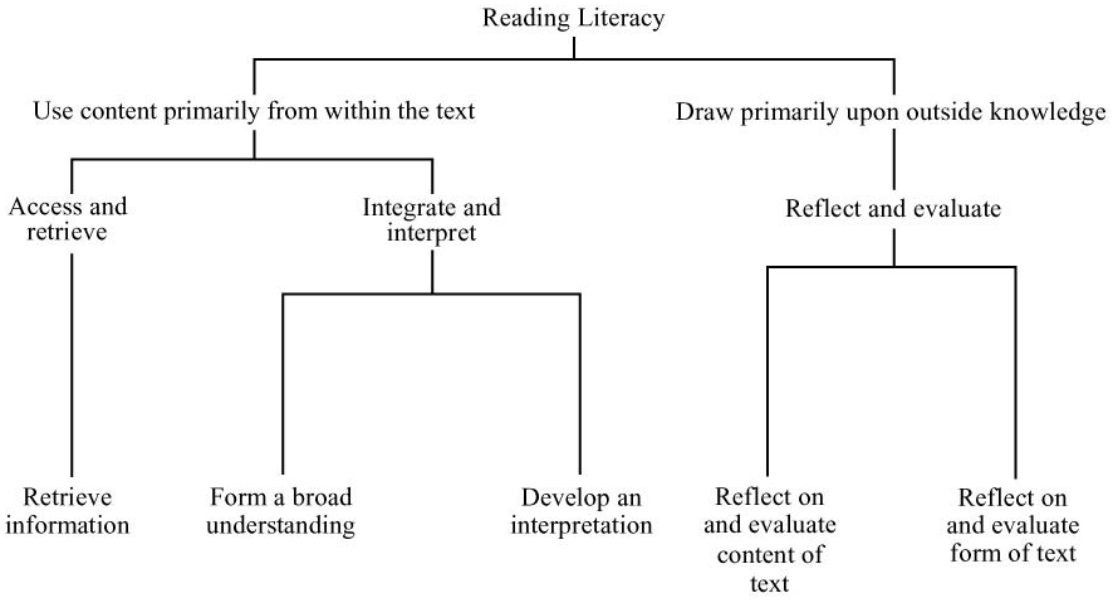
The PISA reading literacy assessment is built on three dimensions: *situation* – the range of broad contexts or purposes for which reading takes place; *text* – the range (type) of material that is read; and *aspect* – the cognitive approach that determines how readers engage with a text. All three contribute to ensuring broad coverage of the domain. Reading situations refer to the contexts and uses for which the author constructed a text. The four situations in which PISA reading items are located are Personal, Public, Occupational, and Educational.

There are four main text classifications in PISA 2009: medium, environment, text format, and text type. **Medium** refers to the form in which texts are presented – print (paper) or electronic (hypertext). **Environment** applies only to electronic-medium texts and refers to either an *authored* environment (in which the content cannot be modified; e.g., a web page) or a *message-based* environment (in which the reader has the opportunity to add to or change the content; e.g., e-mail, blog). **Text format** refers to whether a text is continuous, non-continuous, mixed or multiple. Continuous texts are formed by sentences organised into paragraphs. Non-continuous texts are composed of a number of lists. Mixed texts contain elements of both continuous and non-continuous formats and multiple texts are texts that are generated and make sense independently, but are juxtaposed for a particular occasion.

Five **text types** were identified for PISA 2009: Description (e.g., information report in prose, catalogue, blog diary); Narration (e.g., play, comic strip story); Exposition (e.g., book review, rating of online shopping item); Argumentation (e.g., advertisement, blog in an online forum), and Instruction (e.g., recipe, instructions for operating software). It is acknowledged that both continuous and non-continuous texts can have a descriptive, narrative, expository, argumentative or instructional purpose.

Aspects are the cognitive strategies, approaches or purposes that readers use to negotiate their way into, around, and between texts. Five aspects guided the development of reading literacy assessment tasks: retrieving information; forming a broad understanding; developing an interpretation; reflecting on and evaluating the content of a text; and reflecting on and evaluating the form of a text. For reporting purposes, these five aspects were organised into three broad aspect categories, and are reported as scales: access and retrieve (navigating a text to locate and retrieve a particular piece of explicitly stated information); integrate and interpret (processing what is read to make internal sense of a text); and reflect and evaluate (drawing upon knowledge, ideas or attitudes beyond the text in order to relate the information provided in the text to one's own conceptual and experiential frames of reference) (Figure 1.1).

Figure 1.1: Relationship between the reading framework and the aspect subscales



The PISA 2009 reading assessment is based on the main elements of the reading literacy framework. The distribution of the 107 reading items by text structure, situation, aspect and text type is presented in Table 1.2. Performance on reading literacy is reported with reference to a combined print reading literacy scale as well as five subscales (access and retrieve; integrate and interpret; reflect and evaluate; continuous texts; and non-continuous texts). Changes in performance since PISA 2000 are also reported, mainly on the basis of performance on a subset of common items, which are broadly representative of the different dimensions of the 2009 reading framework.

Table 1.2: Distribution of 2009 reading items by structure, situation and process (N=107)

Text Structure	%	Aspect	%	Situation	%
Continuous	61.8	Access & retrieve	23.7	Personal	29.0
Non-continuous	29.0	Integrate & interpret	51.1	Public	16.0
Mixed	5.3	Reflect & evaluate	25.2	Occupational	28.2
Multiple	3.8			Educational	26.7
Total	*100*	*Total*	*100*	*Total*	*100*
Text Type	**%**	**Item Format**		**%**	
Argumentation	22.9	Closed Constructed Response		9.9	
Description	22.9	Complex Multiple Choice		7.6	
Exposition	30.5	Multiple Choice		39.7	
Instruction	8.4	Open Constructed Response		34.4	
Narration	15.3	Short Response		8.4	
Total	*100*	*Total*		*100*	

Framework for Mathematical Literacy

PISA mathematical literacy is defined as 'an individual's capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgements and to use and engage with mathematics in ways that meet the needs of that individual's life as a constructive, concerned and reflective citizen' (OECD, 2009, p. 84).

The PISA mathematics assessment focuses on real-world problems, moving beyond the kinds of situations and routine problems typically encountered in classrooms. It emphasises the notion of 'mathematising' which involves starting with a problem in a real-world context, identifying the relevant mathematics, and reorganising the problem according to the mathematical concepts identified. The next step is to gradually trim away the reality so that the mathematics problem can be solved. The final step is to make sense of the mathematical solution in terms of the real situation.

The PISA mathematics framework has three dimensions: (i) **situations and contexts**; (ii) **content**; and (iii) **competencies**. Four categories of mathematical problem situations and contexts are defined and used: *Personal, Educational/ Occupational, Public,* and *Scientific*. PISA also measures student performance in four content areas of mathematics (also called 'overarching ideas'): *Space and Shape; Change and Relationships; Quantity;* and *Uncertainty*. Mathematics items also examine three competencies: *Reproduction* (i.e., reproducing practiced knowledge, performing routine procedures, applying standard algorithms, and manipulating formulae); *Connections* (i.e., integrating and connecting material from the various overarching ideas or from different mathematical curriculum strands); and *Reflection* (i.e., advanced reasoning and the ability to abstract and generalise in new contexts). As mathematics was a minor domain in PISA 2009 (comprising 36 items), performance is reported on a single overall mathematics scale.

Framework for Scientific Literacy

The 2009 PISA framework defines scientific literacy as an individual's

- scientific knowledge and use of that knowledge to identify questions, to acquire new knowledge, to explain scientific phenomena, and to draw evidence-based conclusions about science-related issues;
- understanding of the characteristic features of science as a form of human knowledge and enquiry;
- awareness of how science and technology shape our material, intellectual, and cultural environments; and
- willingness to engage in science-related issues, and with the ideas of science, as a reflective citizen (OECD, 2009, p. 128).

The PISA science assessment focuses on situations in a variety of **contexts**, including *Personal*, *Social*, and *Global situations*. Scientific literacy refers to both **content areas** of *Knowledge of science* and *Knowledge about science*. Knowledge *of* science refers to knowledge of the natural world across the major fields of physical systems, living systems, Earth and space systems, and technology systems. Knowledge *about* science can be divided into *knowledge about scientific enquiry* and *knowledge about scientific explanations*. Scientific enquiry refers to knowledge of the means of science and of how scientists get data. Scientific explanations are the

results of scientific enquiry, i.e., how the data are used. PISA also describes scientific literacy in terms of three scientific **competencies**: *Identifying scientific issues*; *Explaining phenomena scientifically*; and *Using scientific evidence*. As science was a minor domain in PISA 2009 (assessed using 53 items), performance is only reported on a single overall science scale.

What is new in PISA 2009?

PISA attempts to strike a balance between measuring change over time and encompassing innovations in these same areas, for example, by including an assessment of digital literacy in 2009 while at the same time maintaining a trend line for reading back to 2000. As noted previously, a computer-based assessment of reading (Electronic Reading Assessment, ERA) was implemented in 19 countries/economies, including Ireland, for the first time in 2009. This assessment adds value to the paper-based assessment by examining students' understanding of electronic texts. Approximately one-quarter of students in these countries participated in both the paper-based assessment and ERA. Results from the latter will be published in June 2011.

In 2009, reading was the first of the domains to be revisited as a major focus. This offered an opportunity to carry out an in-depth examination of changes in students' reading achievements and attitudes since 2000.

Interpreting the Results in this Report

In PISA, achievement scores of students are generated first by estimating the difficulty of items and then by estimating student proficiency. The construction of achievement scores involves the use of Item Response Theory (IRT). It is assumed that item difficulties are equivalent across countries. The scale for each domain was set to an OECD average of 500 and a standard deviation (SD) of 100 when the domain first had the status of a 'major' domain. In 2009 these are close to, but not exactly, 500 and 100, respectively since average performance across countries can change over time and the inclusion of new OECD countries can also have an impact. A standard deviation of 100 means that, on average across the OECD, two-thirds of students score between 400 and 600, and 95% of students score between 300 and 700.

Examining average achievements across countries and in sub-groups within countries (e.g., student gender) should only be considered as a first step in interpreting results, since an examination of the distribution of achievement can also add policy-relevant information. For example, countries A and B might have similar average levels of achievement, but if country A has a large standard deviation compared to country B, this may indicate less equitable outcomes in country A. Furthermore, even if country X and country Y have similar means and standard deviations, these may disguise performance differences at, say, the 10th and 90th percentiles, which are indicative of achievement differences among low and high achievers in the two countries.

It should be noted that some indices based on PISA questionnaire data (e.g., student-teacher relations) may not be fully comparable across countries due to differing response patterns in different countries (due, for example, to the influence of social desirability on participants' responses).

For descriptive purposes, continuous questionnaire variables and scales derived from questionnaire items have been divided into 'high', 'medium' and 'low'

groups, using the 33rd and 67th percentiles as cut-points. In some cases, these groups do not form exact thirds, due to tied ranks at cut-points.

PISA also benchmarks performance against proficiency levels, which are associated with particular skill levels. As discussed further in Chapters 2 and 3, Level 2 (of six levels) is generally accepted as the minimal level of competency required for future participation in education, work and society.

Because PISA assesses samples of students, and because students only complete a subset of all test items, achievement estimates are prone to uncertainty due to sampling and measurement error. A statistic called the standard error attempts to quantify this uncertainty. Given a mean of 500 and a standard error of 2.5, we can say with 95% certainty that the true score lies between 495 and 505 (i.e., 500 ± [1.96×2.5]). Another type of error, link error, is computed when comparisons of a country's achievement scores over time are made.

Student performance in 2009 in each domain is only compared to earlier performance when that particular domain was a 'major' domain (i.e., reading performance in 2009 is compared to 2000, mathematics performance is compared to 2003, and science performance is compared to 2006). In this report, references to OECD averages and scores for other countries/economies (including Northern Ireland) are from Volumes I to IV of the OECD report for PISA 2009 (OECD, 2010a, 2010b, 2010c & 2010d), while references to changes between cycles are from Volume V (OECD, 2010e). An explanation of statistical terms used in this report can be found on page 67.

Chapter 2: Reading Achievement

This chapter describes student performance on the PISA 2009 paper-based reading assessment. Performance is described in terms of the combined (overall) reading scale and of five subscales. Proficiency levels are also used to describe performance and gender differences are examined. Finally, changes in reading achievement from PISA 2000 to PISA 2009 are considered.

Overall Reading Performance

Ireland[12] achieved a mean score on the combined reading scale of 495.6, which is not significantly different from the mean for OECD countries of 493.4 (Table 2.1). Ireland's rank, based on its mean score, is 17th out of 34 OECD[13] countries and 21st out of 65 countries. Applying a 95% confidence interval, which takes into account sampling and measurement error, Ireland's rank ranges from 12th to 22nd among OECD countries and from 15th to 27th among all participating countries.

Ireland's mean score does not differ significantly from those of 15 countries (including Norway, Poland, the United States, Germany, France and the United Kingdom) and is significantly lower than the means of 11 countries (including Shanghai-China, Finland, Canada, New Zealand and Australia). Twelve OECD countries (including Italy, the Czech Republic and Austria) achieved mean reading scores that are significantly lower than Ireland's. The highest mean scores in reading were achieved by Shanghai-China (555.8), Korea (539.3), Finland (535.9) and Hong Kong-China (533.2). The mean score for Northern Ireland (499.4) is higher than, but not significantly different from, both the mean score for Ireland and the OECD average score.

Performance on Reading Subscales

Five reading subscales were formed based on three reading aspects (Access and Retrieve, Integrate and Interpret, and Reflect and Evaluate) and two text formats (Continuous and Non-continuous). With the exception of the Reflect and Evaluate scale, there is little variation in the average performance of students in Ireland across the subscales.

The Irish mean scores for the Access and Retrieve, Integrate and Interpret, and the Continuous and Non-continuous subscales are all higher than the corresponding OECD averages but not significantly so (Table 2.2). Students in Ireland performed best on the Reflect and Evaluate subscale (502.4), achieving a mean score that is significantly above the corresponding OECD average (494.5). Ireland ranks 13th among OECD countries on this subscale and is not significantly different from Norway, the Netherlands or Belgium. Students in Korea obtained the highest scores on the Non-continuous subscale, while students in Shanghai-China obtained the highest scores on the other four reading subscales. The mean score for Northern Ireland does not differ significantly from Ireland's mean score on any of the five subscales and is significantly higher than the OECD average only on the Non-continuous subscale.

[12] Throughout the text, Ireland means Republic of Ireland. Scores for Northern Ireland are reported where available. As Northern Ireland is a region (part of the UK) rather than a participating country in its own right, it does not appear in data tables.
[13] PISA 2009 data for Estonia (an accession candidate country) are included in the OECD average estimates.

Table 2.1: Mean country scores and standard errors (SE) for the combined reading scale and position relative to the OECD and Irish means (2009)

Rank		Mean	SE	SD	SE	IRL
1	*Shanghai-China*	555.8	(2.40)	80	(1.67)	▲
2	Korea	539.3	(3.46)	79	(2.14)	▲
3	Finland	535.9	(2.25)	86	(0.95)	▲
4	*Hong Kong-China*	533.2	(2.12)	84	(1.65)	▲
5	*Singapore*	525.9	(1.06)	97	(1.05)	▲
6	Canada	524.2	(1.48)	90	(0.89)	▲
7	New Zealand	520.9	(2.35)	103	(1.69)	▲
8	Japan	519.9	(3.47)	100	(2.93)	▲
9	Australia	514.9	(2.34)	99	(1.35)	▲
10	Netherlands	508.4	(5.15)	89	(1.64)	▲
11	Belgium	505.9	(2.35)	102	(1.74)	▲
12	Norway	503.2	(2.58)	91	(1.25)	O
13	Estonia	501.0	(2.64)	83	(1.65)	O
14	Switzerland	500.5	(2.44)	93	(1.42)	O
15	Poland	500.5	(2.60)	89	(1.28)	O
16	Iceland	500.3	(1.41)	96	(1.19)	O
17	United States	499.8	(3.65)	97	(1.59)	O
18	*Liechtenstein*	499.3	(2.80)	83	(3.46)	O
19	Sweden	497.4	(2.88)	99	(1.51)	O
20	Germany	497.3	(2.66)	95	(1.84)	O
21	**Ireland**	495.6	(2.97)	95	(2.18)	
22	France	495.6	(3.44)	106	(2.84)	O
23	*Chinese Taipei*	495.2	(2.60)	86	(1.91)	O
24	Denmark	494.9	(2.07)	84	(1.16)	O
25	United Kingdom	494.2	(2.28)	95	(1.18)	O
26	Hungary	494.2	(3.17)	90	(2.35)	O
27	Portugal	489.3	(3.07)	87	(1.58)	O
28	*Macao-China*	486.6	(0.89)	76	(0.79)	▼
29	Italy	486.1	(1.57)	96	(1.39)	▼
30	*Latvia*	484.0	(2.96)	80	(1.53)	▼
31	Slovenia	483.1	(1.03)	91	(0.86)	▼
32	Greece	482.8	(4.32)	95	(2.39)	▼
33	Spain	481.0	(2.02)	88	(1.13)	▼
34	Czech Republic	478.2	(2.89)	92	(1.63)	▼
35	Slovak Republic	477.4	(2.54)	90	(1.91)	▼
36	*Croatia*	475.7	(2.87)	88	(1.65)	▼
37	Israel	474.0	(3.63)	112	(2.71)	▼
38	Luxembourg	472.2	(1.25)	104	(0.93)	▼
39	Austria	470.3	(2.95)	100	(2.00)	▼
40	*Lithuania*	468.4	(2.39)	86	(1.59)	▼
41	Turkey	464.2	(3.52)	82	(1.71)	▼
42	*Dubai (UAE)*	459.4	(1.14)	107	(0.88)	▼
43	*Russian Federation*	459.4	(3.34)	90	(1.95)	▼
44	Chile	449.4	(3.13)	83	(1.74)	▼
45	*Serbia*	442.0	(2.43)	84	(1.53)	▼
46	*Bulgaria*	429.1	(6.68)	113	(2.55)	▼
47	*Uruguay*	425.8	(2.60)	99	(1.85)	▼
48	Mexico	425.3	(1.95)	85	(1.20)	▼
49	*Romania*	424.5	(4.09)	90	(2.30)	▼
50	*Thailand*	421.4	(2.64)	72	(1.89)	▼
51	*Trinidad and Tobago*	416.5	(1.24)	113	(1.26)	▼
52	*Colombia*	413.2	(3.74)	87	(1.95)	▼
53	*Brazil*	411.8	(2.73)	94	(1.46)	▼
54	*Montenegro*	407.5	(1.72)	93	(1.13)	▼
55	*Jordan*	405.0	(3.31)	91	(1.98)	▼
56	*Tunisia*	403.6	(2.88)	85	(1.80)	▼
57	*Indonesia*	401.7	(3.74)	66	(1.97)	▼
58	*Argentina*	398.3	(4.63)	108	(3.43)	▼
59	*Kazakhstan*	390.4	(3.07)	91	(1.58)	▼
60	*Albania*	384.8	(4.04)	100	(1.85)	▼
61	*Qatar*	371.7	(0.76)	115	(0.79)	▼
62	*Panama*	370.7	(6.54)	99	(3.48)	▼
63	*Peru*	369.7	(3.95)	98	(2.41)	▼
64	*Azerbaijan*	361.5	(3.33)	76	(1.79)	▼
65	*Kyrgyzstan*	314.0	(3.19)	99	(2.11)	▼

	Significantly above OECD average	▲	Significantly higher than Ireland
	At OECD average	O	Not significantly different to Ireland
	Significantly below OECD average	▼	Significantly lower than Ireland

OECD countries are in regular font, partner countries are in italics

Table 2.2: Mean scores and standard errors (SE) on reading subscales – Ireland and OECD averages (2009)

	Ireland		OECD	
	Mean	SE	Mean	SE
Access and Retrieve	498.1	(3.3)	494.9	(0.5)
Integrate and Interpret	493.8	(3.0)	493.4	(0.5)
Reflect and Evaluate	**502.4**	(3.1)	494.5	(0.5)
Continuous	496.6	(3.3)	493.8	(0.5)
Non-Continuous	496.3	(3.0)	493.0	(0.5)

The mean score in bold is significantly higher than the OECD average.

Performance on Reading Proficiency Levels

Student performance can also be described in terms of proficiency levels. Proficiency levels group students' scores on a continuous scale into levels so that the skills of students at each level can be described. For reading in PISA 2009, seven proficiency levels are described: Level 1b is the lowest described level, then Level 1a, Level 2, Level 3 and so on up to Level 6 (OECD, 2010a). There is also a below Level 1b category for students who did not demonstrate skills required to answer the easiest PISA reading items. Students at a given level are more likely to succeed than not succeed on tasks at their level, and to succeed on tasks at all lower levels. Table 2.3 describes the skills that students at each level are capable of and shows the range of scale scores that each level represents. The PISA 2009 proficiency levels expand on the 5 proficiency levels established in PISA 2000 by providing greater clarity on skills that the highest and lowest students can achieve, through adding Level 6 and Level 1b, respectively.

Just over 17% of students in Ireland (compared to 18.8% on average across OECD countries) achieve a reading proficiency level at or below Level 1a (Table 2.3), which is considered by the OECD to be below the basic level needed to participate effectively in society and in future learning. This percentage is slightly lower than the corresponding percentages in the United Kingdom (18.4%) and Germany (18.5%) (countries with similar overall mean reading scores to Ireland) but is considerably higher than high-achieving countries such as Finland (8.1%) and Canada (10.3%). Ireland also has comparatively fewer students who do not reach Level 2 than the OECD average on each of the reading subscales.

Ireland has about the same proportion of highly skilled readers, or students at/above Level 5, as is found on average across OECD countries (7.0% versus 7.6%, respectively). The percentage of highly skilled readers in Ireland is also about the same as Germany (7.6%) and the United Kingdom (8.0%), and is lower than in countries such as the United States (9.9%) and Finland (14.5%). In Ireland, this pattern is mirrored for all subscales, with the exception of the Reflect and Evaluate subscale where the percentage of students achieving at/above Level 5 is slightly higher than on average across OECD countries (9.6% and 8.8%, respectively). Ireland has a similar percentage of low-achieving students to Northern Ireland (17.2% compared to 17.5%) but has a somewhat lower percentage of high-achieving students (7.0% compared to 9.3%).

Table 2.3: Descriptions of the seven levels of proficiency in reading and percentages of students achieving each level – Ireland and OECD average (2009)

Level *(Cut-point)*	Students at this level are capable of:	OECD		Ireland	
		%	SE	%	SE
6 *(above 708)*	Conducting fine-grained analysis of texts; understanding both explicit and implicit information; reflecting on and evaluating texts; integrating information from more than one text; dealing with both familiar and unfamiliar content areas presented in typical as well as atypical formats; hypothesising about or critically evaluating a complex text taking into account multiple criteria or perspectives and applying sophisticated understandings from beyond the text. These students are highly skilled readers.	0.8	(0.0)	0.7	(0.2)
5 *(626 to 707)*	Locating and organising deeply embedded information within texts; inferring which information in the text is relevant; critically evaluating or hypothesising about texts; drawing on specialised knowledge and dealing with concepts that are contrary to expectations.	6.8	(0.1)	6.3	(0.5)
4 *(553 to 625)*	Locating and organising embedded information; interpreting the meaning of nuances of language in a section of text by taking into account the text as a whole; understanding and applying categories in an unfamiliar context; using formal or public knowledge to hypothesise about or critically evaluate a text and understanding long or complex texts whose content or form may be unfamiliar.	20.7	(0.2)	21.9	(0.9)
3 *(480 to 552)*	Locating multiple pieces of information, making links between different parts of a text and relating it to familiar everyday knowledge. Tasks at this level are among those that might be expected to be commonly demanded of young and older adults across OECD countries in their everyday lives.	28.9	(0.2)	30.6	(0.9)
2 *(407 to 479)*	Locating information that meets several conditions, making comparisons or contrasts around a single feature, working out what a well-defined part of a text means even when the information is not prominent, and making connections between the text and personal experience. Level 2 can be considered the basic level of proficiency needed to participate effectively and productively in society and future learning.	24.0	(0.2)	23.3	(1.0)
1a *(335 to 406)*	Locating one or more independent pieces of explicitly stated information; recognising the main theme or idea in a text about a familiar topic and making simple connections between information in the text and common, everyday knowledge.	13.1	(0.1)	11.8	(0.7)
1b *(262 to 334)*	Locating a single piece of explicitly stated information in short, simple texts with a familiar style and content, such as a narrative or a simple list; making simple connections between adjacent pieces of information. The text typically provides support to the reader (e.g. repetition of information, pictures or familiar symbols) and there is minimal competing information.	4.6	(0.1)	3.9	(0.5)
Below Level 1b *(below 262)*	There is insufficient information on which to base a description of the reading skills of these students.	1.1	(0.0)	1.5	(0.4)

Source: OECD, 2010a

Gender Differences in Reading

In Ireland, females achieved a mean score (515.4) which is significantly higher than the mean score for males (476.3). The mean scores for females and males in Ireland do not differ significantly from the corresponding OECD average scores (513.2 and 474.1, respectively). The difference between males and females in Ireland is the same as the difference among OECD countries on average (39 points). Colombia has the smallest gender difference among all countries, with females outperforming males by just 9 points, while Albania has the largest (62 points in favour of females). Females perform significantly better than males in all countries. In Northern Ireland, females (513.3) significantly outperform males (484.6) by almost 29 points. The mean scores for males and females in Northern Ireland do not differ significantly from the corresponding mean scores for Ireland or on average across OECD countries.

In Ireland, females significantly outperform males on each of the reading subscales (Table 2.4). The highest mean scores for both males and females in Ireland are on the Reflect and Evaluate subscale (483.5 and 521.9, respectively). Males perform least well on the Access and Retrieve, Integrate and Interpret and the Continuous subscales, while females perform least well on the Integrate and Interpret subscale. The largest difference between males and females (44 points) is on the Access and Retrieve scale.

Table 2.4: Gender differences on the reading subscales – Ireland and OECD average

	Males		Females		IRL diff		OECD diff	
	Mean	SE	Mean	SE	M-F	SE	M-F	SE
Overall	476.3	(4.2)	515.4	(3.1)	**-39**	(4.7)	**-39**	(0.6)
Access and Retrieve	476.1	(4.5)	520.6	(3.4)	**-44**	(4.6)	**-40**	(0.7)
Integrate and Interpret	475.8	(4.4)	512.4	(3.1)	**-37**	(4.8)	**-36**	(0.6)
Reflect and Evaluate	483.5	(4.2)	521.9	(3.5)	**-38**	(4.7)	**-44**	(0.7)
Continuous	476.4	(4.5)	517.4	(3.6)	**-41**	(4.9)	**-42**	(0.6)
Non-Continuous	477.2	(4.3)	515.9	(3.1)	**-39**	(4.6)	**-36**	(0.7)

Significant differences in bold.

On the combined reading scale, almost a quarter of male students (23.2%) in Ireland achieved a mean score which is considered to be inadequate to participate effectively in society and in future learning (below Level 2) compared to 11.3% of females. Conversely, 9.6% of females in Ireland are considered highly skilled readers (at/above Level 5), which is over double that of males (4.5%).

Changes in Reading Performance from PISA 2000 to PISA 2009

In 2009, reading was the major domain in PISA for the second time. This means performance in reading achievement can be compared in detail with 2000 – the first time that reading was a major domain in PISA. Comparisons between 2000 and 2009 can only be made for the 39 countries that have valid data for both cycles.[14]

Ireland's performance in reading dropped 31 points since 2000, the largest decline across all participating countries. Ireland, along with Sweden and France, achieved mean scores above the OECD average in 2000 but their mean scores do not differ significantly from the OECD average in 2009. Ireland's rank dropped from 5th to 17th among the 39 countries that have data available for both cycles.

Other countries with statistically significant declines include Austria (-22), Sweden (-19), Australia (-14) and the Czech Republic (-13). Neither Austria nor the Czech Republic was significantly different from the OECD average in 2000; both are significantly below it in 2009. Countries that experienced significant increases in reading literacy include Peru (+43), Chile (+40), Albania (+36), Latvia (+26), Poland (+21), Portugal (+19) and Germany (+13). The scores of Portugal and Germany have

[14] Australia, Austria, Belgium, Brazil, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Latvia, Liechtenstein, Mexico, New Zealand, Norway, Poland, Portugal, Russian Federation, Spain, Sweden, Switzerland and the United States have valid data for 2000 and 2009.

Albania, Argentina, Bulgaria, Chile, Hong Kong-China, Indonesia, Israel, Peru, Romania and Thailand participated in a second administration of PISA 2000 in 2001, and are included in comparisons between 2000 and 2009.

Due to low response rates, data from the United Kingdom and the Netherlands are not included in the trends analysis. In Luxembourg, the assessment conditions were changed in substantial ways between the PISA 2000 and PISA 2003 surveys and results are therefore only comparable for PISA 2003, PISA 2006 and PISA 2009.

increased from being below the OECD average in 2000 to being at the OECD average in 2009, while Poland has moved from being below the OECD average in 2000 to being above it in 2009. Peru, Chile and Albania still remain below the OECD average.

In 2000, Ireland had significantly more students at/above Level 5 (14.2%) than the OECD average (8.9%). However, the percentage of students at/above Level 5 declined significantly from 14.2% to 7%, meaning that the percentage of students at this level is not significantly different from the OECD average in 2009 (Table 2.5). There has been a corresponding significant increase of just over 6% in the percentage of students below Level 2 in Ireland, meaning that the country has gone from being well below the OECD average at this level in 2000 to being not significantly different from it in 2009. This increase has been more marked in males (from 13.5% to 23.2%) than in females (from 8.3% to 11.3%).

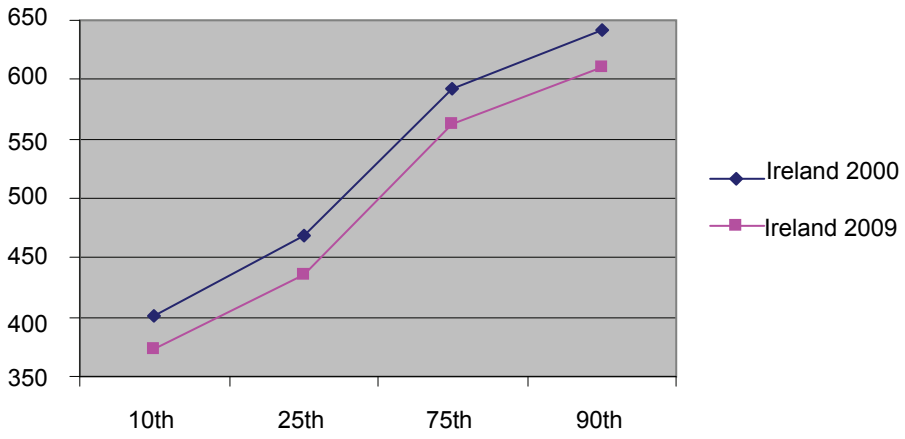
Table 2.5: Percentage of students below Level 2 and at/above Level 5 on the combined reading literacy scale– Ireland and OECD average (2000 and 2009)

	Ireland 2000 %	OECD 2000 %	Ireland 2009 %	OECD 2009 %	Diff Irl 2000-2009
Below Level 2	11.0	19.3	17.2	18.5	**+6.2**
At/above Level 5	14.2	8.9	7.0	8.1	**-7.3**

OECD average based on 27 countries; significant differences for Ireland in bold.

As can be seen in Figure 2.1, the performance of students in Ireland dropped uniformly across each of several key percentile points between 2000 and 2009.

Figure 2.1: Performance at the Key Percentiles on Combined Reading Literacy scale - Ireland 2000 and 2009



In Ireland, the difference in favour of females in 2009 (39 points) was greater than in 2000 (29 points), but not significantly so. However, on average across OECD countries, the gender gap increased significantly, from 32 points in 2000 to 39 in 2009. Hence, in respect of gender differences on combined reading literacy, Ireland is identical to the OECD average in 2009. France saw a similar increase to Ireland in gender difference between 2000 (29 points) and 2009 (40 points); in this case, the increase is significant. In Ireland, the achievement levels of both male and female students dropped significantly from 2000 to 2009 (-37 points for males and -26 points for females). However, across OECD countries on average, males dropped 4 points and females improved by 3 points from 2000 to 2009 (neither of these changes is significant). In Germany and Hungary, the mean scores of both males and females

increased (the increase is significant for males in both countries and significant for females only in Germany).

Conclusions

Ireland's mean score on reading literacy in 2009 was 496 points. This is some 31 points (about one-third of a standard deviation) lower than in 2000, when the mean score was 527. The decline is the largest across all countries that participated in both PISA 2000 and PISA 2009.[15] Ireland's overall rank has dropped from 5th among 31 countries to 21st among 65 countries between 2000 and 2009. If just countries that participated in both surveys are considered, Ireland's rank has dropped from 5th to 17th. Ireland's position relative to the OECD average has also changed since 2000. The mean score of students in Ireland was significantly higher than the OECD average in 2000 but is not significantly different from the OECD average in 2009.

The performance of students in Ireland declined uniformly across all ability levels and so cannot be attributed to higher or lower achievers doing exceptionally poorly. The percentage of lowest performing students (those scoring below proficiency Level 2) has risen from 11% to 17%, an increase that has been more marked in males (up by 10%) than in females (up by 3%). Conversely, the percentage of highest performing students in Ireland (those scoring at or above Level 5) halved from 14% in 2000 to 7% in 2009. There has also been an increase in the gender difference in Ireland, from 29 points (in favour of females) to 39 points. However, the gender difference in favour of females also increased across OECD countries on average. The difference in Ireland is now identical to the OECD average.

[15] Ireland's performance on reading fell by 11.2 points between 2000 and 2003 (from 526.7 to 515.5), while there was a slight increase between 2003 and 2006 (from 515.5 to 517.3). Therefore, in interpreting the 31-point drop from 2000 to 2009, the 9.4 point drop between 2000 and 2006 should be considered.

Chapter 3: Mathematics and Science Achievement

In this chapter, performance on mathematics and science in PISA 2009 is described. As mathematics and science were minor domains in 2009, data are limited to a single overall scale score for each domain. Performance is also reported in terms of proficiency levels and gender differences are examined. Changes in mathematics and science achievement across PISA cycles are also considered.

Overall Mathematics Performance

Ireland achieved a mean score of 487.1 on the combined mathematics scale, which is significantly below the OECD average of 495.7 (Table 3.1). Ireland's ranking in mathematics is 26th out of 34 OECD[16] countries and 32nd out of 65 countries. Applying a 95% confidence interval which takes into account measurement and sampling error, we can say that Ireland's rank is between 22nd and 29th among OECD countries and between 28th and 35th among all countries.

Ireland's mean score does not differ significantly from the mean scores of 10 countries, including Sweden, the Czech Republic, the United Kingdom and the United States. Nineteen OECD countries (including Korea, Finland, Germany and Austria) achieved a mean score that is significantly higher than Ireland's, while five OECD countries (Greece, Israel, Turkey, Chile and Mexico) performed significantly lower than Ireland.

The mean score for Northern Ireland (492.2) does not differ significantly from the mean score for Ireland or the OECD average mean score. The highest mean score on PISA 2009 mathematics was 600.1 points in Shanghai-China. Other high-scoring countries include Singapore (562.0), Hong Kong-China (554.5), Korea (546.2), Chinese-Taipei (543.2) and Finland (540.5).

Performance on Mathematics Proficiency Levels

As in 2003, when mathematics was the major domain, six levels of proficiency were defined for the mathematics scale. Level 6 represents the most difficult tasks while Level 1 represents the most basic tasks and is considered to be below the minimum level needed to meet the mathematics demands of adult life and further education (OECD, 2010a). There is also a 'below Level 1' category which takes account of students who do not demonstrate the most basic mathematical skills assessed by PISA. Table 3.2 summarises some of the main skills associated with each level.

The percentage of students at/below Level 1 in Ireland (20.8%)[17] is slightly less than on average across OECD countries (22.0%) and is similar to that in the United Kingdom (20.2%) and Poland (20.5%), both of which achieved an overall mean score not significantly different from the OECD average. However, Ireland has significantly fewer students at the higher proficiency levels (at/above Level 5) than the OECD average (6.7% compared to 12.7%), the United Kingdom (9.8%) and Poland (10.4%).

[16] Although Estonia is an accession candidate country, its data for PISA 2009 are included in the OECD average estimates.
[17] Multiple decimal places were used when combining the percentages of students across adjacent levels.

Table 3.1: Mean country scores and standard errors (SE) for the mathematics and science scales and position relative to the OECD and Irish means

	Mathematics					Science				
Rank		Mean	SE	SD	SE	IRL	Mean	SE	SD	SE	IRL
1	*Shanghai-China*	600.1	(2.82)	103	(2.11)	▲	*Shanghai-China*	574.6	(2.30)	82	(1.68)	▲
2	*Singapore*	562.0	(1.44)	104	(1.22)	▲	Finland	554.1	(2.34)	89	(1.11)	▲
3	*Hong Kong-China*	554.5	(2.73)	95	(1.77)	▲	*Hong Kong-China*	549.0	(2.75)	87	(1.97)	▲
4	Korea	546.2	(4.02)	89	(2.52)	▲	*Singapore*	541.7	(1.36)	104	(1.12)	▲
5	*Chinese Taipei*	543.2	(3.40)	105	(2.33)	▲	Japan	539.4	(3.41)	100	(2.50)	▲
6	Finland	540.5	(2.17)	82	(1.10)	▲	Korea	538.0	(3.44)	82	(2.32)	▲
7	*Liechtenstein*	536.0	(4.06)	88	(4.37)	▲	New Zealand	532.0	(2.58)	107	(1.96)	▲
8	Switzerland	534.0	(3.30)	99	(1.59)	▲	Canada	528.7	(1.62)	90	(0.94)	▲
9	Japan	529.0	(3.33)	94	(2.21)	▲	Estonia	527.8	(2.67)	84	(1.62)	▲
10	Canada	526.8	(1.61)	88	(0.97)	▲	Australia	527.3	(2.53)	101	(1.61)	▲
11	Netherlands	525.8	(4.75)	89	(1.66)	▲	Netherlands	522.2	(5.42)	96	(2.13)	▲
12	*Macao-China*	525.3	(0.92)	85	(0.85)	▲	*Chinese Taipei*	520.4	(2.63)	87	(1.64)	▲
13	New Zealand	519.3	(2.31)	96	(1.59)	▲	Germany	520.4	(2.80)	101	(1.90)	▲
14	Belgium	515.3	(2.25)	104	(1.76)	▲	*Liechtenstein*	519.9	(3.42)	87	(3.36)	▲
15	Australia	514.3	(2.53)	94	(1.45)	▲	Switzerland	516.6	(2.82)	96	(1.40)	▲
16	Germany	512.8	(2.86)	98	(1.67)	▲	United Kingdom	513.7	(2.52)	99	(1.36)	O
17	Estonia	512.1	(2.57)	81	(1.64)	▲	Slovenia	511.8	(1.15)	94	(0.96)	O
18	Iceland	506.7	(1.39)	91	(1.17)	▲	*Macao-China*	511.1	(1.03)	76	(0.85)	O
19	Denmark	503.3	(2.60)	87	(1.26)	▲	Poland	508.1	(2.41)	87	(1.21)	O
20	Slovenia	501.5	(1.23)	95	(0.87)	▲	**Ireland**	508.0	(3.27)	97	(2.10)	
21	Norway	498.0	(2.40)	85	(1.19)	▲	Belgium	506.6	(2.52)	105	(2.28)	O
22	France	496.8	(3.09)	101	(2.09)	▲	Hungary	502.6	(3.14)	86	(2.88)	O
23	Slovak Republic	496.7	(3.08)	96	(2.36)	▲	United States	502.0	(3.64)	98	(1.69)	O
24	Austria	495.9	(2.66)	96	(2.00)	▲	Czech Republic	500.5	(2.97)	97	(1.95)	O
25	Poland	494.8	(2.84)	88	(1.39)	▲	Norway	499.9	(2.60)	90	(1.02)	O
26	Sweden	494.2	(2.90)	94	(1.35)	O	Denmark	499.3	(2.48)	92	(1.30)	▼
27	Czech Republic	492.8	(2.83)	93	(1.78)	O	France	498.2	(3.60)	103	(2.84)	▼
28	United Kingdom	492.4	(2.42)	87	(1.22)	O	Iceland	495.6	(1.41)	95	(1.18)	▼
29	Hungary	490.2	(3.45)	92	(2.81)	O	Sweden	495.1	(2.72)	100	(1.53)	▼
30	Luxembourg	489.1	(1.18)	98	(1.19)	O	Austria	494.3	(3.24)	102	(2.19)	▼
31	United States	487.4	(3.57)	91	(1.61)	O	*Latvia*	493.9	(3.07)	78	(1.73)	▼
32	**Ireland**	487.1	(2.54)	86	(1.59)		Portugal	492.9	(2.90)	83	(1.42)	▼
33	Portugal	486.9	(2.91)	91	(1.52)	O	*Lithuania*	491.4	(2.93)	85	(2.13)	▼
34	Spain	483.5	(2.11)	91	(1.05)	O	Slovak Republic	490.3	(2.99)	95	(2.55)	▼
35	Italy	482.9	(1.86)	93	(1.68)	O	Italy	488.8	(1.77)	97	(1.48)	▼
36	*Latvia*	482.0	(3.07)	79	(1.41)	O	Spain	488.3	(2.05)	87	(1.05)	▼
37	*Lithuania*	476.6	(2.62)	88	(1.77)	▼	*Croatia*	486.4	(2.83)	85	(1.78)	▼
38	*Russian Federation*	467.8	(3.29)	85	(2.09)	▼	Luxembourg	483.9	(1.23)	104	(1.07)	▼
39	Greece	466.1	(3.88)	89	(1.99)	▼	*Russian Federation*	478.3	(3.30)	90	(1.99)	▼
40	*Croatia*	459.9	(3.09)	88	(1.81)	▼	Greece	470.1	(4.04)	92	(2.15)	▼
41	*Dubai (UAE)*	452.5	(1.07)	99	(0.86)	▼	*Dubai (UAE)*	466.5	(1.22)	106	(1.07)	▼
42	Israel	446.9	(3.28)	104	(2.41)	▼	Israel	454.9	(3.11)	107	(2.43)	▼
43	Turkey	445.5	(4.44)	93	(3.00)	▼	Turkey	453.9	(3.60)	81	(2.00)	▼
44	*Serbia*	442.4	(2.92)	91	(1.86)	▼	Chile	447.5	(2.92)	81	(1.48)	▼
45	*Azerbaijan*	431.0	(2.76)	64	(2.18)	▼	*Serbia*	442.8	(2.37)	84	(1.64)	▼
46	*Bulgaria*	428.1	(5.86)	99	(2.83)	▼	*Bulgaria*	439.3	(5.86)	106	(2.54)	▼
47	*Romania*	427.1	(3.41)	79	(2.12)	▼	*Romania*	428.2	(3.36)	79	(1.89)	▼
48	*Uruguay*	426.7	(2.59)	91	(1.68)	▼	*Uruguay*	427.2	(2.57)	97	(1.70)	▼
49	Chile	421.1	(3.06)	80	(1.73)	▼	*Thailand*	425.3	(2.98)	80	(1.99)	▼
50	*Thailand*	418.6	(3.23)	79	(2.48)	▼	Mexico	415.9	(1.79)	77	(0.94)	▼
51	Mexico	418.5	(1.83)	79	(1.08)	▼	*Jordan*	415.4	(3.54)	89	(2.09)	▼
52	*Trinidad and Tobago*	414.0	(1.28)	99	(1.18)	▼	*Trinidad and Tobago*	410.2	(1.24)	108	(1.03)	▼
53	*Kazakhstan*	404.9	(3.04)	83	(2.30)	▼	*Brazil*	405.4	(2.43)	84	(1.35)	▼
54	*Montenegro*	402.5	(2.03)	85	(1.53)	▼	*Colombia*	401.8	(3.63)	81	(1.84)	▼
55	*Argentina*	388.1	(4.09)	93	(2.90)	▼	*Montenegro*	401.3	(2.03)	87	(1.36)	▼
56	*Jordan*	386.7	(3.71)	83	(2.57)	▼	*Argentina*	400.8	(4.58)	102	(3.68)	▼
57	*Brazil*	385.8	(2.39)	81	(1.64)	▼	*Tunisia*	400.7	(2.69)	81	(1.88)	▼
58	*Colombia*	380.8	(3.24)	75	(1.69)	▼	*Kazakhstan*	400.4	(3.13)	87	(1.73)	▼
59	*Albania*	377.5	(3.98)	91	(2.18)	▼	*Albania*	390.7	(3.94)	89	(1.67)	▼
60	*Tunisia*	371.5	(2.98)	78	(2.32)	▼	*Indonesia*	382.6	(3.78)	69	(2.08)	▼
61	*Indonesia*	371.3	(3.72)	70	(2.29)	▼	*Qatar*	379.4	(0.89)	104	(0.77)	▼
62	*Qatar*	368.1	(0.70)	98	(0.85)	▼	*Panama*	375.9	(5.74)	90	(2.88)	▼
63	*Peru*	365.1	(4.00)	90	(2.43)	▼	*Azerbaijan*	373.2	(3.05)	74	(1.64)	▼
64	*Panama*	359.7	(5.25)	81	(3.24)	▼	*Peru*	369.4	(3.49)	89	(2.08)	▼
65	*Kyrgyzstan*	331.2	(2.87)	81	(2.12)	▼	*Kyrgyzstan*	329.5	(2.92)	91	(2.02)	▼

Significantly above OECD average
At OECD average
Significantly below OECD average

▲ Significantly higher than Ireland
O Not significantly different to Ireland
▼ Significantly lower than Ireland

OECD countries are in regular font, partner countries are in italics

The percentage of low-achieving students in Northern Ireland (21.4%) is similar to the corresponding percentage in Ireland (20.8%) and on average across OECD countries; however, there are proportionally more high-achieving students in Northern Ireland (10.3%) than in Ireland (6.7%), and just marginally fewer than on average across OECD countries.

The percentage of high-achieving students in Ireland (6.7%) is also substantially lower than the corresponding percentage in Finland where 21.6% of students achieved at Level 5 or 6. Such findings suggest that Ireland's low average performance is, in part, attributable to the comparatively low performance of higher-achieving students.

Table 3.2: Summary descriptions for the six levels of proficiency in mathematics

Level *(cut-point)*	**Students at this level are capable of:**	OECD		Ireland	
		%	SE	%	SE
6 *(above 669)*	Evaluating, generalising and using information from investigation and modelling of complex problem situations; linking different information sources and representations; engaging in advanced thinking and reasoning; precisely communicating actions and reflections regarding findings and arguments.	3.1	(0.1)	0.9	(0.2)
5 *(607 to 669)*	Developing and working with mathematical models of complex situations, identifying constraints and specifying assumptions; selecting, comparing and evaluating appropriate problem-solving strategies for dealing with complex problems related to these models; and formulating and communicating their interpretations and reasoning.	9.6	(0.1)	5.8	(0.6)
4 *(545 to 606)*	Working with mathematical models of complex concrete situations; selecting and integrating different representations including symbolic ones, linking them directly to aspects of real-world situations; and constructing and communicating explanations and arguments.	18.9	(0.2)	19.4	(0.9)
3 *(482 to 544)*	Executing clearly described procedures, including those that require sequential decisions; selecting and applying simple problem-solving strategies; interpreting and using representations based on different information sources and reasoning from them directly; and developing short communications to report results and reasoning.	24.3	(0.2)	28.6	(1.2)
2 *(420 to 481)*	Working in simple contexts that require no more than direct inference; extracting relevant information from a single source and making use of a single representational mode; applying basic algorithms, formulae, procedures or conventions; and reasoning directly and making literal interpretations of results.	22.0	(0.2)	24.5	(1.1)
1 *(358 to 419)*	Working on clearly-defined tasks with familiar contexts where all the relevant information is present; identifying information and carrying out routine procedures according to direct instructions in explicit situations; and performing actions that are obvious and follow immediately from given stimuli.	14.0	(0.1)	13.6	(0.7)
Below Level 1 *(below 358)*	Students at this level have a less than 50% chance of responding correctly to Level 1 tasks. Mathematical literacy at this level is not assessed by PISA.	8.0	(0.1)	7.3	(0.6)

Source: OECD, 2010a.

Gender Differences in Mathematics

In Ireland, males (490.9) outperformed females (483.3) on mathematical literacy, but the difference is not significant. The mean scores for males and females are significantly below the corresponding OECD average scores (501.4 and 489.9, respectively). Twenty-one OECD countries had a significant gender gap favouring males, the largest being Belgium with 21.8 points. No significant gender difference was observed in the remaining 13 OECD countries. In Northern Ireland, both male and female students achieved mean scores (501.1 and 483.8. respectively) that are not significantly different from the corresponding scores for Ireland or the OECD averages. However, unlike Ireland, male students in Northern Ireland had a significantly higher average score than females.

The proportions of low-achieving (at/below Level 1) males (20.6%) and females (21.0%) in Ireland are very similar to the corresponding OECD averages (20.9% and 23.1%, respectively). There are proportionally more males than females achieving at/above Level 5, both in Ireland and on average across the OECD. However, in Ireland, there are considerably fewer high-achieving males (8.1%) and females (5.1%) than on average across the OECD (14.8% and 10.6%, respectively).

Changes in Mathematics Performance from PISA 2003 to PISA 2009

Changes in mathematics performance are examined for 40 countries between 2003, when mathematics was last a major domain, and 2009.[18] Ireland's mean mathematics score dropped 16 points, from 502.8 to 487.1. Most of this decline (14 of the 16 points) occurred between 2006 and 2009. Just one other country, the Czech Republic, experienced a greater decline (24 points). Ireland's rank dropped from 20th to 26th among countries that participated in both cycles. Northern Ireland has also seen a significant drop in mathematics performance since 2003 (from 514.7 to 492.2).

Just three countries changed their position relative to the OECD average since 2003. Poland and Hungary were below the OECD average in 2003, but not significantly different from it in 2009, while Ireland's position changed from being at the OECD average in 2003 to being significantly below it in 2009. Countries with significant declines include Sweden (-15), France (-14), Belgium (-14) and the Netherlands (-12), while Mexico (+33), Brazil (+30), Portugal (+21) and Germany (+10) had significant increases.

In 2003, Ireland had significantly fewer students at/below Level 1 (16.8%) than on average across the OECD (21.5%). In 2009, the percentage of low-achieving students increased to 20.8% in Ireland and now is not significantly different from the OECD average (22.0%). The percentage of students at/above Level 5 in Ireland decreased from 11.4% in 2003 to 6.7% in 2009 and still remains significantly lower than the corresponding OECD average (12.7% in 2009).

In Ireland, the performance of both male and female students dropped significantly since 2003 (-19 points for males and -12 points for females). Males outperformed females in both years, but only significantly so in 2003. Similarly, in Northern Ireland, the performance of males and females dropped significantly since 2003. Males outperformed females in both years, but the difference was significant only in 2009. The average gender gap across the OECD changed very little between 2003 and 2009 (11.1 and 11.5 points, respectively).

[18] Australia, Austria, Belgium, Brazil, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hong Kong-China, Hungary, Iceland, Indonesia, Ireland, Italy, Japan, Korea, Luxembourg, Latvia, Liechtenstein, Macao-China, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Russian Federation, Serbia, Slovak Republic, Spain, Sweden, Switzerland, Thailand, Tunisia, Turkey, the United States and Uruguay participated in both PISA 2003 and 2009.

Due to sampling issues and low response rates, data from the United Kingdom is not included in the comparisons.

Overall Science Performance

Ireland's mean score for science in 2009 was 508.0, which is significantly higher than the OECD average of 500.8 (Table 3.1). The mean score for Ireland is 14th highest of 34 OECD countries and 20th highest of the 65 participating countries. Applying a 95% confidence interval which takes into account measurement and sampling error, we can say that Ireland's true rank is between 11th and 17th among OECD countries and between 16th and 23rd among all countries. Ireland's mean score does not differ significantly from the mean scores of nine countries, including the United Kingdom (513.7), Poland (508.1) and the United States (502.0). Ten OECD countries (including Finland, Australia and Germany) achieved mean scores that are significantly higher than Ireland's, while 15 OECD countries (including Denmark, France and Iceland) performed significantly less well than Ireland. Students in Northern Ireland achieved a mean score (511.4) that is significantly above the OECD average, but is not significantly different from Ireland's mean score. Shanghai-China achieved the highest mean score (574.6), followed by Finland (554.1) and Hong Kong-China (549.0).

Performance on Science Proficiency Levels

For science, six levels of proficiency are defined, with Level 6 representing the highest level (Table 3.3). There is also a 'below Level 1' category which represents students who do not succeed at the most basic level of science that PISA measures.

Table 3.3: Summary descriptions for the six levels of proficiency in science

Level *(cut-point)*	**Students at this level are capable of:**	**OECD**		**Ireland**	
		%	**SE**	**%**	**SE**
6 *(above 708)*	Consistently identifying, explaining and applying scientific knowledge and knowledge about science in a variety of complex life situations; using evidence from different sources to justify decisions and using advanced scientific thinking and reasoning to solve problems in unfamiliar scientific and technological situations.	1.1	(0.0)	1.2	(0.2)
5 *(633 to 707)*	Identifying scientific components; applying both scientific concepts and *knowledge about science* to complex life situations; linking knowledge appropriately; bringing critical insights to situations; constructing evidence-based explanations.	7.4	(0.1)	7.5	(0.7)
4 *(559 to 632)*	Using non-complex situations to make inferences about the role of science or technology; selecting and integrating explanations from different disciplines and applying them directly; reflecting on their actions and communicating decisions using scientific knowledge and evidence.	20.6	(0.2)	22.9	(0.9)
3 *(484 to 558)*	Identifying clearly described scientific issues in a range of contexts; interpreting and using scientific concepts from different disciplines and applying them directly; developing short statements using facts and making decisions based on scientific knowledge.	28.6	(0.2)	29.9	(1.0)
2 *(409 to 483)*	Providing possible explanations in familiar contexts; drawing conclusions based on simple investigations; engaging in direct reasoning and making literal interpretations of the results of scientific inquiry. Level 2 can be considered the basic level of proficiency needed to participate actively in scientific and technological situations.	24.4	(0.2)	23.3	(1.2)
1 *(335 to 408)*	Applying a limited store of scientific knowledge to a few, familiar situations; and presenting scientific explanations that are obvious and follow explicitly from given evidence.	13.0	(0.1)	10.7	(1.0)
Below Level 1 *(below 335)*	Students at this level have a less than 50% chance of responding correctly to Level 1 tasks. Scientific literacy at this level is not assessed by PISA.	5.0	(0.1)	4.4	(0.7)

Source: OECD, 2010a.

The percentage of students at/below Level 1 in Ireland (15.2%)[19] is significantly lower than on average across OECD countries (18.0%). However, the percentage of such students in Ireland is somewhat higher than in Canada (9.6%) and Estonia (8.3%), countries that also achieved mean science scores that are significantly higher than the OECD average. The percentage of students at/above Level 5 in Ireland (8.7%) is not significantly different to the average level across OECD countries (8.5%) and is marginally higher than in Poland (7.5%), which achieved the same overall mean score as Ireland. However, the percentage of high-achieving students in Shanghai-China (24.3%), the highest achieving country/economy, is almost three times the percentage found in Ireland. The percentage of low-achieving students in Northern Ireland (16.7%) is similar to the corresponding percentage in Ireland (15.2%) and on average across the OECD; however, there is a proportionally higher percentage of high-achieving students in Northern Ireland (10.3%) than in Ireland (8.7%) and across OECD countries on average (8.5%).

Gender Differences in Science

In Ireland, females achieved a higher, although not significantly different, mean score than males (509.4 and 506.6, respectively), while the OECD average scores for males and females were almost identical (500.9 and 500.8, respectively). The mean score for females in Ireland is significantly higher than the corresponding OECD average score, while males in Ireland do not differ from males on average across the OECD. The mean scores for males and females in Northern Ireland (513.8 and 509.1, respectively) do not differ significantly from the corresponding mean scores for Ireland or across OECD countries on average.

Across OECD countries, gender differences in science performance tend to be small and, in most countries, the difference is not statistically significant. The United States and Denmark show the largest gender differences in favour of males among OECD countries (14 and 12 points, respectively), while significant differences in favour of females are observed in Finland (15 points) and Slovenia (14 points).

In Ireland there are slightly more males (16.0%) than females (14.3%) at the lower levels of proficiency (at/below Level 1) and these percentages are slightly below the corresponding averages across OECD countries (18.8% and 17.1%, respectively). On the other hand, the percentage of high-achieving Irish males (9.0%) and females (8.3%) are almost identical and neither differs significantly from the corresponding averages across OECD countries (9.4% and 7.7%, respectively).

Changes in Science Performance from PISA 2006 to PISA 2009

In Ireland, the mean score for science did not change between 2006 and 2009 (508.3 and 508.0, respectively) and is still significantly above the OECD average. Ireland's rank among OECD countries remains the same across the two cycles (14th out of 34). However, in terms of overall rank, Ireland climbed two places from 20th to 18th among the 57 countries that participated in both cycles.[20]

Eleven countries have seen significant increases between 2006 and 2009 in their science performance, including Norway and the United States, both of which moved from being below to being not significantly different from the OECD average. Poland also changed position, moving from being at the OECD average in 2006 to being significantly above it in 2009. Science performance dropped significantly in six countries, including Finland, the Czech Republic (which was significantly above and now is not significantly different from

[19] Multiple decimal places were used when combining the percentages of students at different levels.

[20] In addition to the countries listed in footnote 18, Argentina, Azerbaijan, Bulgaria, Chile, Chinese Taipei, Colombia, Croatia, Estonia, Israel, Jordan, Kyrgyzstan, Lituania, Montenegro, Qatar, Romania and Slovenia also participated in PISA 2006 and 2009.

the OECD average) and Austria (which dropped from being significantly above to now being significantly below the OECD average). In Northern Ireland, science performance increased slightly, but not significantly, since 2006 (from 508.1 to 511.4).

On average across OECD countries, the percentages of students at/below Level 1 and at/above Level 5 dropped significantly since 2006 (from 19.8% to 18.0% for low achieving students and from 8.9% to 8.5% for high-achieving students). However, the percentages of these students in Ireland did not change significantly since 2006.

The gender gap widened marginally in Ireland since 2006 (from 0.4 to 2.8 points in favour of females) but still remains small and not significant. In contrast, the difference between males and females on average across OECD countries has narrowed from 2.2 points to one-tenth of a point. The mean scores of male and female students in Ireland have not changed significantly between 2006 (508.1 and 508.5, respectively) and 2009 (506.6 and 509.4, respectively). In Northern Ireland, the mean scores for both males and females increased, although not significantly, since 2006 (from 509.2 to 513.8 for males and from 507.0 to 509.1 for females).

Conclusions

Ireland's mean mathematics score was 503 in 2003, and 487 in 2009 – a decline of 16 points (or one-sixth of a standard deviation) – the second largest of any country participating in both years.[21] Ireland's rank dropped from 20th among 40 countries to 32nd among 65 countries. Among countries that participated in both 2003 and 2009, Ireland's rank dropped from 20th to 26th. Ireland's mean score has changed from being not significantly different from the OECD average in 2003 to being significantly below it in 2009.

As in reading, the decline in performance has been uniform across the student range of ability, with a slightly more pronounced decline at the upper end of the achievement distribution. The percentage of lower achieving students in Ireland (those scoring at proficiency Level 1 or below) has increased (from 17% to 22%) while there has been a decrease (of over 4%) among the highest-achieving students (those scoring at or above Level 5) (from 11% to 7%). The scores of both male and female students have declined in Ireland and this decline has been more marked for male students, with the result that the gender difference has narrowed to 8 points in favour of males, and is not statistically significant, whereas in 2003 males significantly outperformed females by 15 points.

In Ireland, the mean score on science was 508 in both 2006 and 2009, indicating no change in performance. Moreover, Ireland's mean score is still significantly above the OECD average. Ireland's overall rank is unchanged (20th out of 57 countries in 2006 and 20th out of 65 countries in 2009). If we look only at the 57 countries that participated in both 2006 and 2009, Ireland's rank has climbed two places from 20th to 18th. Similar to previous PISA cycles, gender differences in science in Ireland remain small and non-significant.

[21] Ireland's performance in mathematics declined slightly from 502.8 in 2003 to 501.5 in 2006. Therefore, the majority of the decline in mathematics between 2003 and 2009 occurred between 2006 and 2009 (14 of the 16 points).

Chapter 4: Student- and School-Level Associations with Reading Achievement

In this chapter, associations between student achievement and student- and school-level characteristics are examined. The analyses reported are univariate, that is, they describe how a single explanatory variable (e.g., immigrant status) relates to a response variable (i.e., reading achievement). This does not take into account the fact that many variables associated with achievement are themselves inter-related, although relationships between individual variables and student socioeconomic background are briefly commented on. More complex analyses will be included in the main PISA 2009 national report for Ireland which will be published in 2011.

Analyses in this chapter generally report associations with reading achievement only, as performance on the three PISA domains are inter-related and tend to have similar relationships with explanatory variables.[22] Unless otherwise stated, background variables have an OECD mean of 0 and a standard deviation of 1. For descriptive purposes, three groups have been identified for continuous variables – those with 'high', 'medium' and 'low' scores – using the 33rd and 67th percentiles as cut-points. In some cases, the resulting groups do not form exact thirds due to tied ranks at cut-points.

Student Background Characteristics

Economic, Social and Cultural Status (ESCS)

In PISA 2009, the index of economic, social and cultural status (ESCS) is composed of a set of six inter-related measures of different aspects of student socioeconomic background: parental occupation, educational level of parents, number of books in the home, family wealth (material possessions), home educational resources, and cultural possessions at home. ESCS accounts for a smaller percentage of the variation in reading performance in Ireland (12.9%) than on average across OECD countries (14.1%), although this difference is not significant. Student ESCS is positively associated with reading achievement in Ireland, with a 76 score-point difference on the reading scale between students in the low and high categories of the ESCS scale (Table 4.1). Ireland's mean ESCS score (-0.01) is almost the same as the OECD average (0.00) (Table 4.2) and is significantly lower than the mean ESCS score in Northern Ireland (0.12).

Table 4.1: Mean reading scores of students in Ireland, by economic, social and cultural status (ESCS)

	%	Mean	SE	SD
Low	33.2	**459.5**	3.56	92.3
Average (Ref. group)	33.5	497.9	3.88	91.1
High	33.4	**535.5**	3.09	82.5

Note: Missing = 2.4%. Significant differences in bold. Percentages and mean scores were computed using normalised population weights. Standard errors (SE) were computed using a balanced repeated replication (BRR) method of variance estimation.

Comparisons of Irish and OECD mean scores on four of the variables contributing to ESCS are summarised in Table 4.2, along with correlations with reading achievement. In Ireland, mean scores on the home educational resources and cultural possessions indices are significantly lower than the corresponding OECD averages and the mean score on the material possessions index is significantly higher. Ireland's mean score on the parental

[22] An exception is grade (year) level.

occupation index does not differ significantly from the average across OECD countries (49.3). All four variables are positively and significantly correlated with reading achievement, though the correlation is weak in the case of material possessions.

Table 4.2: Mean scores of students in Ireland on student socioeconomic background variables, comparisons with OECD means and correlations with reading achievement

	Mean IRL	SE	SD	OECD Mean	Corr. Reading (r)
ESCS	-0.01	0.03	0.9	=	**.359**
Parental occupation	49.92	0.48	16.3	=	**.317**
Home educational resources	-0.37	0.02	1.0	↓	**.227**
Cultural possessions	-0.43	0.02	0.9	↓	**.272**
Material possessions	0.27	0.02	0.8	↑	**.065**

Note: Parental occupation OECD mean = 49.3, SE = 0.07. Significantly higher ($p \leq .05$) than OECD mean ↑; significantly lower ($p \leq .05$) than OECD mean ↓; Not significantly different ($p \leq .05$) from OECD mean = . Values of r in bold indicate a significant correlation with reading achievement ($p<.05$). Mean scores were computed using normalised population weights. Standard errors (SE) were computed using a balanced repeated replication (BRR) method of variance estimation.

The two remaining variables contributing to the ESCS index, educational level of parents and number of books in the home, are also strongly linked to achievement in Ireland. Students whose parents have a lower level of education, i.e., none or primary (2.4%), have a significantly lower mean reading score than students whose parents have a higher level of education, i.e., third level (51.0%) (with mean reading scores of 430.2 and 517.8, respectively). The mean reading score of students who have a low number of books in the home (0-10 books, 13.8% of student in Ireland), is significantly lower than the mean score of students who have a large number of books (more than 500 books, 7.4% of student in Ireland) (mean reading scores of 428.0 and 543.4, respectively).

Family Structure

In Ireland, students in lone-parent families have a significantly lower mean reading score than students in other family types (Table 4.3). The gap (24 score-points) is higher than that found on average across OECD countries (15 score-points), though this difference is not significant. Although this disparity may in part be explained by student socioeconomic status, Irish students in lone-parent families remain at a significant disadvantage of 13 score-points when this factor is controlled for (compared to 5 points on average across OECD countries) (OECD, 2010b).

Table 4.3: Mean reading scores of students in Ireland, by family structure

	%	Mean	SE	SD
Lone parent family (Ref. group)	15.7	478.5	5.62	98.1
Other family type	84.3	**502.6**	2.91	91.6

Note: Missing = 3.4%. Significant differences in bold. Percentages and mean scores were computed using normalised population weights. Standard errors (SE) were computed using a balanced repeated replication (BRR) method of variance estimation.

Migrant and Language Background

PISA categorises students as 'native' (born in the country or had at least one parent born in the country), 'second generation' (born in the country with both parents born in another country) or 'first generation' (student and both parents born in another country). In Ireland, first generation migrant students[23] have a significantly lower mean reading score (465.7) than

[23] 6.8% of all students.

native students (501.9), while second generation students[24] have a higher mean score (508.2) than native students, though not significantly so. This is in contrast to the situation at OECD level, where second generation students perform on average 35 score-points lower than native students. The gap between first and second generation migrant students in Ireland is 42 score points – the third largest across OECD countries. The mean scores of native and immigrant students[25] in Northern Ireland did not differ significantly (502.3 and 485.0, respectively).

Migrant students can also be differentiated according to whether they speak the same language as their host country or a different language. In Ireland, 94.3% of second generation students speak English or Irish compared to just 47.5% of first generation students. Migrant students in Ireland who speak English or Irish have almost identical scores to native students (Table 4.4), whereas migrant students who speak a different language perform 59 score-points below the native average (a similar pattern for mathematics achievement is also observed).

Table 4.4: Mean reading scores of students in Ireland, by migrant/ language status

	%	Mean	SE	SD
Native (Ref. group)	92.0	501.9	3.01	92.1
Migrant with English or Irish	4.5	499.7	8.33	91.4
Migrant with other language	3.5	**442.7**	11.24	102.8

Note: This variable is unique to Ireland. Missing = 4.9%. Of the 92.0% of students classified as native, 0.2% speak a language other than English/Irish. Significant differences in bold. Percentages and mean scores were computed using normalised population weights. Standard errors (SE) were computed using a balanced repeated replication (BRR) method of variance estimation.

Other key student-level variables associated with achievement include level of parental interaction and time spent in paid work (both of these indices are unique to Ireland; therefore international comparisons cannot be made). Students reporting higher levels of interaction with parents (e.g., 'spend time just chatting', 'discuss books, films or television programmes') have a significantly higher mean reading score (526.0) than students reporting lower levels of interaction (473.5).[26] Students who spend a lot of time in paid work during term time, defined as more than eight hours per week, have a significantly lower mean reading score (462.4) than students who do not engage in any paid work during term time (508.5).

The Student in School

Current Grade (Year) Level

Comparisons of achievement scores by grade (year) level are presented for all three domains (Table 4.5), as the achievement patterns vary across domains. In all domains, Third Year students perform at a significantly higher level than students in Second Year and at a significantly lower level than students in Transition Year. In mathematics, Third Year students have significantly lower mean scores than Fifth Year students, but differences between the mean scores of Third and Fifth Year students for reading and science are not significant. When the mean score for Transition Year students is used as the reference group, these students have significantly higher mean reading and science scores than all other grade

[24] 1.4% of all students.
[25] There are too few second generation students in Northern Ireland to provide a reliable estimate; therefore native students are compared to immigrant students (first and second generation combined).
[26] High, medium and low groups on the index of parental interaction were derived from dividing the scale into approximate thirds.

(year) levels, but their mean mathematics score differs significantly only from that of students in Second and Third Year.

Table 4.5: Mean reading, mathematics and science scores of students in Ireland, by current grade (year) level

	%	Reading		Mathematics		Science	
		Mean	SE	Mean	SE	Mean	SE
Second Year	2.5	**376.0**	10.88	**384.8**	11.63	**403.7**	10.24
Third Year (Ref. group)	59.1	487.9	3.43	480.1	3.07	501.7	3.74
Transition Year	24.0	**525.3**	4.42	**509.5**	3.88	**532.9**	4.93
Fifth Year	14.4	498.2	5.51	**496.1**	4.86	510.0	5.57

Note: Significant differences in bold. Of the 2.5% of students in the Second Year category, 0.1% were in First Year. Percentages and mean scores were computed using normalised population weights. Standard errors (SE) were computed using a balanced repeated replication (BRR) method of variance estimation.

School Economic, Social and Cultural Status (ESCS)

Each student was assigned a score representing the average ESCS of their school, calculated by averaging student-level ESCS within the school. As with student-level ESCS, school ESCS is positively associated with reading achievement (Table 4.6). The mean score of students attending schools of average ESCS is significantly higher than the mean score of students attending schools of relatively low ESCS, and significantly lower than the mean score of those attending schools of high ESCS. In almost all participating countries, including Ireland, school ESCS accounts for a much larger part of the variation in reading performance than student ESCS. In Ireland, a change of one unit on the index of school ESCS is associated with a 49 score-point difference, whereas the same change on the index of student ESCS is a 26-point difference. However, school and student ESCS are also correlated with one another ($r = .510$, $p < .001$).

Table 4.6: Mean reading scores of students in Ireland, by school ESCS

	%	Mean	SE	SD
Low	32.9	**458.0**	6.33	98.2
Average (Ref. group)	34.1	499.1	5.31	91.0
High	33.0	**530.2**	4.78	81.5

Note: Missing = 0.8%. Significant differences in bold. Percentages and mean scores were computed using normalised population weights. Standard errors (SE) were computed using a balanced repeated replication (BRR) method of variance estimation.

Another indicator of school-level socioeconomic status in Ireland is whether schools participate in the School Support Programme (SSP) under DEIS. On average, the 23.7% of students in schools in the SSP were at a significant disadvantage of almost 70 score-points on the PISA reading scale, compared with students in schools not in receipt of the programme (the group mean scores were 436.4 and 506.3, respectively).

School Sector and Gender Composition

Students attending girls' secondary schools obtained a mean reading score significantly exceeding the mean scores of students attending all other school types (Table 4.7). Students attending mixed secondary schools achieved the next highest mean score, while those attending vocational schools had the lowest mean score.

Table 4.7: Mean reading scores of students in Ireland, by school sector/gender composition

	%	Mean	SE	SD
Community/Comprehensive	15.4	**486.9**	7.75	96.6
Boys' Secondary	18.5	**488.2**	9.00	94.2
Girls' Secondary (Ref. group)	22.5	530.8	4.41	80.9
Mixed Secondary	20.5	**504.3**	5.86	86.3
Vocational	23.1	**465.6**	6.47	102.9

Note: Missing = 0.0%. Significant differences in bold. Percentages and mean scores were computed using normalised population weights. Standard errors (SE) were computed using a balanced repeated replication (BRR) method of variance estimation.

School Climate[27]

Student Behaviour

School principals were asked to indicate the extent to which learning was hindered in their school by various student behaviours (e.g. absenteeism, bullying and disruption of class). These items were used to form an index of 'student-related factors affecting school climate', on which higher scores denote less hindrance to learning. Each student was assigned the score corresponding to his/her school. Students in schools with a lower amount of negative student behaviour were found to have a significant advantage in average reading performance (35 score-points) over those in schools with an average amount of negative student behaviour (Table 4.8). The 16-point difference between students in schools with greater and average amounts of negative student behaviour is not significant. Ireland's mean score on the index (-0.25) is the fifth lowest among OECD countries, indicating that behaviour problems among students in Ireland are perceived to have a greater impact on learning than in most OECD countries.

Table 4.8: Mean reading scores of students in Ireland, by extent to which student behaviour hinders learning

	%	Mean	SE	SD
Greater	31.3	473.2	7.36	99.8
Average (Ref. group)	42.4	489.5	5.74	96.9
Lesser	26.3	**524.9**	5.70	82.4

Note: Missing = 12.9%. Significant differences in bold. Percentages and mean scores were computed using normalised population weights. Standard errors (SE) were computed using a balanced repeated replication (BRR) method of variance estimation.

Student-teacher Relations

Quality of student-teacher relations, as measured by extent of student agreement with a number of statements (e.g., 'I get along well with most of my teachers' and 'Most of my teachers treat me fairly') is also positively associated with reading scores. The relationship with achievement is stronger at the lower end of the scale. Students who perceive themselves as having poor relationships with their teachers have significantly lower scores (471.8) than students with relationships of an average quality (508.6). Those with good relationships achieved a mean reading score (517.9) that is not significantly different from the score obtained by students whose relationships were of an average quality. Ireland's mean score on the index (-0.08) is significantly lower than the OECD average, implying relatively lower perceived quality of student-teacher relations in schools in Ireland.

[27] All variables in this subsection are at the student level, with the exception of the index of student behaviour, which is based on principals' responses.

Disciplinary Climate and Relevance of Schooling

A 'disciplinary climate' index was constructed from students' reports on the frequency of disciplinary problems during English classes (e.g. 'Students don't listen to what the teacher says'; 'There is noise and disorder'). Higher scores on the index indicate a better disciplinary climate (fewer interruptions in class). Mean reading scores associated with high, average and low levels are 518.0, 496.5 and 479.0, respectively, with significant differences in favour of high over average, and average over low groups. Ireland's mean score on the disciplinary climate index (-0.03) is not significantly different from the OECD average.

A school climate index on which Ireland has a significantly higher mean score (0.14) than that found on average across OECD countries is the index of perceived relevance of schooling. Higher scores on this index indicate that students perceive school to be more relevant. The index was constructed from student responses to items such as 'school has been a waste of time' and 'school has taught me things which could be useful in a job'. The index is positively and significantly (though weakly) associated with achievement in Ireland ($r = .143$, $p < .001$).

Relationships between School and Student Characteristics and ESCS

Although this chapter is concerned with presenting univariate analyses of the relationships between individual school and student characteristics and reading achievement, it is important to note the role played by ESCS in mediating these relationships. As shown in Table 4.9, all continuous school and student variables reported in this chapter are significantly correlated with ESCS, although only just so in the case of disciplinary climate.

Table 4.9: Correlations between continuous school and student characteristics variables and ESCS - Ireland

	r	t	p
Parental interaction	**.273**	18.66	<.001
Time spent in paid work	**-.076**	-5.10	<.001
Student behaviour*	**.212**	5.19	<.001
Student-teacher relations	**.113**	5.89	<.001
Disciplinary climate	**.050**	2.32	<.05
Perceived relevance of schooling	**.117**	6.46	<.001

Note: Significant correlations in bold. * = School-level variable.

Groups derived from categorical variables also vary by ESCS, as shown in Table 4.10. Differences in mean ESCS scores across groups reflect in some instances performance differences noted earlier in the chapter. For example, students in lone-parent families have a significantly lower mean ESCS score (-0.27) than students in other family types (0.04) and students in vocational schools have the lowest mean ESCS score of all school types.

However, relationships between student and school variables and achievement are not entirely explained by differences in ESCS. For example, although students in girls' secondary schools have significantly higher achievement scores than students in all other school types, their mean ESCS score (0.06) is lower (though not significantly so) than students in both mixed secondary (0.15) and boys' secondary (0.12) schools. Finally, although native students have a significantly higher mean reading score than migrant students who do not speak English or Irish, the groups do not significantly differ by average ESCS score (-0.01 and -0.11, respectively). It is also interesting to note that migrant students with English or Irish have a significantly higher mean ESCS score (0.22) than native students (-0.01), while the achievement scores of these groups are practically identical.

Table 4.10: Mean ESCS scores for groups derived from categorical school and student characteristics - Ireland

Family Structure	Mean	Migrant/ Language Status	Mean	Grade (Year)	Mean	School Sector/ Gender Composition	Mean
Lone-parent (Ref.)	-0.27	Native (Ref.)	-0.01	First/ Second Year	**-0.47**	Comm/ Comp.	-0.09
Other family type	**0.04**	Migrant with English/ Irish	**0.22**	Third Year (Ref.)	0.00	Boys' Sec.	0.12
		Migrant with other lang.	-0.11	Transition Year	0.13	Girls' Sec. (Ref.)	0.06
				Fifth Year	**-0.21**	Mixed Sec.	0.15
						Vocational	**-0.29**

Note: Significant differences in bold. Mean scores were computed using normalised population weights.

Changes in Student- and School-Level Associations with Achievement since 2000

ESCS

Between 2000 and 2009, Ireland's mean ESCS score increased by 0.06 points, although this change was not significant (Table 4.11). The trend at the OECD level was in the opposite direction, with a significant fall of 0.06 points. The mean ESCS score of students in Ireland does not differ significantly from the OECD average in either year. On average across the OECD, the ESCS-achievement relationship remained unchanged between 2000 and 2009, with one unit increase on the ESCS index being associated with a score point change of 37 points on the reading scale in both cycles (Table 4.11). In Ireland, the association of ESCS with reading achievement, as represented by the score point change, was significantly stronger in 2009 than in 2000, going from being 5 points below the OECD average in 2000 to exceeding it by one point in 2009.

While Ireland's mean score on the overall ESCS scale remains close to the OECD average across both PISA 2000 and 2009, differences may be observed on some of the variables contributing to ESCS. Ireland's level of material possessions was not significantly different from the OECD average in 2000, but in 2009 Ireland had a significantly higher level of material possessions than that found on average across OECD countries. Ireland's relative position on the indices of home educational resources and cultural possessions did not display a parallel increase, however, with Ireland's mean scores on these indices remaining significantly below the corresponding OECD averages in 2000 and 2009.

Table 4.11: Comparisons of ESCS mean scores and associated score point changes on the reading achievement scale (2000 - 2009)

	2000		2009		Diff. (2009 - 2000)	
	Mean	Assoc. with Reading	Mean	Assoc. with Reading	Mean	Assoc. with Reading
Ireland	-0.07	32	-0.01	38	0.06	**6.7**
OECD	0.01	37	-0.05	37	**-0.06**	-0.6

Note: Figures are based on 27 countries. Significant differences in bold. Association with reading = score point difference on the reading scale associated with one unit of the ESCS.

Family Structure

The percentage of students in Ireland in lone-parent families increased significantly from 12.3% in 2000 to 15.7% in 2009, and is approaching the 2009 OECD average of 16.9%. The gap in performance between students in/not in lone parent families in Ireland did not change between 2000 and 2009 (24 points), but the scores of both groups declined in equal amount.

Immigrant Background

The average percentage of students with an immigrant background[28] across the OECD increased significantly from 8.3% in 2000 to 10.0% in 2009 (Table 4.12). Ireland had the fourth largest increase in the OECD, going from just 2.3% in 2000 (significantly below the OECD average) to 8.3% in 2009 (not significantly different from the OECD average). At OECD level, native students had significantly higher reading scores than immigrant students in both cycles. The OECD performance gap between groups did not change significantly over the period, with mean scores of both groups remaining almost identical.

In Ireland, however, the association between immigrant background and achievement underwent a reversal. In 2000, students in Ireland with an immigrant background had a significant advantage of 24 score points; however, by 2009, they were at a significant disadvantage of 29 points. While achievement scores of both groups fell significantly over the period, the drop experienced by immigrant students in Ireland was much larger (79 points) than that of native students (26 points). The advantage of native students relative to immigrant students in Ireland is still below the OECD average, though not significantly so.

Table 4.12: Percentages of immigrant students and comparisons of mean reading scores of native and immigrant students (2000 - 2009)

	Ireland				OECD			
	% Immig.	Native Mean	Immig. Mean	Diff. (Native - Immig.)	% Immig.	Native Mean	Immig. Mean	Diff. (Native - Immig.)
2000	2.3	527.5	551.8	**-24.3**	8.3	500.5	457.8	**46.2**
2009	8.3	501.9	473.1	**28.8**	10.0	500.8	456.6	**43.7**
Diff. (2009 - 2000)	**5.9**	**-25.6**	**-78.7**	**53.1**	**2.0**	0.3	-1.2	-4.1

Note: Figures are based on 27 countries. Significant differences in bold.

Language

As the percentage of immigrant students in Ireland has risen, so has the percentage of students who speak a language other than English or Irish at home, increasing from 0.9% in 2000 to 3.6% in 2009 (Table 4.13).[29] In 2000, students who spoke another language (whether they were immigrants or not) obtained a higher mean score (532.8) than students who spoke English or Irish (527.4), although this difference is not significant. Reflecting the trends in the performance of immigrant versus native students, by 2009 students speaking another language had a mean score that was 57 points lower than students speaking English/Irish. Again, although the mean scores of both groups dropped significantly over the period, the drop in the scores of students speaking another language (89 points) was larger than that of students speaking English or Irish (27 points), perhaps reflecting other changes since 2000 in

[28] 'Immigrant students' here refer to both first and second generation migrant students.

[29] The percentage of students who speak a language other than the test language in the OECD report for PISA 2009 (OECD, 2010b, 2010e) is 5.8%. This includes students who spoke neither English nor Irish at home (3.6% of all students), those who spoke Irish at home but did the mathematics and science tests in English (0.5%), and those who spoke English at home but did these tests in Irish (1.5%). Also included are students for whom the language of the test was unspecified but who spoke English at home (0.2%) – these students were recoded by the OECD as 'other language' students.

the characteristics of those who do not speak English/Irish. The composition of 'other language' students in Ireland also changed between 2000 and 2009. In 2000, the socioeconomic status of 'other language' students, as measured by parental occupation, was higher than that of students who spoke English or Irish (58.1 and 48.3, respectively), whereas in 2009 the socioeconomic status of both groups hardly differs (50.6 and 49.9, respectively).

Table 4.13: Comparisons of mean scores of students in Ireland who speak English/ Irish and those who speak a different language (2000 - 2009)

	Other Language			English/ Irish			Diff. (English/ Irish – Other Lang.)	
	%	Mean	SE	%	Mean	SE	Mean	SE
2000	0.9	532.8	23.83	99.1	527.4	3.16	-5.4	24.03
2009	3.6	443.9	10.43	96.4	500.4	2.98	**56.6**	10.85

Note: This variable is unique to Ireland. Significant difference in bold. Percentages and mean scores were computed using normalised population weights. Standard errors (SE) were computed using a balanced repeated replication (BRR) method of variance estimation.

Current Grade (Year) Level

As can be seen in Table 4.14 there has been a marked increase in the percentage of students in Transition Year (from 16.0% in 2000 to 24.0% in 2009) and a corresponding decrease in Fifth Year (from 18.6% in 2000 to 14.4% in 2009).

Table 4.14: Percentage of students in Ireland across grade levels (2000, 2003, 2006 and 2009)

Grade Level	2000 %	2003 %	2006 %	2009 %
Second Year	3.3	2.8	2.7	2.4
Third Year	62.0	60.9	58.5	59.1
Transition Year	16.0	16.7	21.2	24.0
Fifth Year	18.6	19.6	17.5	14.4

Note: Percentages and mean scores were computed using normalised population weights. The percentage of students in Second Year in 2009 differs slightly from the value given in Table 4.5 due to the exclusion of the 0.1% of First Year students.

Table 4.15 shows mean achievement scores by grade level for all three domains, across all four PISA cycles. The pattern of mean achievement scores across grade levels differs for each domain; therefore mean scores for mathematics and science are also presented in this section. Although the mean reading scores of students in all grade levels declined significantly between 2000 and 2009, the drop was greatest for Fifth Year students (from 547.9 to 498.2) and smallest for students in Third Year (from 516.9 to 487.9). It should be noted that average socioeconomic status (ESCS) was considerably lower in Fifth Year than in either Third Year or Transition Year, although the difference was only significant in the case of Third Year (see Table 4.10).

There was a significant drop in the mean mathematics scores for Third, Transition and Fifth Year students between 2003 and 2009. For mathematics performance, Third Year again displays the smallest drop (from 492.3 to 480.1), but for this domain the decline is greatest for Transition Year (from 542.9 to 509.5). There were no significant changes in the mean science scores for students at any grade level between 2006 and 2009. In science, Third Year students achieved a marginally higher score in 2009 than in 2006 (501.7 and 499.3, respectively).

Table 4.15: Mean achievement of students in Ireland in reading, mathematics and science across grade levels (2000, 2003, 2006 and 2009)

	2000		2003		2006		2009		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	
	Reading scores								Diff 2009-2000
Second Year	410.7	9.55	406.2	10.01	420.2	13.06	376.0	10.88	**-34.7**
Third Year	516.9	3.60	502.8	3.23	506.9	3.85	487.9	3.43	**-29.0**
Transition Year	568.4	4.52	562.0	4.48	547.8	4.70	525.3	4.42	**-43.1**
Fifth Year	547.9	4.30	530.8	4.36	530.9	4.56	498.2	5.51	**-49.7**
	Mathematics scores								Diff 2009-2003
Second Year	409.1	12.14	406.8	9.48	414.9	9.54	384.8	11.63	-22.00
Third Year	495.4	3.11	492.3	2.97	492.3	2.95	480.1	3.07	**-12.20**
Transition Year	537.3	5.72	542.9	4.56	530.1	4.30	509.5	3.88	**-33.40**
Fifth Year	516.6	4.48	515.1	5.32	511.5	4.18	496.1	4.86	**-19.00**
	Science scores								Diff 2009-2006
Second Year	425.8	10.49	400.5	9.95	408.5	11.0	403.7	10.24	-4.80
Third Year	504.6	3.86	494.1	3.30	499.3	3.5	501.7	3.74	+2.40
Transition Year	550.9	5.61	548.6	4.71	537.1	4.3	532.9	4.93	-4.20
Fifth Year	529.6	5.15	518.8	5.23	519.6	4.3	510.0	5.57	-9.60

Note: This variable is unique to Ireland. Percentages and mean scores were computed using normalised population weights. Standard errors (SE) were computed using a balanced repeated replication (BRR) method of variance estimation.

School Sector and Gender Composition

Data on the combined sector and gender composition of schools are not available for 2000; therefore these variables are examined separately below (Tables 4.16 and 4.17). The mean reading score of students in community/comprehensive schools dropped significantly between 2000 and 2009 (from 521.9 to 486.9), as did the mean score of secondary school students (from 543.2 to 509.1) (Table 4.16). The drop in the mean score of vocational school students (from 483.7 to 465.6) was not significant. Secondary school students obtained significantly higher mean scores than students in either community/comprehensive or vocational schools in both PISA cycles.

Table 4.16: Comparisons of mean reading scores of students in Ireland by school sector (2000 - 2009)

	2000			2009			Diff. (2009 - 2000)	
	%	Mean	SE	%	Mean	SE	Mean	SE
Comm./Comp.	14.9	521.9	6.38	15.4	486.9	7.75	**-35.0**	10.04
Secondary	62.7	543.2	3.81	61.5	509.1	3.69	**-34.1**	5.30
Vocational	22.4	483.7	6.74	23.1	465.6	6.47	-18.1	9.34

Note: The school sector variable is unique to Ireland. Significant differences in bold. Percentages and mean scores were computed using normalised population weights. Standard errors (SE) were computed using a balanced repeated replication (BRR) method of variance estimation.

The mean reading scores of students in all girls', all boys' and mixed schools were all significantly lower in 2009 than in 2000 (Table 4.17). In 2009, students in all girls' schools had a significantly higher mean score than students in all boys' and mixed schools, while the difference was only significant between all girls' schools and mixed schools in 2000.

Table 4.17: Comparisons of mean reading scores of students in Ireland by school gender composition (2000 - 2009)

	2000			2009			Diff. (2009 - 2000)	
	%	Mean	SE	%	Mean	SE	Mean	SE
All girls'	24.3	548.9	5.67	23.1	531.5	4.35	**-17.4**	7.15
All boys'	17.6	532.7	6.11	19.2	485.7	9.04	**-47.0**	10.91
Mixed	58.1	515.6	4.59	57.7	484.6	3.95	**-31.0**	6.06

Note: The school gender composition variable is unique to Ireland. Significant differences in bold. Percentages and mean scores were computed using normalised population weights. Standard errors (SE) were computed using a balanced repeated replication (BRR) method of variance estimation.

Disciplinary Climate and Teacher-Student Relations

As previously noted, disciplinary climate and teacher-student relations are student-level variables, with higher scores on both scales indicating more positive conditions. Although Ireland's mean score on the disciplinary climate index increased by 0.06 points since 2000 (Table 4.18), the country has gone from being significantly above the OECD average on the index in 2000 to not being significantly different from it in 2009. This is due to an even larger increase at OECD level, from -0.19 in 2000 to 0.02 in 2009.[30] The OECD mean score on the index of teacher-student relations has undergone a very similar change between cycles, increasing significantly across OECD countries from -0.20 to 0.01. Ireland also experienced a significant increase on this scale, though it was not as large. As a result, Ireland is still significantly below the OECD average on the scale, having been at a similar level in 2000.

Table 4.18: Comparisons of mean scores on disciplinary climate and teacher-student relations indices (2000 - 2009)

	2000		2009		Diff. (2009 - 2000)	
	Mean	SE	Mean	SE	Mean	SE
Disciplinary Climate						
Ireland	-0.09	0.02	-0.03	0.03	0.06	0.04
OECD	-0.19	0.00	0.02	0.00	**0.21**	0.00
Teacher-Student Relations						
Ireland	-0.21	0.02	-0.08	0.02	**0.13**	0.03
OECD	-0.20	0.00	0.01	0.00	**0.20**	0.00

Note: Figures are based on 27 countries. Significant differences in bold.

Variation in Performance

Though still below the OECD average of 38.9%, the percentage of variance in reading achievement scores in Ireland attributable to differences between schools increased significantly from 18.2% in 2000 to 31.0% in 2009 (Table 4.19). However, if eight very low-performing schools that participated in PISA 2009 in Ireland are excluded from the analysis, there is no increase in between-school variance in Ireland over the period (this issue is examined in more detail in Chapter 7). In 2000, the total variance in student performance in reading in Ireland was less than the OECD average. By 2009, Ireland's total variance exceeded the OECD average, due to a significant drop in variance at OECD level, and a rise in variance in Ireland. However, the rise in total variance in Ireland was not significant.

[30] Scores on the disciplinary climate and teacher-student relations indices for 2000 have been placed on the 2009 scales for these indices.

Table 4.19: Comparisons of total, within- and between-school variance in student performance on the reading scale (2000 - 2009)

	2000		2009		Diff. (2009 - 2000)	
	IRL	OECD	IRL	OECD	IRL	OECD
Between	1593	3324	2805	3420	**1211**	96
Within	7181	5922	6966	5875	-215	-47
Total	8756	9260	9053	8793	297	**-467**
% Between Schools	18.2	35.9	31.0	38.9	**12.8**	3.0

Note: Figures are based on 26 countries. Significant differences in bold.

Relationship between Performance and ESCS

Across the OECD, the strength of the relationship between ESCS and reading performance between schools decreased significantly, while the strength of the relationship between socioeconomic background and performance within schools increased significantly. In Ireland, there was no significant change in the strength of the ESCS-achievement relationship, either within or between schools, though, as was shown in Table 4.11, the average association between ESCS and reading achievement increased at the individual student level.

Table 4.20: Comparisons of within- and between-school associations of ESCS and reading achievement (2000 - 2009)

	2000		2009		Diff. (2009 - 2000)	
	IRL	OECD	IRL	OECD	IRL	OECD
Between-School Assoc. of ESCS	53.8	65.6	53.1	61.4	-0.7	**-7.3**
Within-School Assoc. of ESCS	22.9	17.9	26.9	19.1	4.0	**1.8**
Overall association of ESCS	33.7	39.1	39.4	38.3	5.8	-0.9

Note: 'Between-School Association of ESCS' = school-level score point difference associated with one unit of the school mean ESCS. 'Within-School Association of ESCS' = student-level score point difference associated with one unit of the student level ESCS, averaged across schools. Figures are based on 26 countries. Significant differences in bold. The Diff (2009 – 2000) at OECD level does not equal the 2009 OECD value minus the 2000 OECD value as Japan is not included in the trend estimates but is included in the OECD averages for 2009.

Conclusions

Although the mean economic, social and cultural status (ESCS) score of students in Ireland increased marginally (by 0.06 points)[31] between 2000 and 2009, and there was a corresponding significant average decrease across OECD countries, the mean score for Ireland did not differ significantly from the OECD average in either year. In Ireland, the overall relationship between ESCS and reading achievement, as represented by score point change, was significantly stronger in 2009 than in 2000, while on average across OECD countries this relationship has remained unchanged. While Ireland's level of material possessions changed from being not significantly different from the OECD average in 2000 to being significantly above it in 2009, there was not a corresponding change in the levels of home-educational resources and cultural possessions in Ireland.

The percentage of students with an immigrant background in Ireland increased from 2.3% in 2000 to 8.3% in 2009. In Ireland, the relationship between immigrant background and reading achievement underwent a reversal between 2000 and 2009. In 2000, immigrant students in Ireland achieved a mean reading score significantly above the mean score of native students; however, by 2009 they scored significantly below native students, while the

[31] The ESCS scale has an OECD country average of 0.0 and a standard deviation of 1.

average performance gap between immigrant and native students across OECD countries remained unchanged. A similar pattern is observed for students who spoke a language other than English or Irish. The percentage of such students increased from 0.9% in 2000 to 3.6%[32] in 2009. While students who spoke a language other than English or Irish achieved a mean score higher than (but not significantly different from) students who spoke English or Irish in 2000, by 2009 students speaking another language obtained a mean score significantly below the means of students who spoke English or Irish.

Ireland's mean score on the index of disciplinary climate increased slightly (by 0.06 points) since 2000 and its position changed from being significantly above the OECD average (indicating a more positive disciplinary climate) in 2000 to not being significantly different from the OECD average in 2009. Ireland also experienced a significant increase on the teacher-student relations scale (indicating more positive teacher-student relations); however, as the OECD average on this measure also increased, Ireland's position on the scale also moved from being not significantly different from the OECD average in 2000 to now being significantly below the OECD average.

Although there was a significant increase between 2000 and 2009 in the percentage of students in Ireland in lone-parent families (from 12.3% to 15.7%), the gap in reading performance between students in lone-parent and other family types did not change (24 points in 2000 and 2009).

While the general pattern of performance at different grade levels remained the same between PISA cycles (i.e., performance is highest among students in Transition Year, followed by students in Fifth Year, Third and Second Year), there have been changes in relative achievement depending on grade level and domain. For reading, the decline is largest in Fifth Year and smallest in Third Year between 2000 and 2009. In contrast, for mathematics, the decline (between 2003 and 2009) is most marked in Transition Year and least in Third Year. In the case of science, the change in achievement (between 2006 and 2009) is again smallest in Third Year, where there was a very slight increase. There have also been some shifts in the percentages of students at each grade level, with an increase in Transition Year (e.g., from 16.7% in 2003 to 24.0% in 2009) and a corresponding decrease in Fifth Year (19.6% in 2003, 14.4% in 2009). Average socioeconomic status (ESCS) was considerably lower in Fifth Year than in either Third Year or Transition Year in 2009.

Students in all school types (with the exception of vocational schools) achieved significantly lower mean reading scores in 2009 than in 2000. However, the relationship between school type and achievement did not change since 2000; students in secondary schools obtained significantly higher mean reading scores than students in community/comprehensive and vocational schools. Furthermore, students attending all boys', all girls' and mixed schools had significantly lower reading scores in 2009 than in 2000. In 2009, students attending all girls' schools achieved a significantly higher mean reading score than students in all boys' and mixed schools, while the difference was only significant between all girls' and mixed schools in 2000.

From 2000 to 2009, the total variance (dispersion) in students' reading achievement in schools in Ireland increased, while across the OECD, on average, it decreased. While Ireland's total variance was below the OECD average in 2000, it exceeded it in 2009. Between-school variance in reading achievement in Ireland also increased between 2000 (18.2%) and 2009 (31.0%).

[32] The percentage of students who speak a language other than the test language in the OECD report for PISA 2009 (OECD, 2010b, 2010e) is 5.8%. This includes students who spoke neither English nor Irish at home (3.6% of all students), those who spoke Irish at home but did the test in English (0.5%), and those who spoke English at home but did the mathematics and science test in Irish (1.5%). Also included are students for whom the language of the test was unspecified but who spoke English at home (0.2%) – these students were recoded by the OECD as 'other language' students.

Chapter 5: Reading Engagement and Approaches to Learning

Since reading was a major assessment domain in PISA 2009, data were gathered on students' engagement in reading and their use of learning strategies, which are considered to be preconditions for reading proficiency (see Box 5.1 for a list of aspects of engagement and learning examined in PISA 2009). The chapter is divided into three main parts. The first deals with reading engagement, the second with learning strategies, and the third with trends in engagement between 2000 and 2009. Data on reading for school are not considered here.

Box 5.1: Aspects of Reading Engagement and Learning Assessed in PISA 2009

Reading Engagement

- Time spent reading for enjoyment
- Reading for enjoyment (attitude)
- Diversity of print reading materials
- Diversity of online reading activities
- Reading for school

Approaches to Learning

- Understanding and remembering
- Summarising
- Memorisation strategies
- Elaboration strategies
- Control strategies

Reading Engagement

Four aspects of engagement in reading are considered in this section: the frequency with which 15-year-olds read for enjoyment on a daily basis, the extent to which 15-year-olds report enjoying reading, the range/frequency (diversity) of print texts read by 15-year-olds, and the diversity of their online reading activities.

Frequency of Reading for Enjoyment

Students were asked in a questionnaire to indicate how much time they usually spend reading for enjoyment each day. In Ireland, 41.9% reported that they don't read at all for enjoyment, 26.0% that they read for up to 30 minutes per day; 16.3% that they read for 30 minutes to one hour; and 15.8% read for at least one hour a day (Table 5.1). Students who don't read have a mean reading score (457.6) that is significantly lower than that of students who read for up to 30 minutes day (505.4), while those who read for between 30 minutes and an hour (540.1) and those who read for more than one hour (550.1) have significantly higher scores than students who read for up to 30 minutes (Table 5.1). The 10-point difference between students who read for more than an hour a day and students who read for between half-an-hour and one hour is not statistically significant.

More males (47.5%) than females (36.2%) in Ireland said that they did not read for enjoyment at all (Table 5.1). The mean reading score of females who did not read for enjoyment (474.8) is significantly higher than the mean of non-reading males (444.7). Among students who reported that they do not engage in any reading for enjoyment, those in the bottom quartile of the ESCS (socioeconomic status) scale (see page 25) had a mean reading score of 431.4, while non-readers in the top quartile had a mean score of 498.0.

Hence, it seems that ESCS, at least in part, mediates the association between frequency of reading and reading achievement.

Table 5.1: Percentages of students indicating four levels of reading for enjoyment and mean reading achievement scores, all students, males and females – Ireland (2009)

	All Students				Males		Females	
	%	(SE)	Mean	(SE)	%	(SE)	%	(SE)
Don't read for enjoyment	41.9	(0.95)	**457.6**	3.51	47.5	(1.36)	**36.2**	(1.25)
30 minutes or less day (Ref)	26.0	(0.70)	505.4	3.93	26.2	(1.02)	25.7	(0.95)
31 – 60 minutes a day	16.3	(0.65)	**540.1**	3.80	14.2	(0.83)	**18.5**	(0.95)
More than 1 hour a day	15.8	(0.67)	**550.1**	3.89	12.2	(0.85)	**19.5**	(0.98)

Note: Statistically significant gender differences (percentages) within Ireland are in bold in the Females column. Missing = 2.9%. Percentages and mean scores were computed using normalised population weights. Standard errors (SE) were computed using a balanced repeated replication (BRR) method of variance estimation.

The percentage of students in Ireland reporting that they don't read for enjoyment (41.9%) is greater than the OECD country average of 37.4%, but is about the same as in Japan (44.2%) and Belgium (44.4%), and is lower than in Luxembourg (48.2%) and the Netherlands (48.6%). In Northern Ireland, 43.3% reported that they don't read for enjoyment – about the same as in Ireland. In Finland, the highest-scoring European country in reading literacy in 2009, one-third (33%; 19.4% of females and 46.7% of males) reported that they don't read for enjoyment.

Enjoyment of Reading as a Leisure Activity

Students indicated their levels of agreement with 10 statements relating to enjoyment of reading. In Ireland, 31.7% (23.4% of males, 40.2% of females) agreed or strongly agreed that 'Reading is one my favourite hobbies', while 32.5% (18.2% of males, 47.2% of females) indicated similar levels of agreement with 'I like to exchange books with friends'.

Table 5.2: Percentages of students 'agreeing' or 'strongly agreeing' with various statements about their enjoyment of reading, all students, males and females – Ireland (2009)

	All		Male		Female	
	%	(SE)	%	(SE)	%	(SE)
I read only if I have to	39.2	(1.04)	45.4	(1.62)	**32.8**	(1.25)
Reading is one of my favourite hobbies	31.7	(0.94)	23.4	(1.18)	**40.2**	(1.29)
I like chatting to other people about books	34.7	(1.08)	24.8	(1.31)	**44.9**	(1.37)
I find it hard to finish books	40.4	(1.01)	42.1	(1.52)	38.7	(1.71)
I feel happy if I receive a book as a present	45.8	(0.92)	40.7	(1.18)	**51.0**	(1.39)
For me, reading is a waste of time	24.1	(0.85)	28.7	(1.31)	**19.3**	(0.97)
I enjoy going to a bookstore or library	40.0	(0.93)	32.5	(1.19)	**47.6**	(1.29)
I read only to get information that I need	44.9	(1.06)	54.3	(1.51)	**35.4**	(1.33)
I cannot sit still and read for more than a few minutes	31.6	(0.91)	36.1	(1.24)	**26.9**	(1.37)
I like to express my opinions about books I have read	44.2	(1.15)	38.2	(1.49)	**50.2**	(1.42)
I like to exchange books with friends	32.5	(1.20)	18.2	(1.05)	**47.2**	(1.77)

Note: Statistically significant gender differences (percentages) in bold. Percentages and mean scores were computed using normalised population weights. Standard errors (SE) were computed using a balanced repeated replication (BRR) method of variance estimation.

On nine statements, females had significantly higher average scores than males for positively-worded statements and significantly lower scores for negatively-worded statements. The exception was 'I find it hard to finish books', with which 42.1% of males and 38.7% of females agreed or strongly agreed.

A composite index of enjoyment of reading was established, based on all ten statements. The index was set to have an OECD country average of 0, and a standard deviation of 1 (indicating that two-thirds of student scores on the index lie between +1 and -1). The mean score for Ireland on the index was -0.08 (Table 5.3), indicating slightly below-average enjoyment of reading. Portugal (0.21), Japan (0.20) and Canada (0.13) had relatively high enjoyment scores, while Belgium (-0.20) and the Netherlands (-0.32) had low scores. The mean score for Finland (0.05) was higher than for Ireland, while the mean score for Northern Ireland (-0.19) was lower.

Table 5.3: Mean score, gender difference, association with reading achievement, and percent of variance explained for three indices of reading engagement – Ireland (2009)

Index	Mean Score	Gender Difference (M-F)	Change in Reading Achiev. per Unit Change on Index	Percent of Variance in Reading Explained	Correlation with Reading Performance	Correlation with Socio-economic Status (ESCS)
Enjoyment of reading	-0.08	**-0.45**	45.1	23.8	**.488**	**.258**
Diversity of print reading	-0.13	**-0.14**	19.3	3.2	**.179**	**.121**
Diversity of online reading	-0.50	-0.04	18.9	3.6	**.190**	**.191**

Note: Statistically significant gender differences in bold. All correlation coefficients are statistically significant

In Ireland, the mean enjoyment score for females was 0.15, while for males it was -0.30. The difference (-0.45), although large, is below the OECD average difference of -0.62. Large gender differences were observed in Norway (-1.0), Finland (-0.91) and the Netherlands (-0.69). The change in reading performance associated with a one-standard deviation increase in enjoyment of reading in Ireland was 45.1 points (Table 5.3), which is marginally higher than the OECD average change of 39.5 points. In Ireland, enjoyment of reading explained 23.8% of the variance in reading achievement. The percentage of explained variance was marginally higher in just two countries – Finland (27.0%) and Australia (26.0%).

In Ireland, the correlation between enjoyment of reading and ESCS is at the lower end of the moderate range (0.26) (Table 5.3). Among students in Ireland in the lowest ESCS quartile, 56.3% reported that they never read for enjoyment, while among those in the top quartile, just 26.0% reported never reading.

Diversity of Print Materials Read

Students were asked to indicate the frequency with which they read various print-based texts – fiction (novels, narratives, stories), non-fiction, magazines, comic books and newspapers – because they wanted to. Almost a third (30.3%) of students in Ireland read fiction at least several times a month, while just 16.0% read non-fiction books (Table 5.4). On the other hand, about two-thirds (67.5%) read newspapers with this frequency, while over half (57.1%) read magazines. Fewer than one-tenth (7.5%) of students reported reading comics. Females reported reading magazines and fiction books more frequently than males, and males read comic books and newspapers more frequently than females. Just 10.2% of males and 4.7% of females read comic books, indicating that this was the least frequently read print text.

An index of diversity of reading print materials was constructed based on the five text types in Table 5.4, with the OECD country average again set to 0 and the standard deviation to 1. The mean score for students in Ireland on this scale (-0.13) reflects a below average diversity of reading, with boys in Ireland reading significantly less diverse materials than females (Table 5.3). OECD countries with high scores on this scale include Finland (0.45) and Japan (0.38), while the mean score for the US was very low (-0.32). The mean score for Northern Ireland (-0.05) was marginally higher than in Ireland. Females in Ireland had a higher score than males by a sixth of a standard deviation (0.14 points). While large differences in favour of females were also observed in Sweden (0.32), Canada (0.25) and Finland (0.19), the difference in Japan (0.02) is not statistically significant. In Ireland, there is a change of 19.3 points in reading performance associated with a one standard deviation change on the index of diversity of print reading (Table 5.3). Hence the association between diversity and reading performance is considerably weaker than between enjoyment of reading and reading performance (a 45.1 score-point difference). The correlation between diversity of print reading and ESCS (.12) is at the lower end of the weak to moderate range.

Table 5.4: Percentages of students indicating that they read different types of material because they want to at least several times a month, all students, males and females – Ireland (2009)

	All Students		Males (Ref)		Females	
	%	(SE)	%	(SE)	%	(SE)
Magazines	57.1	(0.89)	45.6	(1.22)	**68.8**	(1.25)
Comic books	7.5	(0.46)	10.2	(0.76)	**4.7**	(0.47)
Fiction	30.3	(1.04)	24.4	(1.37)	**36.3**	(1.32)
Non-fiction books	16.0	(0.65)	15.0	(0.96)	17.1	(0.82)
Newspapers	67.5	(0.91)	73.4	(1.22)	**61.4**	(1.28)

Note. Missing = 2.5 – 3.3%. Significant gender differences within Ireland are in bold in the Females column. Percentages and mean scores were computed using normalised population weights. Standard errors (SE) were computed using a balanced repeated replication (BRR) method of variance estimation.

Diversity of Online Materials Read

Students were asked to indicate the frequency with which they engaged in various online tasks that require reading, such as reading e-mails, chatting online, and reading online dictionaries and encyclopaedias. The online activities in which students in Ireland engaged most often (at least several times a week) were chatting online (60.3%), reading e-mails (46.0%), and searching online for information about a topic (32.2%) (Table 5.5). More female than male students reported reading e-mails (49.7%, 42.4%) and chatting online (67.6%, 53.1%), while more males than females reported searching online information to learn about a topic (35.0%, 29.5%) and searching for practical information (27.1%, 21.0%) (Table 5.5). In Northern Ireland, more students than in Ireland reported chatting online (79.1%) and reading e-mails (66.8%), while the percentage that reported searching for information about a topic (31.0%) was about the same as in Ireland (32.2%).

Drawing on the items in Table 5.5, a diversity of online reading materials scale was constructed with an OECD mean of 0 and a standard deviation of 1. In Ireland, the mean score was -0.50, indicating a relatively low average level of diversity in online reading materials read (Table 5.3). OECD countries with high scores on this scale include the Czech Republic (0.53) and Poland (0.44). Countries with scores similar to Ireland include Japan (-0.49) and Mexico (-0.54). The mean score for diversity of online reading materials in Northern Ireland was 0.01, which is one-half of a standard deviation higher than in Ireland.

Table 5.5: Percentages of students indicating that they engage in various online reading activities at least several times a week and percentages of male and female students – Ireland (2009)

	All Students		Males		Females	
	%	(SE)	%	(SE)	%	(SE)
Reading emails	46.0	(1.02)	42.4	(1.12)	**49.7**	(1.52)
Chat online	60.3	(1.22)	53.1	(1.69)	**67.6**	(1.43)
Reading online news	19.7	(0.78)	22.6	(1.09)	**16.7**	(1.02)
Using an online dictionary or encyclopaedia	20.4	(0.71)	22.6	(1.16)	**18.2**	(0.92)
Searching online info to learn about a topic	32.2	(0.94)	35.0	(1.36)	**29.5**	(1.45)
Taking part in online group discussions or forums	14.9	(0.72)	17.2	(1.11)	**12.5**	(0.91)
Searching for practical information online	24.1	(0.74)	27.1	(1.13)	**21.0**	(0.95)

Note. Missing = 2.7 – 3.2% Significant gender differences are in bold in the Females column. Percentages and mean scores were computed using normalised population weights. Standard errors (SE) were computed using a balanced repeated replication (BRR) method of variance estimation.

The gender difference on the composite online reading materials scale in Ireland (0.04 in favour of girls) is not statistically significant (Table 5.3). On average across OECD countries, males achieved a significantly higher mean score than females (difference = 0.07), with males in Iceland (0.33), Portugal (0.24) and Denmark (0.23) well ahead of females (0.08, 0.02, and -0.06 respectively). In Ireland, there was a change of 19 points in reading performance per unit increase in online reading, indicating a relationship similar to that between diversity of print reading and reading performance. The corresponding average change across OECD countries was 14.9. It was 28.3 points in France and 26.0 in Australia. The correlation between online reading activity and print reading performance is in the weak to moderate range (0.19).

It should be noted that the reading engagement measures are correlated with one another. For example, the correlation between enjoyment of reading and diversity of print reading for students in Ireland is .44 ($p < .001$), while that between diversity of print reading and online reading is .31 ($p < .001$). The correlation between enjoyment of reading and engagement in online reading is also .31 ($p < .001$).

Learning Strategies

This section describes five indices of learning strategies. Two are specific to reading – understanding and remembering, and summarising information. The others – use of control, memorisation, and elaboration strategies – relate to learning more generally.

Understanding and Remembering

Students were asked to evaluate the extent to which a range of strategies are useful for understanding and remembering information in texts. The strategies included 'After reading the text, I discuss its content with other people', 'I underline important parts of the text', 'I summarise the text in my own words', and 'I read quickly through the text twice'. Based on student responses, and comparing these with experts' ratings of the usefulness of the strategies, an index of understanding and remembering, with an OECD mean of 0 and a standard deviation of 1, was constructed (see Table 5.6, where data on this and other learning

strategies scales may be found). The mean score for Ireland was 0.16, which is significantly above the OECD average (indicating recognition of more effective strategies by students in Ireland). Countries with relatively high scores on this scale include Germany (0.30), Italy (0.25) and Belgium (0.22). Students in Finland had a score of 0.03, indicating lower average awareness of effective strategies for understanding and remembering than their counterparts in Ireland. The mean score for students in Northern Ireland (0.13) was similar to that for students in Ireland.

Female students in Ireland reported a higher awareness of understanding and remembering strategies than male students (Table 5.6), though the difference (0.14) was smaller than the OECD average difference (0.27) or the difference in Finland (0.58). The change in reading performance in Ireland associated with a one standard deviation change on the index is 35 points – the same as the OECD average change. The correlation between understanding and remembering and reading achievement (0.36) is in the moderate range. There is a weak to moderate correlation between understanding and remembering and ESCS (0.16).

Table 5.6: Mean score, gender difference, association with reading achievement, and percent explained for five learning strategy indices– Ireland (2009)

Index	Mean Score	Gender Difference (M-F)	Change in Reading Score per Unit Change on Index	Percent of Variance in Reading Explained	Correlation with Reading Performance	Correlation with Socioeconomic Status (ESCS)
Understanding and remembering information	0.16	**-0.14**	**35.2**	12.9	**.360**	**.163**
Summarising information	0.14	**-0.30**	**38.9**	17.2	**.415**	**.140**
Control Strategies	0.00	**-0.21**	**27.6**	9.3	**.304**	**.231**
Memorisation strategies	-0.01	**-0.26**	**7.0**	0.5	**.073**	**.077**
Elaboration strategies	-0.20	**0.17**	**5.9**	0.4	**.067**	**.138**

Note: Statistically significant gender differences in bold. All correlation coefficients are statistically significant.

Summarising Information

Students were asked to evaluate the usefulness of summarising strategies by rating statements such as 'I carefully check whether the most important facts in the text are represented in the summary', 'I read through the text, underlining the most important sentences', and 'Before writing the summary, I read the text as many times as possible'. Again, the ratings of experts compared to student responses were used to establish a scale with an OECD country average of 0 and a standard deviation of 1. The mean score for students in Ireland was 0.14 (Table 5.6). Other countries with relatively high scores on the index were Italy (0.28), Denmark (0.18), Belgium (0.17), Germany (0.12) and Finland (0.08), while in Northern Ireland, the mean score was -0.10. In Ireland, the gender difference (in favour of female students) was 0.30 (Table 5.6), which is marginally lower than the OECD average difference (0.35), which was also in favour of females. The difference in Finland, in favour of female students, was among the highest across OECD countries (0.60). In Ireland the correlation between summarising and reading performance is 0.42, a value that is at the lower end of the moderate to strong range, while the correlation between scores on the summarising information index and economic, social and cultural status (ESCS) is 0.14 (a weak to moderate correlation).

Use of Control, Memorisation and Elaboration Strategies

Students' use of control strategies was assessed by asking them to indicate how often they engaged in activities such as 'When I study, I start by figuring out what exactly I need to learn' and 'When I study I try to figure out which concepts I haven't really understood'. Memorisation strategies were similarly assessed using statements such as 'When I study, I memorise everything that is covered in the text' and 'When I study, I read the text so many times that I can recite it'. Elaboration strategies were assessed with statements such as 'When I study, I figure out how the information in the text fits in with what happens in real life' and 'When I study, I try to understand the material better by relating it to my own experiences'. Composite indices were constructed for these aspects of learning, each with an OECD mean score set to 0 and standard deviation to 1.

In Ireland, the mean score on use of control strategies was 0.00, the same as the OECD average (Table 5.6). Countries with relatively high scores on this measure included Germany (0.21) and the UK (0.08), while Finland (-0.34) was well below the OECD average. The mean score for Northern Ireland was 0.12. The gender difference in Ireland (0.21), which was in favour of females, was marginally smaller than the OECD country average difference (0.27), which was also in favour of females. In Ireland, the reading score change associated with a one standard deviation change in use of control strategies was 28 points (Table 5.6), while the correlation between use of control strategies and socioeconomic status (ESCS) was at the upper end of the weak to moderate range (0.23). The correlation between control strategies and reading performance is 0.30, a value that is in the moderate range.

The mean score for Ireland on use of memorisation strategies was -0.01 (Table 5.6), a value that is not significantly different from the OECD average. Countries with relatively high scores on this scale include Poland (0.42), Bulgaria (0.38) and Germany (0.22), while the means for Finland and Japan were -0.25 and -0.70 respectively. In Northern Ireland, the mean score on memorisation strategies was 0.24. In Ireland, the difference between males and females was 0.26, with females reporting greater use of memorisation strategies. The OECD average difference was 0.17, also in favour of females. The change in reading performance in Ireland associated with a one-standard deviation change in use of memorisation strategies is small (7 points) (Table 5.6), while the correlation with ESCS, although statistically significant, is weak (0.08). The correlation between memorisation strategies and reading is also significant but weak (0.07).

Ireland's mean score on use of elaboration strategies was -0.20, or one-fifth of a standard deviation below the OECD average. Countries with relatively high mean scores on this measure include Turkey (0.44), Portugal (0.39) and Romania (0.32). Countries with scores below the OECD average include Finland (-0.15) and Japan (-0.70). The mean score on this index in Northern Ireland (-0.16) was about the same as in Ireland. Unlike the other indices in Table 5.6, male students in Ireland had a significantly higher mean score on elaboration strategies than females. The difference (0.17) is in the opposite direction to the OECD average difference (-0.08). The change in reading performance in Ireland associated with a one-standard deviation increase in use of elaboration strategies is 6 points, the lowest change per unit in reading scores in Table 5.6. The correlation between elaboration strategies and reading performance is 0.07, while that between elaboration strategies and ESCS is 0.14.

The various learning strategies correlate with each other. For example, the correlation between control strategies and elaboration strategies is 0.51 ($p < .001$), while that between control strategies and memorisation strategies is 0.49 ($p. < .001$) While the correlation between understanding and remembering and summarising is 0.41 ($p. < .001$), correlations between these two variables and memorisation strategies are not statistically significant.

Comparisons of Reading Engagement Indices between 2000 and 2009

A number of comparisons can be made between the responses of students to questions about reading engagement in 2000 and 2009. These include frequency of reading for enjoyment, engagement in reading (called attitude to reading in 2000), and diversity of reading (with the 2000 version of this scale rescaled to include printed reading materials only). The changes in engagement in Ireland reported in this section should be interpreted with reference to demographic changes since 2000, as well as other characteristics of the 2000 and 2009 samples of schools and students (see Chapter 7).

Table 5.7 shows a substantial increase in the percentage of students in Ireland reporting that they don't read for enjoyment, from 33.4% in 2000 to 41.9% in 2009.[33] There has also been a corresponding increase in the percentage of such students on average across the OECD (from 31.6% to 36.7%), although to a somewhat lesser degree. In Ireland, the percentage reading for more than one hour a day was about the same in both years (15.4% and 15.8% respectively). While 75.5% of females and 57.6% of males reported that they did at least some reading for enjoyment in 2000, by 2009, 63.8% of females and 52.5% of males reported doing so. Hence, the decline was greater among females (11.7%) than among males (5.1%); both differences are statistically significant.

Table 5.7: Comparisons of percentages of students in Ireland indicating frequency of reading for enjoyment, in PISA 2000 and PISA 2009 - Ireland

	2000		2009		2009-2000	
	%	(SE)	%	(SE)	Diff	SED
Don't read for enjoyment	33.4	(0.94)	41.9	(0.95)	**8.5**	1.34
30 minutes or less a day	30.9	(0.67)	26.0	(0.70)	**-4.9**	0.96
31 – 60 minutes a day	20.4	(0.68)	16.3	(0.65)	**-4.1**	0.94
More than 1 hour a day	15.4	(0.65)	15.8	(0.67)	0.4	0.93

Note. Differences that are significant across cycles in bold. Percentages and mean scores were computed using normalised population weights. Standard errors (SE) were computed using a balanced repeated replication (BRR) method of variance estimation.

Somewhat lower levels of enjoyment of reading are evident in 2009 for four of the statements contributing to the engagement in reading scale (Table 5.8). For example, 5.6% more students in 2009 agreed or strongly agreed that they only read when they have to, while 4.7% more in 2009 agreed or strongly agreed that, for them, reading is a waste of time.

Table 5.9 shows mean scores for students in Ireland on the aspects of engagement in reading administered in both 2000 and 2009, for all students, and for males and females. There were no overall significant differences on enjoyment of reading or diversity of print reading. However, female students had significantly lower scores in 2009 than in 2000 on enjoyment of reading and diversity of materials read. In the case of male students, differences are not statistically significant, though mean scores for males continue to lag well behind those for females.

[33] The reading for enjoyment index does not differentiate between paper-based and online reading tasks in either 2000 or 2009.

Table 5.8: Comparisons of percentages of students in Ireland indicating agreement or strong agreement with various statements about their enjoyment of reading, in PISA 2000 and PISA 2009 - Ireland

	2000		2009		2009-2000	
	%	(SE)	%	(SE)	Diff	SED
I read only if I have to	33.5	(0.91)	39.2	(1.04)	**5.6**	1.38
Reading is one of my favourite hobbies	35.7	(1.05)	31.7	(0.94)	**-4.0**	1.41
I like chatting to other people about books	27.8	(0.93)	34.7	(1.08)	**6.9**	1.42
For me, reading is a waste of time	19.3	(0.73)	24.1	(0.85)	**4.7**	1.12

Differences that are significant across cycles are in bold.

Table 5.9: Comparisons of mean scores of students in Ireland on student engagement indices common to PISA 2000 and PISA 2009

	2000		2009		2009-2003	
	Mean	SE	Mean	SE	Diff	SE
Enjoyment of reading						
All students	-0.03	0.02	-0.08	0.02	-0.05	0.03
Females	0.25	0.03	0.15	0.03	**-0.11**	0.04
Males	-0.32	0.03	-0.30	0.03	0.02	0.04
Diversity of reading (print texts)						
All students	-0.09	0.02	-0.13	0.02	-0.03	0.03
Females	0.00	0.02	-0.06	0.02	**-0.06**	0.03
Males	-0.20	0.03	-0.20	0.03	0.00	0.04

Note: Differences that are significant across cycles are in bold. The enjoyment of reading index was labelled 'attitudes to reading' in PISA 2000. Percentages and mean scores were computed using normalised population weights. Standard errors (SE) were computed using a balanced repeated replication (BRR) method of variance estimation.

Conclusions

In PISA 2009, 41.9% of students in Ireland reported that they spent no time reading for enjoyment on a daily basis, while 16% reported reading for more than one hour. Average reading achievement scores were highest for students who read for more than an hour per day, while no difference was observed between the reading achievements of students who read for 31-60 minutes and those who read for more than an hour.

A number of scales were constructed internationally to summarise students' enjoyment of reading and the range of print and digital texts they read. The mean score of students in Ireland on the enjoyment of reading scale was -0.08, indicating an average level of enjoyment below the corresponding OECD average (0.01). The correlation between enjoyment and reading performance in Ireland is 0.49, which is in the moderate to strong range. Females in Ireland and in most OECD countries had a higher average enjoyment of reading score than males.

The mean score of students in Ireland on the diversity of print reading scale was -0.13, which is again below the OECD average, and well below a number of countries with high average reading achievement, including Finland and Japan. The mean score for students in Ireland on online reading activities was -0.50. However, a number of high-performing countries in reading also had low scores on this index, while Finland scored close to the OECD average. In Ireland, correlations between the diversity of reading measures and reading performance on PISA are weak to moderate.

The mean scores for students in Ireland on the scales for understanding and remembering (0.16) and summarising information (0.14) are both above the corresponding OECD averages. Both scales are significantly correlated with reading achievement (0.36 in

the case of understanding and remembering, and 0.42 in the case of summarising information). Of the remaining scales, which relate to learning more generally rather than reading in particular, only use of control strategies had a moderate correlation with reading performance (0.30). The relatively strong correlations between engagement and reading achievement, and between strategy use (whether remembering and understanding, summarising, or use of control strategies) may have implications for the types of interventions designed to address low reading achievement and for understanding gender differences in reading (see OECD, 2010c, for a detailed discussion on this issue).

Declines in the frequency of reading for pleasure and on the indices of enjoyment of reading and diversity of reading print materials were observed in Ireland between 2000 and 2009, with somewhat greater declines on all three variables among females than among males, though males continued to have mean scores that were well below those of females.

Chapter 6: Information and Communications Technologies (ICTs)

Ireland was one of 43 countries that opted to include questions relating to student ICT (Information and Communications Technology) use and engagement in the student questionnaire in PISA 2009. An additional series of questions concerning school ICT resources and instruction was developed nationally and administered in Ireland as part of the school questionnaire, completed by principals.

This chapter presents the results of univariate analyses examining the relationships between ICT variables and scores on the PISA print reading scale. Where possible (i.e., for indices derived from the student questionnaire), mean scores of students in Ireland on ICT indices are compared to the averages across the OECD countries in which these items were administered. These indices are standardised to have an OECD mean of 0 and a standard deviation of 1. Some of the observed achievement differences are partially attributable to differences in student background characteristics (e.g., socioeconomic status) and this issue is also considered in this chapter. The results of international analyses of ICT data will be published by the OECD in June 2011.

Student Use of ICT Resources

Availability and Use of ICT Resources at Home

Students were asked whether various ICT resources were available in their homes, and whether or not they used them. Their responses formed the basis of an index of ICT availability at home. The percentages of students in Ireland reporting that the individual ICT resources were *not* available in their homes are generally low. For example, just 0.4% did not have a mobile phone at home; 5.0% did not have an Mp3/Mp4 player; and 6.6% did not have an Internet connection. The index displays a non-linear relationship with reading achievement in Ireland: students in the 'average' group on the scale have a significantly higher mean reading score than those in the 'low' and 'high' groups (Table 6.1). Ireland's mean score on the index (0.23) is significantly higher than the average across OECD countries, indicating relatively high availability of ICT resources in the homes of students in Ireland.

Table 6.1: Mean reading scores of students in Ireland, by availability of ICT at home, and mean scores on the index for each group

	%	Mean Scores on the Index	Mean Reading Scores	SE	SD
Low	27.8	-0.86	**487.8**	3.89	96.0
Average (Ref. group)	34.7	0.08	513.7	3.08	85.4
High	37.5	1.18	**496.9**	3.82	92.9

Note: Missing = 4.7%. Significant differences in bold. Percentages and mean scores were computed using normalised population weights. Standard errors (SE) were computed using a balanced repeated replication (BRR) method of variance estimation.

An index of ICT internet/entertainment use at home was derived from student responses to the frequency with which they engaged in various ICT-related activities. The index displays a similar relationship with achievement as that for ICT resources. Students with average scores on this index have a significantly higher mean reading score than students with high scores (Table 6.2). The 'average' group also has a higher mean reading score than the 'low' group, although this difference is not significant. Despite students in Ireland having a score on the index of *availability* of ICT at home that significantly exceeds

the average across OECD countries, the mean score of students in Ireland on the overall index of ICT internet/entertainment *use* at home (-0.18) is significantly lower than the OECD average. Examples of activities from this index that particularly high percentages of students in Ireland report 'never or hardly ever' engaging in are: using email (25.7%); chatting instantly online (26.5%); doing homework on a computer (37.8%); and publishing/ maintaining a personal website, weblog or blog (58.9%).

Table 6.2: Mean reading scores of students in Ireland, by ICT Internet/entertainment use at home, and mean scores on the index for each group

	%	Mean Scores on the Index	Mean Reading Scores	SE	SD
Low	29.5	-1.30	500.2	3.66	92.0
Average (Ref. group)	36.6	-0.17	511.4	3.48	88.7
High	33.9	0.77	**490.3**	3.80	2.35

Note: Missing = 5.1%. Significant differences in bold. Percentages and mean scores were computed using normalised population weights. Standard errors (SE) were computed using a balanced repeated replication (BRR) method of variance estimation.

Students were asked how frequently they used ICTs to do schoolwork at home. Percentages of students in Ireland reporting 'never or hardly ever' using ICTs for this purpose at home are very high. For example, 86.6% 'never or hardly ever' used email to communicate with teachers or to submit schoolwork; 79.6% 'never or hardly ever' browsed, uploaded to or downloaded information from their school website; and 30.4% 'never or hardly ever' browsed the Internet for schoolwork. The scale derived from these items, 'ICT for school-related tasks', is again related to achievement in a non-linear fashion. The 'average' group have a significantly higher mean reading score than either the 'low' or 'high' groups (Table 6.3). Ireland's mean score on the index (-0.62) is substantially below the average for OECD countries, indicating that students in Ireland make use of ICT for doing schoolwork comparatively infrequently.

Table 6.3: Mean reading scores of students in Ireland, by use of ICT at home for doing schoolwork, and mean scores on the index for each group

	%	Mean Scores on the Index	Mean Reading Scores	SE	SD
Low	24.4	-1.92	**475.8**	3.97	91.0
Average (Ref. group)	41.5	-0.70	525.1	2.80	82.6
High	34.1	0.40	**490.1**	4.39	94.8

Note: Missing = 5.4%. Significant differences in bold. Percentages and mean scores were computed using normalised population weights. Standard errors (SE) were computed using a balanced repeated replication (BRR) method of variance estimation.

Availability and Usage of ICT Resources at School

An index of ICT availability at school was constructed from students' reports of whether five ICT resources (desktop computer, portable laptop or electronic notebook, internet connection, printer, USB stick) are available for their use in school. Ireland's mean score on the index (-0.01) does not differ from the average across OECD countries. No significant differences were found when the reading scores of students categorised as attending schools with 'low' (508.8), 'average' (504.0) or 'high' (491.2) availability of ICT resources were compared.

An index of use of ICTs at school was derived from student reports of the frequency with which they use a computer for various activities at school. High percentages of students in Ireland reported 'never or hardly ever' using a computer for the following activities at school: using email (75.2%); posting work on the school website (92.5%); and reviewing basic skills in areas such as foreign language learning or mathematics (77.2%). Students with

high scores on the index have a significantly lower mean reading score than students with average scores (Table 6.4). The difference between the 'low' and 'average' groups is not significant. Although Ireland is close to the OECD average on the index of ICT *availability* at school, its mean score on the index of *use* of ICT at school (-0.37) is significantly and substantially below the OECD average, mirroring the situation regarding ICT availability and use at home: average or above average availability, but below average use.

Table 6.4: Mean reading scores of students in Ireland, by use of ICT at school, and mean scores on the index for each group

	%	Mean Scores on the Index	Mean Reading Scores	SE	SD
Low	26.3	-1.64	503.6	3.76	89.5
Average (Ref. group)	36.4	-0.46	509.0	3.34	85.5
High	37.3	0.61	**492.1**	4.28	96.7

Note: Missing = 5.5%. Significant differences in bold. Percentages and mean scores were computed using normalised population weights. Standard errors (SE) were computed using a balanced repeated replication (BRR) method of variance estimation.

Self-Confidence with, and Attitudes towards, Computers

An index of self-confidence in high-level ICT tasks was derived from students' reports of how confident they would feel performing five tasks on a computer that would require a relatively high degree of computer literacy (e.g., creating a database, using a spreadsheet to plot a graph). Highest scores on the reading scale were obtained by the 'average' group, followed by the 'high' group, and finally the 'low' group, with a significant difference between the 'low' and 'average' groups (Table 6.5). The mean scale score of students in Ireland (-0.11) is significantly lower than the average across OECD countries.

Table 6.5: Mean reading scores of students in Ireland, by self-confidence in ICT high-level tasks, and mean scores on the index for each group

	%	Mean Scores on the Index	Mean Reading Scores	SE	SD
Low	33.3	-1.31	**492.6**	3.40	92.2
Average (Ref. group)	27.2	-0.27	509.0	3.43	87.8
High	39.5	1.00	504.6	3.50	91.2

Note: Missing = 6.2%. Significant differences in bold. Percentages and mean scores were computed using normalised population weights. Standard errors (SE) were computed using a balanced repeated replication (BRR) method of variance estimation.

Levels of student agreement with four statements concerning their attitudes towards computers (e.g., 'It is very important to me to work with a computer', 'I use a computer because I am very interested') was used to compose an 'attitude towards computers' index. This scale displays a linear relationship with achievement: students in the 'average' group have a significantly higher mean score than those in the 'low' group and a lower mean score than those in the 'high' group, though the difference between the latter scores is not significant (Table 6.6). Students in Ireland have a significantly higher mean score on the index (0.14) than the OECD average. These findings suggest that, on average, students in Ireland have positive attitudes towards computers, but a comparative lack of confidence in performing high-level ICT tasks.

Table 6.6: Mean reading scores of students in Ireland, by attitudes towards computers, and mean scores on the index for each group

	%	Mean Scores on the Index	Mean Reading Scores	SE	SD
Low	23.2	-1.20	**488.4**	4.27	92.1
Average (Ref. group)	25.3	-0.09	502.7	3.58	91.2
High	51.5	0.86	509.7	3.15	87.1

Note: Missing = 8.9%. Significant differences in bold. Percentages and mean scores were computed using normalised population weights. Standard errors (SE) were computed using a balanced repeated replication (BRR) method of variance estimation.

Variation in Scale Scores by Background Characteristics

ESCS, Gender and Language Status

As noted previously, differences on outcome variables are associated with differences in student background characteristics. Table 6.7 provides comparisons of mean student scores on ICT indices according to gender and language status (i.e., whether students speak English/Irish or another language). Correlations between ICT indices and ESCS (economic, social and cultural status; see page 25) are also provided. Students with higher levels of ESCS are significantly more likely to report: greater availability of ICTs at home; greater use of ICT/internet/entertainment at home; greater use of ICT at home for doing school work; higher self-confidence in ICT high-level tasks; and more positive attitudes towards computers. In the case of ICT availability at home the correlation is moderate; in all other cases, correlations are weak or weak to moderate. The indices measuring ICT availability and use at school are not significantly associated with ESCS. Male students are significantly more likely than female students to report greater availability of ICT at home, greater ICT internet/entertainment use at home, and higher self-confidence in ICT high-level tasks. There are no gender differences associated with ICT use at home for school work, ICT availability and use at school, or with attitudes towards computers. Students who speak a language other than English/Irish report significantly and substantially higher levels of ICT internet/ entertainment use at home and use of ICT at home for doing school work than students who speak English/Irish, despite having a lower level of availability of ICT at home (although the latter difference is not significant). Students who speak another language also report significantly higher levels of self-confidence in ICT high-level tasks and significantly more positive attitudes towards computers. There are no significant language-based differences with respect to ICT availability or use at school.

Table 6.7: Correlations between ICT indices and ESCS and differences in mean scale scores by gender and language status

	ESCS		Gender (M-F)		Language (Other – Eng./Irish)	
	r	SE	Diff.	SE Diff.	Diff.	SE Diff.
Availability of ICT at home	**.270**	0.02	**0.12**	0.04	-0.11	0.10
ICT/ Internet/ entertainment use at home	**.092**	0.02	**0.09**	0.04	**0.47**	0.09
Use of ICT at home for doing school work	**.153**	0.02	-0.05	0.04	**0.58**	0.12
ICT availability at school	-.011	0.02	-0.01	0.06	-0.17	0.11
Use of ICT at school	.006	0.02	0.00	0.06	0.08	0.12
Self-confidence in ICT high-level tasks	**.118**	0.02	**0.13**	0.05	**0.23**	0.11
Attitudes towards computers	**.082**	0.02	-0.01	0.03	**0.18**	0.08

Note: Significant correlations in bold ($p < .05$). Significant differences in bold. Gender Diff. = (Male – Female). Language Diff. = (Another language – English/ Irish).

School Support Programme (SSP) Status

Table 6.8 presents mean score comparisons on ICT indices for students in schools participating in the SSP (School Support Programme) under DEIS (Delivering Equality of Opportunity in Schools) and their counterparts in non-SSP schools. Overall scale means for all schools are also presented. Students in non-SSP schools are significantly more likely to report higher levels of availability of ICT at home (0.24 compared to 0.12 in SSP schools) and use of ICT at home for doing school work (-0.63 compared to -0.73), whereas students in SSP schools are significantly more likely to report higher levels of availability of ICT at school (0.19 compared to -0.09) and use of ICT at school (-0.19 compared to -0.48). Differences with respect to ICT use at home for leisure, self-confidence in ICT, and attitudes towards computers are not significant.

Table 6.8: Comparisons of mean scale scores of students in Ireland on ICT indices, by whether or not their school participates in the School Support Programme (SSP), and overall mean scale scores

	All Schools		SSP		Non-SSP (Ref Group)	
	Mean	SE	Mean	SE	Mean	SE
Availability of ICT at home	0.23	0.02	**0.12**	0.45	0.24	0.02
ICT/Internet/entertainment use at home	-0.18	0.02	-0.10	0.05	-0.21	0.03
Use of ICT at home for doing school work	-0.62	0.02	**-0.73**	0.03	-0.63	0.03
Availability of ICT at school	-0.01	0.03	**0.19**	0.07	-0.09	0.04
Usage of ICT at school	-0.37	0.03	**-0.19**	0.08	-0.48	0.04
Self-confidence in ICT	-0.11	0.03	-0.14	0.07	-0.11	0.03
Attitudes towards computers	0.14	0.02	0.11	0.05	0.15	0.02

Note: Significant differences in bold. Mean scores were computed using normalised population weights. Standard errors (SE) were computed using a balanced repeated replication (BRR) method of variance estimation.

School ICT Resources and Instruction

Analyses in this section relate to questions which were asked only in Ireland. Variables are derived from principals' responses and reported at the student level (i.e., each student is assigned a score corresponding to their school). The response rate for the school questionnaire in Ireland was 88.2%; therefore, there is a relatively high degree of missing data for the variables in this section.[34]

Broadband Internet

The vast majority of students (95.4%) were in schools in which 'all or most' school computers had broadband internet connectivity.[35] The corresponding estimate for mixed secondary schools was 88.5%, which is significantly lower than for girls' secondary and vocational schools (both 100%). Whereas all students in SSP schools had access to broadband internet connectivity, just 94.4% in non-SSP schools had.

[34] This corresponds to 12.2% of missing responses for students. This percentage was computed using normalised population weights.
[35] The rate of missing data for this variable is 12.2% at student level (this includes students attending the 17 schools that did not return a questionnaire).

School ICT Co-ordinator

Principals were asked questions regarding the availability of a designated ICT co-ordinator in their school and the nature of the post, if one existed. The percentages reported here are calculated on the basis of the 90.4% of students attending a school with a designated ICT co-ordinator.[36] The majority of students (85.1%) were in schools in which the post of designated ICT co-ordinator formed all or part of a post of responsibility. A significantly greater percentage of students in boys' than in girls' secondary schools had an ICT co-ordinator whose role was a post of responsibility (95.3% and 74.5% respectively). Of the students in schools in which the role was not a post of responsibility, around half (50.5%) attended schools in which the co-ordinator was remunerated in some other way. Almost two-thirds of students (64.4%) were in schools in which the principal reported being either dissatisfied or very dissatisfied with the time available to the ICT co-ordinator to complete his or her work. A greater percentage of students in SSP schools had a principal who reported being dissatisfied or very dissatisfied (70.2% compared to 56.8% in non-SSP schools), although this difference is not significant. The ICT co-ordinator provided mainly technical support in schools attended by 41.3% of students, mainly pedagogical support in schools attended by 11.3% of students, and a mix of both types of support in schools accounting for 47.4% of students. A greater percentage of students in SSP schools had an ICT co-ordinator who provided mainly technical support (47.6% compared to 39.9% in non-SSP schools) and a greater proportion of students in non-SSP schools had an ICT co-ordinator who provided mainly pedagogical support (13.9% compared to 4.9% in SSP schools), though these differences are not significant. The vast majority of participating students attended schools in which the ICT co-ordinator was assigned the role mainly on the basis of either an ICT qualification (47.2% of students) or an interest in ICT (48.5% of students).

Integration of Technology in Schools

Principals were asked to indicate the degree of emphasis placed on the integration of technology into instruction.[37] Less than half of participating students (45.1%) were in schools placing a 'heavy' degree of emphasis on this aim. Students attending schools where principals placed a heavy degree of emphasis on the integration of technology had a significantly higher mean score on the international index of self-confidence in ICT high-level tasks (-0.04) than students in schools where principals placed 'some, little or no emphasis' on this (-0.18).

An index of perceived obstacles to integrating technology in school was constructed from principals' ratings of the degree to which various conditions acted as obstacles to making more effective use of technology in school.[38] The index has a national mean of 0 and a standard deviation of 1. The percentages of students in schools in which principals perceived the various conditions to be *major* obstacles are presented in Table 6.9, for all schools and by SSP status. More than half of students were in schools in which principals deemed the following to be major obstacles: too few computers in classrooms (52.4%); insufficient time for teachers to participate in training and development (58.9%); lack of leadership related to technology nationally (58.2%); and lack of a common understanding of technology integration nationally (55.0%). Students in non-SSP schools were significantly

[36] The rate of missing data for whether schools have a designated ICT co-ordinator is 13.5% at student level (this includes students attending the 17 schools that did not return a questionnaire).
[37] The rate of missing data on this variable is 12.9% at student level (this includes students attending the 17 schools that did not return a questionnaire).
[38] The rate of missing data for this index is 26.3% at student level (this includes students attending the 17 schools that did not return a questionnaire).

more likely to have a principal who reported that having too few computers in classrooms (66.0%, compared to 32.4% in SSP schools), and outdated computers (35.0%, compared to 16.3% in non-SSP schools) were major obstacles. Lack of computer skills in students was reported to be a greater problem in SSP schools. Over a fifth (22.5%) of students in such schools had a principal who reported that this was a major obstacle, compared to just 3.5% in non-SSP schools (this difference is significant). There are no other significant differences between SSP and non-SSP schools on these items.

Table 6.9: Percentages of students in all schools, SSP schools and non-SSP schools, in which principals perceived various factors to act as major obstacles to making more effective use of technology in school

	All schools		SSP Schools		Non-SSP Schools (Ref Group)	
	%	SE	%	SE	%	SE
Too few computers in classrooms	52.4	4.40	**32.4**	8.18	66.0	5.19
Too few computers in labs	14.9	3.56	11.6	6.73	18.2	4.64
Insufficient training and development for teachers	45.0	4.88	38.9	9.25	51.2	6.31
Insufficient time for teachers to participate in training and development	58.9	4.84	56.4	9.70	61.2	5.92
Insufficient or inadequate software	27.8	4.27	27.0	8.87	32.4	5.65
Outdated computers	28.0	4.12	**16.3**	6.36	35.0	5.36
Slow or unreliable Internet connection	15.5	3.53	7.4	4.61	19.3	4.77
Significant technical problems	23.1	4.00	30.1	9.19	23.6	4.88
Lack of computer skills in teachers	31.2	4.58	39.8	9.87	30.6	5.58
Lack of computer skills in students	7.2	2.17	**22.5**	8.38	3.5	1.77
Large class sizes	35.8	4.39	26.8	8.04	42.9	5.82
Lack of leadership related to technology nationally	58.2	4.78	49.6	8.89	62.0	5.94
Lack of leadership related to technology in the school	8.7	2.64	13.8	6.12	7.2	3.04
Lack of a common understanding of technology integration nationally	55.0	4.52	40.9	9.57	60.3	5.76
Lack of a common understanding of technology integration in the school	27.8	4.51	25.6	8.41	30.4	5.72

Note: Missing = 18.9 – 21.0%. Significant differences between SSP and non-SSP schools are in bold in the SSP columns. Percentages and mean scores were computed using normalised population weights. Standard errors (SE) were computed using a balanced repeated replication (BRR) method of variance estimation.

Comparisons of mean scores on the overall index by SSP status show that students in SSP schools have a significantly lower mean score on the index of perceived obstacles to making more effective use of technology in schools (-0.26, compared to 0.26 in non-SSP schools). This means that the principals in SSP schools perceive a significantly lower level of obstacles to making more effective use of ICT in school than the principals in non-SSP schools.

Comparisons with Previous PISA cycles

Self-Confidence with Computers

The index of self-confidence in ICT high-level tasks was also included in PISA 2006, although the set of items that the index was constructed from in 2009 was a subset of those used in 2006.[39] There was a considerable increase in Ireland's mean score on this index between 2006 and 2009 (from -0.33 to -0.11); however, Ireland's mean score on the index was significantly below the average across OECD countries in both years. This suggests that, although students in Ireland have become more confident in performing ICT high-level tasks, they are still significantly below the average level of confidence across OECD countries.

Conclusions

Students in Ireland have significantly lower levels of use of ICT resources, both in school and at home (for leisure and homework), than on average across OECD countries. This is despite having an average level of ICT availability in school and an above average level of ICT availability at home. Although students in Ireland have significantly lower levels of self-confidence in performing ICT high-level tasks than found on average across the OECD, they also have significantly more positive attitudes towards computers. International ICT indices tend to relate to reading achievement in a non-linear fashion in Ireland, and most display significant associations with socioeconomic status, as measured by student ESCS scores and school SSP status.

While male students report significantly greater availability of ICT at home, greater ICT internet/entertainment use at home and higher self-confidence in ICT high level tasks, gender differences are small. There is some evidence of a socioeconomic advantage for availability and use of ICT at home. Students with higher levels of reported ESCS are significantly more likely to report the following: greater availability of ICTs at home; greater use of ICT/internet/entertainment at home; greater use of ICT at home for doing school work; higher self-confidence in ICT high-level tasks; and more positive attitudes towards computers. Students who speak a language other than English or Irish report higher levels of using ICT at home for both internet/entertainment use and for doing school work. These students also report higher levels of self-confidence and more positive attitudes towards computers.

Although the vast majority of students in Ireland attend schools in which 'most or all' computers have broadband internet connectivity and a designated ICT co-ordinator, some significant differences were found between school types, e.g., students in boys' secondary schools are more likely to have an ICT co-ordinator whose role is a post of responsibility than students in girls' secondary schools. Further, a high proportion of students attend schools in which the principal reported being dissatisfied or very dissatisfied with the time available to the ICT co-ordinator. Less than half of students in Ireland had a principal who reported placing a heavy degree of emphasis on the integration of technology in the school. This group of students have significantly higher levels of self-confidence in ICT high-level tasks. Finally, the extent of obstacles to making more effective use of ICT in school perceived by principals differs significantly by school SSP status, with the principals of students in SSP schools reporting a lower average level of overall difficulty.

[39] PISA 2003 also featured an index of self-confidence in ICT high-level tasks, although the items used in the construction of the scale were different from those used in subsequent cycles. Ireland had a mean score on this index (-0.24) that was significantly below the OECD average (0.01) (Cosgrove, Shiel & Zastrutzki, 2005).

Chapter 7: Interpreting Changes in Achievement in PISA

This chapter examines some factors which may have impacted on the performance of students in Ireland in reading, mathematics and science between 2000 and 2009. PISA 2009 is the second assessment of reading as a 'major domain' since PISA began in 2000. This allows for a detailed analysis of how student performance in reading has changed since 2000. Mathematics and science were assessed as minor domains in PISA 2009; therefore, comparisons over time in these areas are more limited. In comparing performance over time, each domain is compared to when it was last assessed as a major domain (2000 in the case of reading, 2003 for mathematics and 2006 for science).[40]

Understanding Changes in Achievement between PISA 2000 and PISA 2009

Possible factors that may have contributed to the decline in Irish scores in reading and mathematics can be considered to fall under two general headings: those that are indicative of real declines in the knowledge and skills of students in Ireland and those that explain the decline in terms of factors associated with the administration of PISA in 2009 and/or linking data from one administration to another, which may have resulted in an inadequate representation of the knowledge and skills of students in Ireland.

Firstly, factors that may have contributed to a real decline in student achievement, including changes in the population of students from 2000 to 2009 (demographic factors) and the educational experience of the students in 2009, are considered.

Demographic Factors and Structural Changes

There have been some significant demographic changes in the school-going population in Ireland since 2000 as well as structural changes in the education system. These are reflected in the PISA 2009 sample and could have impacted on Ireland's achievement in 2009.

Firstly, the percentage of students with immigrant status in the PISA sample rose (from 2.3% in 2000 to 8.3% in 2009), while the percentage of students who spoke a language other than English/Irish at home also increased (from 0.9% in 2000 to 3.6% in 2009). In 2000, students who spoke another language obtained a higher mean score (532.8) than students who spoke English or Irish (527.4), although this difference was not significant. In 2009, the migrant students in Ireland who spoke English or Irish had almost identical scores to native students, whereas migrant students who spoke a different language performed 59 score points below the native average. Some of the decrease in the mean score for students who spoke a language other than English/Irish is likely to be due to the differing composition of these two groups in 2000 and 2009 (e.g., in 2000 'other language' students [58.1] had a higher socioeconomic status than the students who spoke English or Irish [48.3] whereas in 2009 the socioeconomic status of the two groups did not differ [50.6 and 49.9, respectively]) (Cosgrove, Shiel, Archer & Perkins, 2010).

Although difficult to quantify, greater numbers of children with identified special educational needs have been integrated into mainstream schools since 2000. Exclusion rates on PISA (including students with special educational needs [SEN] and little familiarity with

[40] Although readers might assume that a direct link is established across major domains (e.g. reading in 2000 and 2009), in practice, a chain of backward links is established (i.e., from 2009 to 2006, 2006 to 2003, 2003 to 2000 for reading, with common items used to establish the backward links).

the test language) are similar in both 2000 and 2009 (2.8% and 2.7% respectively). However, we know that the proportion of students who have special educational needs and the proportion who speak a language other than English or Irish has increased since 2000; therefore it is likely that more of these students would have participated in PISA in 2009 compared to 2000. Furthermore, while we know that 3.5% of students who participated in 2009 were classified as having a special educational need, a separate estimate of the number with special educational needs who participated in 2000 is not available.

Another demographic change relates to the rate of early school leaving before age 16, which has decreased since 2000 (from 2.1% to 1.5%). This is based on the number of 15-year-olds selected to participate in PISA who, according to their schools, have left the educational system between the beginning of the school year in which PISA takes place and the date at which student participation lists are sent to schools (Cosgrove et al., 2010). As students at risk of early school leaving tend to be lower achievers, higher retention of such students could contribute to some of the decline in achievement.

A structural change in the education system since 2000 concerns the participation of students in Transition Year. Perhaps because of the greater availability of Transition Year in schools since 2000, the percentage of students in Transition Year has increased (from 16.0% to 24.0%) while the percentage in Fifth Year decreased (18.6% to 14.4%). The largest declines in average reading scores (2000-2009) occurred in Fifth Year (50 points) while the largest in mathematics (2003-2009) occurred in Transition Year (33 points). The relatively large decline in reading in Fifth Year in 2009 may be due to a shift of more able students from Fifth Year to Transition Year, while the decline in Transition Year mathematics may reflect the fact that students in this year may not experience mathematics instruction in the same way as they would in Third or Fifth years.

Between-school variance in reading performance increased between 2000 and 2009 (from 18.2% to 31.0%). When eight very low-scoring schools are removed from the 2009 sample, the between-school variance in achievement falls back to the 2000 level (18%)[41] (Cosgrove et al., 2010). It should be noted that in previous PISA surveys, it so happened that no schools with very low performance (i.e., more than 100 score points below the national student average) were sampled.

Between-school variance in average socioeconomic composition also increased, from 13% in 2000 to 18% in 2009. This can be interpreted as meaning that schools in 2009 are more different in terms of the socioeconomic background of their students. When analyses of variance components were conducted again on the 2009 SES scores (based on parental occupation) with the eight low-scoring schools excluded, between-school variation in SES decreased from about 18% to 17%, and overall variation in SES remained almost identical to the analyses that include the eight low-scoring schools (Cosgrove et al., 2010). Hence, the 'chance' inclusion of these eight schools could account for the observed increase in achievement differences between schools, but not the changes in between-school differences in SES.

Factors Related to the Educational Experience of the Students

The educational experiences of the students who participated in PISA 2009 could have differed from those of students in PISA 2000. The majority of the 2009 PISA students would have experienced aspects of the revised Primary School English Curriculum introduced in 2001-2002, and the revised Primary School Mathematics Curriculum introduced in 2002-2003. There is some evidence from Inspectorate reports that teachers experienced difficulties in the early stages of introducing these new curricula (DES Inspectorate, 2005). However,

[41] The SES measure used for this analysis was based on parental occupation (HISEI).

results of the national assessments of reading and mathematics conducted in 1998/1999 and 2004 did not show any change in average performance (Eivers, Shiel, Perkins & Cosgrove, 2005; Shiel, Surgenor, Close & Millar, 2006). It might be noted that students who were in Transition or Fifth Year in PISA 2009 (40% of the PISA cohort) would have been eligible to participate in the 2004 National Assessment of English Reading in Fifth class. Since performance at primary level did not change significantly in 2004 compared to the previous national assessment of reading in 1998, it seems unlikely that changes in curriculum implementation at primary level can explain the decline in performance on PISA reading literacy between 2000 and 2009.

There has been some curriculum change at post-primary level with the introduction of Project Maths into schools in September 2008. However, for its first two years, the project was implemented in 24 pilot schools, and has only been extended to schools in general since September 2010. The total number of students in the 24 pilot schools who had some exposure to the Project Maths curriculum and participated in PISA was 35, all in Fifth Year. Hence, since it involved such a small proportion of the PISA 2009 sample, it can be concluded that Project Maths had no direct impact on the mathematics performance of students in Ireland in PISA 2009. The introduction of science as a subject in primary schools in 2003-2004 and the implementation of the Junior Certificate Science Curriculum at post-primary level may have mitigated the effects of changes in demography and sampling that might otherwise have lowered performance in science in PISA 2009.

Ireland also participated in the International Civic and Citizenship Education Study (ICCS), which was administered to Second Year students in schools in the month previous to the PISA 2009 survey. Although the same schools were not selected to participate in both surveys and the measurement instruments, subject domains, sample designs and target populations were not the same either, it is still of interest to compare general country performance for the 33 countries that participated in both assessments as there is a strong correlation between the country-level mean scores on ICCS and PISA reading (.83). Also, it appears that there is a literacy component to ICCS as the gender difference observed in Ireland was accounted for when frequency of leisure reading (in which females reported engaging in more often) was added to a multi-level model of civic and citizenship knowledge (Cosgrove, Gilleece & Shiel, in press). On average, these 33 countries had a higher mean score on ICCS compared with PISA. Ireland ranks 8th out of 33 countries on ICCS (with a mean score that was significantly higher than the ICCS country average), yet only 13th among the 33 ICCS countries on PISA reading.

Factors specific to the implementation of PISA which may have resulted in an inadequate assessment of the knowledge and skills of students include sampling factors, test administration factors and linking and scaling factors. These are considered here in turn.

Sampling Factors

Country average performance in PISA is an estimate of proficiency based on the performance of a sample of students from each country. Samples are drawn in such a way as to ensure that participating schools and students are representative of the general population of students. To check if differences in the samples selected in 2000 and 2009 (either due to systematic changes in the methodology used or random fluctuations) could have impacted on achievement scores, an analysis of the two samples was carried out. This showed that the samples were comparable to one another and to the population of schools in Ireland in terms of school type (sector), enrolment size, gender composition and socioeconomic status (Cosgrove et al., 2010; LaRoche & Cartwright, 2010). The populations from which the samples were drawn in each year were also compared and again, no notable differences were found.

Both the 2000 and 2009 samples for Ireland were approved by the PISA consortium prior to implementing the studies. The response rates achieved by Ireland in all PISA cycles to date have met the requirements set out by the OECD (a weighted response rate of 85% at school level and 80% at student level). School and student response rates in Ireland were very similar in 2000 (88% and 86%, respectively) and 2009 (88% and 84%, respectively). Furthermore, the rates of exclusion due to special educational needs (SEN) or unfamiliarity with the language of the test were similar in the two years (2.8% in 2000 and 2.7% in 2009).

As noted above, Ireland participated in another international survey (ICCS) in post-primary schools during the same period as the PISA 2009 study. To prevent overlap of sampled schools in the two studies, the pool of post-primary schools was split and each sample drawn from half of all schools. In effect, this meant the PISA 2009 sample was drawn from a smaller number of schools than had been the case in previous studies. However, analysis of the two samples indicates that this did not have a detectable systematic effect on the PISA sample (LaRoche & Cartwright, 2010). In particular, it was found that no 'very large' schools were allocated to either sample, something that could have distorted performance if such schools had differed from one another in terms of achievement.

The inclusion of an additional school characteristic (the percentage of students with a fee waiver in the Junior Certificate examination – a proxy for school socioeconomic composition) in the selection of the PISA 2009 sample, which had not been used in previous cycles, was found not to have impacted on the comparability of the 2000 and 2009 samples (LaRoche & Cartwright, 2010). This was shown by applying the 'Junior Certificate fee-waiver' variable retrospectively to the 2000 sample and illustrating that equivalent proportions of schools in 2000 and 2009 were allocated to each fee-waiver quartile.

In 2000, all schools that participated in PISA had a mean achievement score that was within plus or minus 100 points of the national mean score (527). In 2009, eight schools were identified that performed over 100 points below the new mean score (496). Analysis of the Junior Certificate examination results for these low-scoring schools confirms that achievement in these schools was significantly lower than in other schools (Cosgrove et al., 2010). Several of these low-scoring schools also performed very poorly on PISA mathematics. The inclusion of these schools is not due to a systematic change in sampling methods. Hence, it seems that their presence in the sample may be due to random sampling fluctuation. An analysis of the characteristics of these schools compared with other schools (Cosgrove et al., 2010) found that:

- Students in the low-scoring schools had close to three times as many missing responses on the test.
- The low-scoring schools had a mean score in all three domains that was one standard deviation or more below the mean of other schools.
- Low-scoring schools had a mean SES score (based on parental occupation) that was 0.7 standard deviations below that of other schools, and twice the rate of Junior Certificate fee waivers.
- The average percentage of female students in the low-scoring schools (32%) was lower than in other schools (51%).
- 14% of student in low-scoring schools were 'other' language speakers compared to 3% in other schools.
- PISA student participation rates were lower in low-scoring schools than in other schools, at 69% and 84%, respectively.

Test Administration Factors

A small number of procedural changes between 2000 and 2009 in how the PISA study was administered could have impacted on student engagement with the assessment. It should be

noted that, in addition to these, there may have been complex interactions between procedural changes and other changes (e.g., demographic changes) that may prove difficult or impossible to disentangle and quantify.

One procedural change in PISA 2009 was the introduction of a prize draw to incentivise student participation. In each school, participating students were entered into a draw and three students in each school received a €15 voucher. Analyses of the samples for 2000 and 2009, described in the previous section, indicate that the two samples were comparable; therefore, it is unlikely that the introduction of a prize draw for students impacted on the composition of the 2009 sample.

Another change in 2009 was that the PISA test was either administered by a teacher in the school (76% of schools) or an external administrator (24% of schools), which, although in line with practice in other PISA countries, differed from the method used in previous cycles in Ireland in which external administrators administered PISA in all participating schools. Although the mean score of students in schools where a teacher administered the test in 2009 was 5 points lower than in schools with an external administrator, this difference can be explained by differences in the socioeconomic composition of schools. Schools with an external test administrator were more socioeconomically advantaged, as evidenced by data on both parental occupation and school average percentage of Junior Certificate fee waivers (Cosgrove et al., 2010).

Survey fatigue (disengagement arising from over-surveying) may have been more widespread in Ireland in 2009 than in 2000. Some of the PISA 2009 schools also participated in the Teaching and Learning International Study (TALIS) survey and the field trials for both ICCS and PISA in the previous year, any or all of which might have impacted on school/ teacher and student engagement with the PISA assessment in 2009. Furthermore, many Third Year students were engaged in practical examinations around the time PISA was administered and this could have affected their engagement in PISA, but it is not possible to quantify this issue.

Analysis of the rate of missing responses on the PISA tests indicates there has been an increase in skipping of questions. For example, in 2000, 2.6% of students skipped more than a quarter of questions; by 2009 this had doubled to 5.2%. Across the 30[42] countries that participated in PISA in 2000 and 2009, the percent of missing responses increased in five countries, and Ireland had the second highest increase. In Ireland, the average percentage of missing responses in reading increased from 4.2% in 2000 to 5.2% in 2009, while the average percentage missing decreased marginally in mathematics (from 11.1% to 10.4%) and to a larger extent in science (from 6.8% to 3.9%). These findings may indicate differential rates of engagement in reading, mathematics and science in 2009 or they may relate to the particular item sets used to assess each domain in 2000 and 2009 (for example, some 70 new reading items were introduced to PISA for the first time in 2009). Rates of skipping responses are higher among written response items (as opposed to multiple-choice items), while male students and students who spoke a language other than English or Irish also skipped more items. Skipping responses could be indicative of disengagement with the test, an inability to answer some questions, and/or changes in the strategies used to take the test (Cosgrove et al., 2010; Ekölf, 2010).

Another change in PISA 2009 was the administration of the Electronic Reading Assessment (ERA) for the first time. This test was administered to some students after they had completed the two-hour paper-based assessment and may have resulted in lower levels of motivation among these students due to being asked to complete two tests rather than one. However, a comparison of these students with those who did not participate in the ERA

[42] This comparison does not include countries that participated in the PISA 2000 assessment in 2001.

revealed no differences in their mean scores on the paper-based assessment (Cosgrove et al., 2010).

Linking and Scaling Factors

Reading became the major domain for the second time in the PISA 2009 cycle (it was also the major domain in 2000). In monitoring performance over time, the OECD compares each domain to when it was last a major domain. Therefore, PISA 2009 is the first opportunity to examine changes in reading performance in depth. To allow comparisons to be made across time in reading, 41 items were repeated in the 2000 and 2009 cycles, though just 28 of these were designated as link items (these 28 items have been repeated across all cycles).

The reading tests in 2000 and 2009 contained many more test items than the link items that were used to make the comparisons between 2000 and 2009. In practice, just 26 link items[43] were actually used for linking purposes (the 2009 scale was linked back to the 2006 scale, while in previous cycles, the 2006 reading items had been linked back to 2003, and the 2003 items back to 2000). The number of link items available (26) is fewer than the number of link items in mathematics (32) (where the link was back to 2006, with a link back to 2003 already established in 2006) and science (49, with a link back to 2006). One concern with the comparison of performance on reading from 2000 to 2009, and to a slightly lesser extent for mathematics from 2003 to 2009, is that the results for trends rely on a very small number of common items, which can impact negatively on the the stability of the trend estimate (Mazzeo & von Davier, 2008). The effect of the small number of link items in reading is compounded by the fact that reading the items are associated with only eight pieces of text.

Another potential problem is that PISA reading link items have not always appeared in the same position in the test between cycles. This is likely to further compound the stability of trend estimates in the case of reading since the measurement properties of questions are very sensitive to such changes (see Beaton, 1998, for analysis in the context of the National Assessment of Educational Progress in the United States). Changes in PISA booklet design between 2000 and 2003 were extensive and may have contributed to the fall of 11 points in Ireland's mean score in 2003 – a drop that, although large, was not statistically significant. There is some evidence that the choice of link items may have advantaged some countries (where students found the set relatively easy compared with the non-link items) and disadvantaged others (where students found the set relatively more difficult) (Gebhardt & Adams, 2007), though, in Ireland, the link items do not seem to have operated in these ways in 2009 (LaRoche & Cartwright, 2010).

As noted earlier, PISA reading scores are computed on the basis of a series of chain links (2009 to 2006, 2006 to 2003, and 2003 to 2000) and, while link error accumulates across cycles, the OECD does not make an adjustment to its estimates of link error to account for multiple linkages (LaRoche & Cartwright, 2010). If the link error is underestimated, significant differences in trends will be over-estimated, and there is currently no agreed method to compute this link error (Gebhardt & Adams, 2007).

Another possible explanation for at least part of the decline in Ireland's mean score is regression to the mean – a tendency for extreme mean scores at the country level to move closer to the international mean over time. Since Ireland's mean score in 2000 was high relative to most other countries, it might be expected that it would regress somewhat in subsequent assessments. The OECD do not mention this possibility in its analysis of achievement trends (OECD, 2010e). However, it is a naturally-occurring phenomenon, even

[43] Two items were deleted from the international database. For some booklets in Ireland the number of link items was reduced to 24 due to national deletions.

if it cannot always be measured empirically (LaRoche & Cartwright, 2010), and may also partly account for the improvement made by several low-scoring countries between 2000 and 2009.

PISA uses the Rasch (one parameter) model for scaling student achievement data. This model uses estimates of item difficulty to predict the probability that a student will answer a question correctly and assumes that items behave in the same way across countries, which in fact is not the case. An examination of the 2009 reading data for Ireland suggests a problem with respect to model data fit (i.e., actual performance of students in Ireland was better than predicted by the model on 65% of the items) (LaRoche & Cartwright, 2010). This suggests that PISA scores tend to underestimate student performance in the case of Ireland, although it is unknown at present to what extent this occurs for other countries. Furthermore, analysis of the reading items for 2009 shows that while the percentage of students who correctly answered the link items dropped from 69% to 65%, the percentage who correctly answered the non-link items in 2009 (60%) is much lower than in 2000 (67%). It may be that some aspect or aspects of the non-link reading items in 2009 disadvantaged Irish students in some respects, though this possibility has not yet been examined. Further analyses, comparing performance across link and non-link items in countries other than Ireland, and on average across OECD countries, will be conducted when the item-level data file for other countries becomes available.

Conclusions

Results from PISA 2009 indicate that there has been a decline in student performance in Ireland, particularly in reading, with a smaller decline in mathematics and no change in science from earlier cycles of PISA.

It is likely that the declines in reading and mathematics are due to a combination of factors, including demographic changes, structural changes in the education system, aspects of test scaling, and random sampling fluctuations.

An analysis of issues relating to sampling did not reveal any systematic source of bias, though there is evidence that a cluster of eight schools (identified as low-scoring) performed unexpectedly poorly relative to earlier PISA cycles, and that their inclusion in the sample may have been due to random sampling fluctuation.

Test administration procedures do not appear to have affected the results, although the increased number of educational surveys administered in Ireland in recent years may have given rise to survey fatigue – one possible explanation for the increased numbers of skipped questions on the PISA test in Ireland compared to other countries. The increase in the percentage of students skipping responses could also be due to lower proficiency among students, lower motivation to engage with the assessment, or some combination of these and other factors.

The methods used to establish student scores and compare these across cycles are not without problems and there is some evidence that the model used to scale student scores did not adequately represent student performance in Ireland. Furthermore, the much poorer performance of students in Ireland on the non-link reading items relative to the link items in 2000 and 2009 suggests that the items used in the 2009 reading test may not be equivalent to those in the 2000 test (i.e., the 2009 test is a more difficult test for students in Ireland), though this needs to be examined in greater detail when item level data from other countries become available.

It is important to note that because a chain of backward links is established for reading between 2000 and 2009, the 31 points decline in the mean reading score for Ireland includes the nine-point decline found between 2000 and 2006. The decline in the mean reading score for Ireland in previous cycles may be due to changes in the test booklet design.

Some demographic changes may have contributed to the observed declines. These include the increased number of migrant students with a first language other than English or Irish, increased retention rates, and more integration of students with special educational needs into mainstream schools; however, it is very unlikely that these changes alone account for all of the decline in students' scores in Ireland. Moreover, these changes should not be considered as mutually exclusive.

Although there is no evidence that the educational experiences of students taking PISA in 2009 differ in substantive ways from those of students in earlier cycles, it is noteworthy that there has been a large decline in the mathematics performance of students in Transition Year and in the reading performance of those in Fifth Year, coupled with an increase the percentage of 15-year-olds taking Transition Year and a decrease in the percentage in Fifth Year.

While the declines in performance in reading and mathematics in 2009 relate to students at all levels of ability, the scores of higher-achieving students, in the case of mathematics, have declined to a somewhat greater extent, indicating a need to monitor more closely the performance of students at all ability levels. The phenomenon of low performance among high achievers in Ireland, particularly in mathematics, has been raised as a point of concern in earlier national reports on PISA (e.g., Eivers, Shiel & Cunningham, 2008).

Also of concern is the large increase in the percentage of male students achieving below Level 2 on PISA reading (from 13.5% to 23.2%) and the proportionally larger decline in the mean score of males (-19 points) in mathematics compared to females (-12 points), resulting in the gender difference for mathematics no longer being significant in 2009.

While it would not be wise to formulate a detailed policy response on the basis of one survey alone (for example, Irish students performed relatively well on an international civics [ICCS] test that was administered concurrently with PISA), the results of PISA 2009 should not be set aside. The results of the Electronic Reading Assessment (ERA), which will be published in June 2011, will offer an opportunity to further examine student reading performance in PISA 2009. PISA 2012 will provide new data on performance. With a new trend line for reading from PISA 2012 back to 2009 only, based on a larger number of link items, it is likely that some of the concerns raised in this chapter about linking and scaling of reading will be addressed. It is less clear how performance in mathematics will evolve since the 16 point decline between 2003 and 2009 will be carried through to 2012 (comparisons for mathematics will be between 2003 and 2012). It would seem important to monitor very closely the effects of Project Maths on the performance of students at all levels of ability as the programme is rolled out in the coming years. It would also seem worthwhile to review the nature of the mathematical experiences that students encounter in Transition Year and whether those experiences contribute to continuity in mathematics development. Finally, it would seem important to monitor closely the performance of lower achieving males in reading, given the large increase in the proportion of males below Level 2 in 2009.

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Statistical Terms Used

Correlation	Correlation coefficients are used to describe the strength of a relationship between two variables, e.g., the relationship between socioeconomic status and reading achievement. A negative correlation (e.g. -.26) means that as one variable increases, the other decreases; a positive correlation (e.g. .26) means that both either increase or decrease together. A value of 0 indicates there is no relationship between variables, while the closer a value is to ±1, the stronger the relationship. In this report, the magnitudes of correlations are assigned qualitative labels to assist in interpretation (weak [<±.1], weak to moderate [±.1 to .25], moderate [±.25 to .4], moderate to strong [±.4 to .55], and strong [±.55 or greater]). The letter 'r' is used to denote a correlation.
Percentile	A percentile rank is the percentage of scores in a distribution that are at or below a given score. For example, if a student scores at the 90th percentile, this means that their score was better than or equal to the scores of 90% of the sample. The scores of students at the 10th and 90th percentiles are often used as benchmarks for high and low achievement.
Questionnaire Scales	It should be borne in mind that the scales (indices) derived from responses to the questionnaires are based on self-reported perceptions and the OECD has not yet established whether or not these are comparable across countries.
Scale scores	PISA uses Item Response Theory to convert test data into final test scores for each student. This 'scaling' process places students' performance and item difficulty on the same underlying scales and makes it possible to compare across domains and over time. Domains are scaled to have an OECD mean of 500 and a standard deviation of 100 in the cycle in which they are first the major domain. Indices derived from questionnaire data are scaled to have an OECD mean of 0 and a standard deviation of 1, unless otherwise stated.
Significant difference	A difference between groups is said to be significant if it is established that it is unlikely to have occurred by chance. In this report, where statistical significance is tested, comparisons are made against a 'reference' group which is specified in each table (Ref. group). Significant differences between the reference group and other groups are highlighted in bold.
Standard Error (SE)	PISA test scores are prone to uncertainty due to sampling and measurement error. This is because PISA assesses samples of students rather than the entire population, and also because each student only completes a subset of the pool of test items. In addition, comparisons of achievement across cycles are prone to linking errors. Thus, PISA test scores are estimates. The standard error provides us with a means of estimating how accurately the test scores generated match the 'true' population values.
Standard Deviation (SD)	The standard deviation is a measure of how much variation there is in the scores of a particular group. In PISA, domains are scaled to have an OECD mean of 500 and a standard deviation of 100. A standard deviation of 100 means that, on average across the OECD, two-thirds of students score between 400 and 600, and 95% of students score between 300 and 700.
95% Confidence Interval	The standard error is used to construct 95% confidence intervals around an estimate, in order to provide an indication of how reliable the estimate is. The interval is a range of scores in which there is a 95% chance that the 'true' value falls. For example, 95% confidence intervals constructed around a mean of 490 might give a range of 486 – 494. This means that there is just a 5% chance that the 'true' mean lies outside this range.