PISA 2009:

Results for Ireland and Changes Since 2000

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Preface

The Programme for International Student Assessment (PISA) is a project of the Organisation for Economic Cooperation and Development (OECD) which has as its objective the assessment of how well students, at age 15, are prepared to meet the challenges they may encounter in future education and life. The assessment is conducted in three-yearly cycles, beginning in 2000. Reading literacy was the main focus in PISA 2009, and students were also assessed in mathematics and science. Students in 65 countries, including all 34 OECD member states, participated. Ireland also participated in an international optional assessment of digital reading literacy in PISA 2009, along with 18 other countries (15 of which were OECD member states). In Ireland, the assessment was administered in March and April 2009 with a nationally representative sample of 144 schools, involving close to 4,000 students, their principals, and English teachers.

The OECD published the initial results of PISA in six themed volumes (OECD, 2010a-e, 2011a) and a technical report that describes the design, methods and procedures underlying PISA (OECD, 2011b). The Educational Research Centre published a summary report of the PISA 2009 results (Perkins, Moran, Cosgrove & Shiel, 2010), a summary of the results of the assessment of digital reading (Cosgrove, Perkins, Moran & Shiel, 2011), and a guide for teachers (Perkins, Moran, Shiel & Cosgrove, 2011).

As documented in this report, the results for Ireland for PISA 2009, particularly for reading, were unexpected. This gave rise to a detailed analysis of the findings, which are reported in Cosgrove, Shiel, Archer and Perkins (2010), Shiel, Moran, Cosgrove and Perkins (2010), LaRoche and Cartwright (2010), Cosgrove (2011), Cosgrove and Moran (2011), and Cartwright (2011). The present report is an in-depth analysis of the PISA 2009 results from a national perspective, aimed at school leaders, teachers, policy-makers, researchers, parents, and partners in education. All national PISA publications, including those from previous cycles of PISA, are available at www.erc.ie/pisa. International OECD publications are available at www.pisa.oecd.org.

This report is divided into ten chapters which are preceded by an executive summary. Chapter 1 provides an overview of the design, content, and procedures associated with PISA. Chapter 2 consists of a review of performance of students in Ireland on PISA 2000, 2003, and 2006, together with a description of background characteristics that are relevant to contextualising performance outcomes. Chapter 3 describes the achievements of students on the PISA 2009 assessment of print reading. Data are presented on performance on an overall reading scale, as well as on five subscales, and reading achievement in 2000 and 2009 is compared. Chapter 4 describes the performance of students on the assessment of digital reading. Students' navigational behaviour during the assessment is described, and performance on print and digital reading is compared. Chapter 5 describes the achievements of students in Ireland on the mathematics and science assessments, and compares performance in 2009 with performance in 2003 in the case of mathematics, and in 2006 in the case of science. Chapter 6 provides a description of school and student background characteristics and their associations with achievement (mainly in reading,). Changes in background characteristics over the lifetime of PISA and/or their relationships with achievement are also described. Chapter 7 explores aspects of students' reading engagement, reading

strategies, and learning strategies, how these relate to achievement, and if they vary by characteristics such as gender and socioeconomic background. Changes in reading engagement and learning strategies since 2000 are also described. Chapter 8 considers several key school and student background characteristics jointly in multilevel models of achievement in both print and digital reading. Models of print reading achievement in 2000 and 2009 are compared. Chapter 9 considers possible reasons for the changes in achievement on PISA in 2009 compared with previous cycles. Conclusions and recommendations are presented in Chapter 10.

PISA is administered in Ireland by the Educational Research Centre on behalf of the Department of Education and Skills. Implementation is guided by a national advisory committee, membership of which is listed in Appendix A.

Acknowledgements

The implementation of such a large and complex study as PISA would not have been possible without the support of, and advice from, a large number of individuals and organisations.

Thanks are due, first and foremost, to the school management, teachers and students that participated in PISA 2009 during both the field trial in spring 2008 and the main study in the spring of 2009. The administration of PISA 2009 represented new challenges, particularly in implementing the assessment of digital reading, and the commitment and professionalism of school staff was essential to PISA's success. Participating students were asked to complete a test and a questionnaire, and their engagement in doing so was also vital to successful implementation.

We gratefully acknowledge the contributions and advice from the PISA national advisory committee (Appendix A). The committee provided active guidance and feedback during all stages of the study, from reviewing materials and procedures during the field trial phase, to advising and commenting on the structure, content and focus of the present report.

The changes in achievement in Ireland observed in PISA 2009 were unprecedented, particularly in the case of reading. The Educational Research Centre would like to acknowledge the support and advice from Harold Hislop (Chief Inspector, Department of Education and Skills) and his colleagues in attempting to address and explain the changes. Thanks are also due to Sylvie LaRoche and Fernando Cartwright (Statistics Canada) for their detailed analysis of the implementation and data collation of PISA, and again to Fernando Cartwright for follow-up work that has provided new insights into measurement issues in PISA more generally, as well as more specifically in the case of Ireland.

Thanks are due to staff at the Educational Research Centre, for technical and administrative support: Paula Chute, John Coyle, Mary Rohan, Hilary Walshe, and Emma Pybus, who worked as a research assistant on PISA until September 2008. Thanks to Peter Archer (Acting Director) for ongoing guidance and support. Thanks also to Thomas Kellaghan (former Director) for his detailed review of, and advice on, this report.

We would finally like to acknowledge staff working in the international PISA consortium, particularly the PISA teams at the Australian Council for Educational Research (ACER) and Cito for their guidance during the implementation of PISA. Thanks to staff at the OECD and to colleagues on the PISA Governing Board for collaboration and support, particularly in respect to the policy challenges represented by the PISA results.

Acronyms and Abbreviations

ACER	Australian Council for Educational Research
BRR	Balanced Repeated Replication
Corr	Correlation
Ddiff	Deviance difference
DEIS	Delivering Equality of Opportunity in Schools
DES	Department of Education and Skills
df	Degrees of freedom
Diff	Difference
ERC	Educational Research Centre
ESCS	Economic, Social and Cultural Status
HISEI	Higher International Socio-Economic Index (of occupations)
HLM	Hierarchical Linear Models (software)
IALS	International Adult Literacy Survey
ICCS	International Civic and Citizenship Education Study
IEA	International Association for the Evaluation of Educational Achievement
IRL	Ireland
IRT	Item Response Theory
NCCA	National Council for Curriculum and Assessment
OECD	Organisation for Economic Co-operation and Development
OMCYA	Office for the Minister of Children and Youth Affairs
p	Probability (level)
PE	Parameter Estimate
PIRLS	Progress in International Reading Literacy Study
PISA	Programme for International Student Assessment
Ref	Reference group
SD	Standard Deviation
SE	Standard Error
SEC	State Examinations Commission
SES	Socioeconomic Status
Sig	Significance (level)
SPSS	Statistical Package for the Social Sciences (software)
SSP	School Support Programme
Stat	Statistic
Test Stat	Test statistic
TIMSS	Trends in International Mathematics and Science Study
WLE	Weighted Likelihood Estimate

Executive Summary

PISA, the Programme for International Student Assessment, is an international OECD survey of the reading, mathematics and science literacies of 15-year-olds that has been administered every three years since 2000. PISA 2009 marked the first time since 2000 that reading literacy was the major assessment domain. Mathematics and science were minor domains. In all, 65 countries/economies participated. In Ireland, a nationally-representative sample of 3,896 students and 480 teachers in 144 schools took part. The survey involved a two-hour student paper-based assessment of reading, mathematics, and science taken by all students, and a 40-minute assessment of digital reading taken by about one-third of students. Students, school principals, and teachers of English also completed background questionnaires.

First results of PISA 2009 were reported by the OECD in December 2010 (OECD, 2010a-e), and in June 2011 (OECD, 2011a). In December 2010 and June 2011, summary reports for Ireland on the paper-based assessment (Perkins et al., 2010) and the digital assessment (Cosgrove et al., 2011) were published. A *Guide for Teachers* has also been published (Perkins et al., 2011), along with a number of technical reports that examined changes in the achievements of Irish students on PISA. All national publications can be accessed at www.erc.ie/pisa, and international reports are available at www.pisa.oecd.org.

The PISA achievement scales were set to have an OECD average of about 500 and a standard deviation of 100. Indices derived from the information gathered in the student and school questionnaires were set at an OECD average of 0 and a standard deviation of 1.

Ireland's Achievement on Print Reading

Ireland's mean score of 496 on the overall print reading scale in 2009 is not significantly different from the OECD average of 493, and is 31 points lower than Ireland's score in 2000. The decline is the largest among the 38 countries for which results for 2000 and 2009 can be compared. It includes an 11-point decline in the average score between 2000 and 2003. Ireland's rank changed from 5th in 2000 to 17th in 2009. The percentage of students in Ireland who achieved a mean score below proficiency Level 2 increased from 11% to 17% since 2000, and the percentage at Levels 5 and 6 in 2009 was 7%, which is half of what it was in 2000 (14%).

As well as for a combined print reading scale, results were reported on three process subscales – Access and Retrieve, Integrate and Interpret, and Reflect and Evaluate. Students in Ireland performed best on the Reflect and Evaluate subscale in 2009, achieving a mean score (503) that is significantly above the OECD average (495). Mean performance in Ireland on the other two process subscales (Access and Retrieve, and Integrate and Interpret) did not differ significantly from the corresponding OECD averages. Irish performance on two text format subscales – Continuous and Non-Continuous – was similar to the average performance on the combined reading scale, and did not differ significantly from the OECD averages.

In Ireland, females significantly outperformed males by 39 points on the overall print reading scale, a difference that increased between 2000 and 2009 by 11 points. The

mean scores of both male and female students dropped significantly over this period, with a larger drop for males (-37 points) than for females (-26 points). Gender differences in 2009 were smaller on the Integrate and Interpret (37 points), Reflect and Evaluate (38 points), and Non-Continuous Texts (39 points) subscales, and larger on the Continuous Texts (41 points) and Access and Retrieve (45 points) subscales with females scoring higher on all five. Generally, gender differences in Ireland were similar to the OECD average differences.

In 2009, 5% of males and 10% of females in Ireland achieved scores at the highest levels (Levels 5 and 6) on the combined reading scale, which are similar to the respective OECD averages. At the lower end of the achievement scale, 23% of males and 11% of females scored below Level 2. The corresponding OECD averages for males and females were 25% and 13%, respectively. The percentage of low-achieving males (those scoring below Level 2) in Ireland increased by 10 points since 2000, while that of low-achieving females increased by 3 points. The percentage of high-achieving males (scoring at Levels 5 and 6) in Ireland decreased by 7 points since 2000, while the percentage of high-achieving females was 8 points lower in 2009 than in 2000.

Between-school variance in print reading achievement was 29% in 2009, compared with 18% in 2000, indicating that schools in 2009 differed more from one another in terms of average reading achievement than in 2000. Nonetheless, between-school variance in print reading achievement in Ireland in 2009 was still lower than the OECD average in that year (39%).

Ireland's Achievement on Digital Reading

PISA 2009 included an optional assessment of digital reading, in which Ireland and 18 other countries (15 of them OECD countries) took part. Students in Ireland achieved a mean score of 509, which is 10 points higher and significantly above the OECD average. Ireland ranked 7th among the 16 OECD countries that took part.

About 12% of students in Ireland had a digital reading score that was below Level 2 compared to 17% on average across the OECD, while similar percentages of students in Ireland and across the OECD had a digital reading score at or above Level 5 (about 8% in both cases).

A gender difference in favour of girls on digital reading (31 score points) was the third highest difference observed in the 19 participating countries, and was higher than the OECD average difference (25 score points). In Ireland, 17% of boys scored below Level 2, compared to just 7% of girls (the respective OECD averages were 21% and 13%). At the upper end of the achievement distribution, 6% of boys and 10% of girls in Ireland had digital reading scores at Level 5, which are similar to the percentages across the OECD on average.

During the digital reading assessment, students' navigational behaviour, including the number of relevant web pages visited, was captured. Countries with higher average scores on an index of the number of relevant pages visited tended to have higher average scores on the digital reading assessment, and Ireland's mean score on this index was significantly above the average across OECD countries. Girls had higher scores on the index than boys on average, and the gender difference associated with the number of relevant page visits in Ireland was higher than on average across the OECD. The correlation between this index and digital reading scores is .82 in Ireland,

which is about the same as across the OECD average. There is also a strong positive relationship between this index and performance on print reading, suggesting that students' navigational behaviour is in part a function of their existing (prior) reading knowledge and skills.

Between-school variance in achievement on digital reading in Ireland was 22%, which is lower than the average for participating OECD countries (39%).

Print and Digital Reading Performance Compared

A comparison of performance on digital and print reading literacy indicates that:

- Students in Ireland did better on digital reading, scoring above the OECD average, than on print reading, on which their score did not differ from the OECD average.
- The distribution of scores on the assessment of digital reading was narrower than for print reading in Ireland: that is, the performance gap between low and high achievers was narrower for digital reading than for print reading.
- Fewer students, particularly boys, scored below Level 2 on digital reading than on print reading.
- The gender difference on digital reading in Ireland was smaller than for print reading.
- Schools in Ireland differed less in their average achievement on digital reading than in their average achievement on print reading. Between-school variance was 22% on digital reading and 29% on print reading.

Ireland's Achievement on Mathematics

Ireland's overall performance on the mathematics assessment in 2009 merited a rank of 26th out of 34 OECD countries, with a mean score (487) that is significantly below the OECD average. In previous cycles of PISA, Ireland's average mathematics score did not differ from the OECD average. Results for 2009 indicate a decline in average achievement of 16 points since 2003, which is the second largest decline across the 28 OECD countries with valid data for both cycles. Most of the decline occurred since 2006.

In 2009, across the OECD on average, close to 13% of students achieved Levels 5 and 6 on the PISA mathematics proficiency scale, compared to just under 7% in Ireland. At the lower end of the scale, 21% of students in Ireland scored below proficiency Level 2, compared to 22% on average across the OECD. In Ireland, there was a significant increase of 4 percentage points since 2003 in the share of students scoring below Level 2, together with a corresponding drop of 5 percentage points in the share of students scoring at Levels 5 and 6.

In 2003, male students in Ireland obtained a significantly higher mean mathematics score (510) than female students (495). The mean scores of both genders dropped significantly between 2003 and 2009, with a greater decline for males (19 points) than for females (12 points), with the result that the gender difference was not statistically significant in 2009. On average across OECD countries, there was little change in the gender gap, with male students significantly outscoring females by about 12 points in both 2003 and 2009.

The percentages of both males and females scoring below proficiency Level 2 increased in Ireland between 2003 and 2009. The increase was greater for males (6%) than for females (2%). The decline in performance was also more marked for males at the upper levels of proficiency. Six percent fewer males performed at or above proficiency Level 5, while 4% fewer females did so.

Ireland's Achievement on Science

The average science score for Ireland (508) is significantly above the OECD average score in 2009, ranking Ireland 14th of 34 OECD countries. Across the OECD, 8.5% of students scored at proficiency Levels 5 and 6, compared to 9% in Ireland. There were fewer students scoring at or below Level 2 in Ireland (15%), compared to the OECD average (18%).

Girls achieved the same mean science score as boys on average across the OECD in 2009. In Ireland, the small gender difference in favour of girls (3 points) is not significant. Similar percentages of males (16%) and females (14%) in Ireland scored below Level 2, and the percentages of males (9%) and females (8%) scoring at Levels 5 and 6 were also similar.

In all previous PISA studies, Ireland's mean science score was significantly above the OECD average, and did not change since 2006. Neither did the percentages of students scoring at Levels 5 and 6, or below Level 2. The small, non-significant gender differences in science performance in Ireland also remained unchanged.

Engagement in Reading and Reading Strategies

In Ireland in 2009, 42% of students reported that they did not read for enjoyment, which is significantly above the OECD average of 37%. In contrast, 16% of students in Ireland reported that they read for at least an hour a day, which is similar to the OECD average (15%). Large proportions of students in other OECD countries also reported that they did not read for enjoyment, including students in high-performing countries (such as Japan and the Netherlands).

In Ireland, and on average across OECD countries, males reported lower levels of reading for enjoyment than females. Low levels of reading for enjoyment give rise to concerns for two reasons. First, there is a relatively robust association between frequency of reading and reading achievement in both print and digital formats, even after accounting for other school and student variables associated with reading (see the section below on models of reading achievement). Second, the ability to engage in personal reading as a leisure activity is an important outcome of schooling in its own right. The increase in the percentage of students in Ireland who did not engage in leisure reading – from 33% in 2000 to 42% in 2009 – is larger than on average across OECD countries.

In 2009, Ireland's mean score on the composite measure of enjoyment of reading was -0.08, which is significantly below the OECD average. Again, in Ireland, as well as on average across OECD countries, females had significantly higher levels of enjoyment of reading than males. The relatively strong association between enjoyment of reading and reading performance ($r = .45$), and its presence in the final models of print and digital reading (see below), highlight its importance in understanding individual differences in reading performance. Although slightly lower in 2009 than in 2000, the

change in the mean score on the enjoyment of reading scale in Ireland for these years is not statistically significant.

The mean scores of students in Ireland on three additional measures of reading engagement – diversity of reading (the range of different text types read by students) (-0.13), online reading (-0.50), and library usage (-0.32) – are all significantly below the corresponding OECD averages. Male students had significantly lower average scores than females on two of these measures (diversity of print reading and library usage). Ireland's score on the online reading scale was particularly low, and indicates engagement with a limited range of digital texts compared to students in other countries. In particular, very few students in Ireland reported reading online news, using an online dictionary or encyclopaedia, or searching online to learn about a topic.

Students in Ireland also reported making below-average use of libraries (school-based or public) for such activities as borrowing books to read for pleasure or for schoolwork, or to learn about things that were not course-related. The most frequent library-based activity in which they engaged was use of the Internet. In Ireland as well as in the majority of OECD countries, the association between library usage and print reading achievement was weak and negative.

Students in Ireland had mean scores that were above the OECD averages on two scales measuring awareness of reading strategies: understanding and remembering (0.16) and summarising information (0.14). In Ireland, gender differences in favour of females were smaller on the understanding and remembering index (0.14 points) than on the summarising index (0.30). The significance of both of these indices in the final models of print and digital reading (see below) confirms their moderately strong associations with achievement, though it is unclear to what extent awareness of such strategies contributes to reading performance, or is a consequence of performance.

The mean scores for Ireland on two of three general learning strategy scales – control strategies (0.00) and memorisation strategies (-0.01) – were not significantly different from the OECD averages, while the mean score on the third – elaboration strategies (-0.20) – was significantly lower. Of the three, only the measure of control strategies had moderate positive correlations with print literacy (r = .34) and digital literacy (r = .28). In the case of the other two scales, correlations were weak. Female students in Ireland had significantly higher scores than males on both control and memorisation strategies, and males a significantly higher mean score on elaboration strategies.

Other than for gender, few differences were observed across sub-groups of students, or across students attending different school types, in their engagement in reading or in their awareness or use of reading and learning strategies. However, students in boys' secondary schools and in vocational schools had lower mean scores than students in girls' secondary schools on awareness of understanding and remembering strategies, awareness of summarisation strategies, use of control strategies, and use of memorisation strategies. Immigrant students whose home language was not English or Irish had significantly lower mean scores than non-immigrant students on awareness of understanding and remembering strategies, and awareness of summarisation strategies.

School and Student Characteristics and Achievement

Information on background characteristics is largely based on students' and principals' responses to the PISA questionnaires, with some information on school characteristics taken from national sources. In the first two parts of this section, associations of individual characteristics with achievement are considered, while in the third, the results of multilevel models of print and digital reading are presented.

Student Characteristics

The ESCS (Economic, Social and Cultural Status) indicator is a composite of six background characteristics: parental education, parental occupational status, educational resources available to the student in the home, cultural possessions in the home, number of books in the home, and material possessions in the home. The index is used extensively by the OECD in reporting results and was also examined in detail in national reporting.

The mean ESCS score of Irish students did not differ from the OECD average. ESCS is consistently and positively associated with achievement both in Ireland and across the OECD. In Ireland, a one-point (one standard deviation) increase in ESCS is associated with a 39-point increase in achievement on the print reading scale, which is about the same as the OECD average. The association between ESCS and achievement in digital reading is slightly weaker (a 34-point increase), but is again about the same as the corresponding OECD average.

In its reports, the OECD also provides information on an indicator of 'social equity', which is the percentage of total variance in ESCS that is associated with schools. Lower percentages are indicative of greater social equity. In Ireland, 23% of variation in ESCS is between schools, compared with an OECD average of 25%, indicating that socioeconomic differentiation (or social equity) on the basis of school intake in Ireland is similar to the OECD average.

In Ireland, immigrant students who spoke English or Irish in the home (4.5%) had mean achievement scores that did not differ from native Irish students, and a mean ESCS score that was slightly but significantly lower. Immigrant students who spoke a language other than English or Irish (3.5%) had a mean achievement score in all achievement domains that was significantly lower than the mean score of non-immigrant students, even though their mean ESCS score was significantly higher.

Students from the Traveller community – about 2% of participants in Ireland – scored significantly lower than non-Travellers on the three paper-based domains and on digital reading, and also had a significantly lower mean ESCS score.

About 16% of students in Ireland belonged to lone parent families, which is similar to the OECD average (17%). These students had significantly lower achievement scores, even after differences in ESCS had been taken into account. Number of siblings was also negatively related to achievement and ESCS, albeit weakly. The lowest achievement and ESCS scores were associated with the 12% or so of students with four or more siblings.

About three-quarters of students in Ireland reported that they did not engage in paid work during term time, while 6% worked for more than eight hours a week. More males than females engaged in paid work. The negative association between

participating in paid work and achievement was stronger for males than for females. Time spent in paid work was also negatively, though weakly, associated with ESCS.

Since PISA employs an age-based sample, students in Ireland were in Second, Third, Fourth (Transition), and Fifth Years at the time of the assessment, though the majority (about 60%) were in Third Year. Students in Second Year had significantly lower achievement scores in all achievement domains, as well as a significantly lower mean ESCS score, than students in Third Year. Students in Transition Year significantly outperformed students in Third Year, while the mean ESCS scores of students in these two year levels did not differ. Third Years and Fifth Years achieved print reading and science scores that did not differ from one another, while Fifth Years significantly outperformed Third Years on digital reading and mathematics. The mean ESCS score of Third Years was significantly higher than that of Fifth Years. Transition Year students significantly outperformed Fifth Years in all achievement domains except mathematics, and also had a significantly higher mean ESCS score.

One in seven students in Ireland (17%) reported that they had not attended preschool, which is well above the OECD average (8%). Students in Ireland who had attended preschool had a significantly higher score on the ESCS scale than students who had not. Their achievement scores were significantly higher than non-preschool attenders, even after accounting for ESCS differences.

In Ireland, students were asked if they intended to complete the Leaving Certificate. About 9% indicated that they were not sure or that they definitely wanted to leave prior to completion. There were large achievement differences between students who wanted to leave school early and those who did not – over 60 score points in each domain. There were also marked differences in the socioeconomic characteristics of the two groups: potential early school leavers had a mean ESCS score that was half a standard deviation below potential completers.

Students in Ireland were also asked about the frequency with which they had been absent from school in the two weeks prior to the assessment, though reasons for absence were not asked for. Generally, higher rates of absence were associated with lower average achievement as well as lower average ESCS.

School Characteristics

ESCS scores can be averaged for each school and their associations with achievement examined. A significant relationship between school ESCS and achievement over and above individual student ESCS would provide evidence of a social context effect. In Ireland, half a standard deviation increase on the index of ESCS at the school level was associated with an increase of 27 points on the print reading scale. This may be contrasted with the increase of 14 points which is associated with half a unit increase on the index of ESCS at the student level. While this finding supports the existence of a social context effect, it is somewhat weaker in Ireland than on average across the OECD.

In Ireland, students in girls' secondary schools significantly outperformed students in all other school types in print and digital reading. Students in vocational schools had the lowest scores in all four domains. However, some of these achievement differences are related to differences in ESCS (see the following section). For example, students in vocational schools had a significantly lower mean ESCS score than students in other school types.

Large and significant achievement differences were observed in all domains between students in the School Support Programme (SSP) under DEIS (Department of Education and Science, 2005) and students in non-SSP schools, ranging from about 40 to 70 score points. Students in SSP schools had a mean ESCS score three-fifths of a standard deviation below that of students in non-SSP schools.

Students enrolled in secondary schools that charged fees (about 9% of the sample) had significantly higher mean scores than students in non-fee-paying schools in all achievement domains, with score differences varying from about 40 to 50 points. The mean ESCS score of students in fee-paying schools was also higher, by about four-fifths of a standard deviation.

In Ireland, eight schools (containing 4% of PISA participants) achieved very low average scores, over 100 points lower than other schools in the sample, on the print reading assessment in 2009. No schools with similarly low scores had participated in PISA 2000. Students in these 'outlier' schools had a mean ESCS score that was about three-fifths of a standard deviation lower than students in other schools, as well as a higher concentration of other language speakers. The reasons for the appearance of these schools in the PISA 2009 sample are not clear – that is, whether they represent increasing socioeconomic and demographic diversity in the system as a whole, or were due to chance sampling fluctuations.

Five measures related to school climate were positively associated with both achievement and ESCS, though the strength of these associations is weak: indices of teacher behaviour/expectations, student behaviour, teacher-student relations, disciplinary climate, and students' sense of belonging in school. It should be noted that the design of PISA is not optimal for the measurement of these types of process indicators.

The achievement scores and ESCS scores of students attending schools in differing locations (in terms of population density) generally did not vary significantly. The number of schools available locally was also unrelated to school average achievement and ESCS. Two indicators of school selectivity (ability grouping and academic selectivity on intake) generally did not show any associations with achievement or with ESCS either.

Models of Reading Achievement

Multilevel models of the reading achievements of students in Ireland were used to examine the extent to which a range of school and student characteristics, when considered jointly, contributed to the explanation of variance in print and digital reading achievement in PISA 2009.

The same variable set was used in developing the models for both print and digital reading. At the school level, the following were included: sector/gender composition, fee-paying status, SSP status, average socioeconomic intake (ESCS), percent of students speaking a language other than the language of instruction, urban/rural location, availability of other schools in the local community, use of ability grouping, academic selectivity, school leadership, disciplinary climate, student-teacher relations, and outlier school status. At the student level, the following were included: gender, immigrant/language status, family structure, number of siblings, parental occupation, parental education, number of books in the home, home educational resources, material possessions, cultural possessions, part-time work, grade (year) level,

preschool attendance, summarising strategies, understanding and remembering strategies, reading for enjoyment, attitude to reading, diversity of reading, library usage, online reading, early school leaving intent, and level of absenteeism.

Only two school-level characteristics were statistically significant in the final model of print reading: SSP status and outlier school status. At the student level, several variables were significant: gender, immigrant/language status, number of siblings, parental occupation, parental education, number of books in the home, part-time work, grade (year) level, summarising strategies, understanding and remembering strategies, reading for enjoyment, attitude to reading, library usage, online reading, early school leaving intent, and level of absenteeism. School- and student-level characteristics together explained 59% of the total variance in print reading achievement, or 81% of between-school variance and 51% of variance within schools.

The results of modelling, which show the contribution of each variable after adjusting for all other ones indicated the following:

- Students in SSP schools had an expected print reading score that is 38 points lower than that of students in non-SSP schools.
- Students in outlier schools had an expected print reading score that is 23 points lower than that of students in non-outlier schools.
- Immigrant students who spoke the language of instruction had an expected reading score only slightly lower (by 8 points) than students born in Ireland, while immigrant students who spoke another language had an expected reading score that is 23 points lower.
- Parental occupation, though significant, appears to be less important than parental education in explaining differences in print reading achievement.
- Part-time work, particularly when it is for more than eight hours a week, is negatively associated with achievement in print reading. Similarly, early school leaving intent and more frequent absenteeism are associated with lower reading achievement.
- Significant achievement differences in print reading across grade level remain after adjusting for the other characteristics in the model. Relative to Third Year, students in Transition Year and Fifth Year had an expected print reading score that is about 20 points higher, while students in Second Year had an expected print reading score that is 35 points lower.
- Students' awareness of reading strategies was important in explaining achievement differences in print reading scores. Over and above school and student socioeconomic and demographic characteristics, they explained 10% of the total variance. Similarly, student engagement in reading explained 12% of the total variance in achievement over and above the other characteristics in the model. However, engagement with education (e.g., absenteeism rates) explained little additional variance (2%), indicating its relationship to socioeconomic and demographic characteristics.

The model for digital reading had somewhat weaker explanatory power than the model for print reading. It explained 48% of total variance in achievement, or 57% of variance between schools, and 46% within schools. Unlike the model for print reading, no school characteristics remained in the final model. This is consistent with the

observation that schools differed less from one another with respect to average achievement in digital reading than in print reading.

The final model for digital reading included gender, immigrant/language status, number of siblings, parental occupation, parental education, books in the home, part-time work, grade (year) level, preschool attendance, summarising strategies, understanding and remembering strategies, reading for enjoyment, attitude to reading, library usage, online reading, and early school leaving intent. Results (after adjusting for all of the other characteristics) indicated the following:

- Score differences associated with immigrant/language status were slightly larger for digital reading than for print reading. Immigrant students who spoke the language of instruction had an expected digital reading score 18 points lower than students born in Ireland, while immigrant students who spoke another language had an expected digital reading score that is 33 points lower.
- As with print reading, parental occupation is less important than parental education in explaining differences in digital reading achievement.
- Part-time work, especially when it is for more than eight hours a week, is negatively associated with achievement, as is early school leaving intent.
- Significant achievement differences in digital reading across year levels were found, and these are consistent with those found for print reading.
- Students' awareness of reading strategies and engagement in reading emerged as important covariates of digital reading achievement.

In the models for both print and digital reading, the association between number of books in the home and achievement was stronger for females than for males. This has also been found in multilevel analyses of print reading achievement in Ireland in 2000.

The size of the gender difference in both print and digital reading achievement varied across mixed schools. Follow-up analyses suggested that the difference tended to be smaller in schools with higher overall achievement. Furthermore, gender differences in students' awareness of reading strategies and engagement in reading accounted for about two-thirds of the achievement difference between boys and girls in both the print and digital reading assessments.

These findings identify four areas that merit further examination. First, it is unclear what awareness of reading strategies measures. Further research that that complements PISA's cross-sectional approach is needed to better understand this finding. It would be erroneous on the basis of the PISA results to conclude that promoting students' awareness of reading strategies, or narrowing the gender gap through the use of such strategies, would result in increased reading literacy standards and/or smaller gender differences in Irish schools. Second, engagement in reading is an important covariate of reading achievement, as it was in PISA 2000. Given that the frequency of leisure reading has decreased significantly since 2000, strategies to initiate and develop an interest in reading are needed, particularly for boys. Third, students in Ireland engaged in very different ways on the print and digital assessments. Further research on engagement on print and digital assessments is warranted. This may be particularly relevant for teaching and learning in SSP schools, where the model of digital reading indicated that students in SSP schools and non-SSP schools did not differ on digital reading achievement, when account was taken of other characteristics. Fourth, that outlier school status remained in the model of print reading, together with the finding that no such low-performing schools appeared in the PISA 2000 sample,

indicates the need to identify and examine schools with particularly low (and high) average performance in future PISA cycles.

Trends in Characteristics Associated with Achievement

In examining background characteristics and their relationships to print reading achievement in 2000 and 2009, four findings are worth noting. First, schools in Ireland differed more from one another with respect to achievement in 2009 than in 2000: the between-school variance in achievement on print reading increased from 18% to 29%. Second, there is evidence of greater disparities in achievement on the basis of socioeconomic characteristics at the individual student level in 2009 than in 2000. Third, across all OECD countries but one, Ireland experienced the highest increase in immigrant students participating in PISA, from about 2% in 2000 to 8% in 2009. While immigrant students outperformed their Irish-born counterparts in 2000, the opposite was found to be the case in 2009, while at the same time, the socioeconomic advantage of immigrant students in 2000 was no longer apparent in 2009. Fourth, students were distributed somewhat differently across year levels in 2009 than in 2000, with an increase in the percentage of students enrolled in Transition Year. Trends in achievement vary depending on the year level considered in the case of print reading and mathematics, while mean achievement remained stable in science across all year levels. In the case of reading, drops in performance were more marked for senior cycle students than for students in junior cycle, while in mathematics, the most marked decrease in achievement occurred in Transition Year. These variations in achievement trends cannot be explained by changes between 2000 and 2009 in the socioeconomic characteristics of students in different year levels.

To further examine the extent to which background characteristics may have changed in terms of their relationship to print reading achievement in Ireland over time, multilevel models of print reading achievement for PISA 2000 and PISA 2009 were compared. The same variable set was used in both years. At the school level, just one variable was included – school average ESCS. At the student level, gender, ESCS, year level, reading for enjoyment, and attitude to reading were examined. The model for PISA 2000 explained 38% of the total variance in reading achievement, or 77% of between-school variance and 29% of variance within schools. The model for PISA 2009 explained 39% of variance in total, or 61% of the variance between schools, and 33% within schools.

The main findings arising from the results of this analysis may be summarised as follows. First, the gender difference in 2000 was no longer significant when the other variables were included, but in 2009, it remained significant. This is consistent with the finding that the unadjusted gender difference in reading achievement widened between 2000 and 2009. Second, school and student ESCS were somewhat more strongly associated with achievement in 2009 than in 2000. This may be related to the increase in achievement differences between schools across PISA cycles (as well as the appearance of outlier schools in the PISA 2009 sample). Third, achievement differences between year levels were significant in both 2000 and 2009, but have decreased. This may be related to the increased availability of Transition year, slight changes in social composition across year levels, or instructional experiences of students at different year levels. Further research is needed, particularly in the case of mathematics. Fourth, in the models for both years, a random slope for gender was found; i.e., the size of the gender difference

in achievement varied across (mixed) schools, which suggests that this is a persistent feature of Irish post-primary schools. Further research in this area is warranted to explore the possibility of identifying the characteristics of schools that are successful in reducing the gender gap in reading achievement. In this work, a prior measure of reading achievement and adjustments for the social intake of schools would be required, since part of the gap may be attributable to characteristics of male and female students at the time of entry into post-primary school.

Explaining Changes in Achievement

Declines in achievement in reading and mathematics in PISA 2009 may or may not be symptomatic of a decline in achievement standards in Irish schools. However, other than the State Examinations at post-primary level, there is currently no systematic national assessment of the achievements of post-primary students in Ireland, so it is not possible to compare changes in achievement on PISA in Ireland with other standardised assessment measures.

Nonetheless, other factors may be relevant in explaining the declines. These include the manner in which PISA was implemented in 2009 in Ireland, demographic and curriculum changes between 2000 and 2009, changes in the characteristics of the PISA tests and in how students responded to these tests, and aspects of PISA's approach to estimating and reporting changes in achievement that can be viewed as problematic. In considering these factors it should be borne in mind that the assessment of students in 2000 was not itself unproblematic; for example, the booklet design was not balanced, in that it did not control fully for the interactions between the position of items within booklets and student test fatigue.

It is unlikely that changes in achievement levels can be attributed to problems arising from implementation since all aspects of the implementation of PISA in Ireland satisfied the technical standards in 2000, 2003, 2006, and 2009 (OECD, 2011b). Comparisons of procedures relating to sampling, test administration, participation rates and calculation of sampling weights did not reveal any anomalies in either 2000 or 2009. There were, however, a small number of very low-performing schools in PISA 2009 (as noted previously). This cannot be explained by any systematic anomalies in the implementation of PISA and is most likely due to a combination of factors relating to chance, demographic characteristics of students in these schools, and very low levels of engagement with the print assessment (relative to the digital one).

There have been significant changes in some of the demographic characteristics of the PISA cohort in Ireland since PISA 2000. In particular, Ireland experienced a very large increase in the numbers of immigrant students (the second highest across all OECD countries, with only Spain experiencing a larger increase in this period). Furthermore, the socioeconomic composition of the immigrant student population in Ireland in 2009 indicates that it is now less advantaged than it was in 2000. Other demographic changes associated with achievement that were identified include a slight reduction in rates of early school leaving, greater inclusion of students with special educational needs, and changes in the distribution of students across year levels. Any attempt to quantify the effects of these changes on the decline in achievement is extremely difficult, given the complexity of, and interrelationships between, the factors.

It is also difficult, if not impossible, to quantify the effects of curricular change on achievement, particularly with respect to assessments such as PISA, which are not

designed to measure the effects of national curriculum reforms. Having said this, recent changes to science curricula at primary and post-primary levels may have offset a decline in science performance, in contrast to reading and mathematics, for which curricula had been in place for many years.

Aspects of the PISA test design, chiefly the format of questions (multiple-choice, written response) vary substantially across domains and cycles, and students in Ireland showed quite distinctive changes across cycles, relative to other countries, in their response patterns to different item types (Cartwright, 2011). Thus, it is reasonable to conclude that this aspect of the PISA test design, which is not explicitly intended to be related to changes in achievement, in fact is. Furthermore, that response patterns on PISA questions were less stable on written response items may go some way towards explaining why performance on science remained stable relative to the other two domains, since the science assessment had relatively few written response items in all cycles compared to the reading and mathematics assessments.

A further potential explanation of the decline in scores on the reading assessment may be a decline in engagement with, or effort invested in, the testing situation, as opposed to solely or largely a decline in student proficiency. Analyses of students' response patterns in Ireland supported this view, particularly in the case of reading, where the percentage of correct responses has remained stable in earlier parts of the test, while it has declined in the latter parts. Also, the incidence of skipped questions was much higher in latter parts of the reading test in 2009 than in 2000. Comparisons of the print and digital reading assessments revealed a higher level of engagement on the latter, which of course is consistent with the higher levels of achievement on digital reading. In mathematics, a small decline in the percentage of attempted items that were correct was evident at both the beginning and end parts of the testing sessions, together with an increase in non-attempted questions towards the end of the testing session. This pattern may be indicative of both a decline in proficiency as well as a decline in engagement. Inferences regarding science were limited due to changes to the PISA test design across cycles.

Comparisons of response patterns in Ireland with other countries show that students' response patterns in Ireland are idiosyncratic with respect to non-attempted items. Non-response is also related to performance and appears to be a characteristic that is distinct from proficiency.

Other issues, not specific to Ireland, can be identified as problematic in PISA's approach to estimating and reporting trends. These include the need to improve stability and consistency in the distribution of item formats across domains and cycles; the inappropriateness (over-constraining nature) of the Rasch statistical model in producing achievement estimates across different education systems; the inadequacy of the rationale for, and likely underestimation of, the link error used to infer statistical significance in achievement differences across cycles; and the significant challenges posed by the choice of mixed-domain booklets to the estimates of unbiased achievement scores within and across cycles.

Chapter 1: Overview and Implementation

The Programme for International Student Assessment (PISA) is a project of the Organisation for Economic Cooperation and Development (OECD) which assesses how well students, at age 15, are prepared to meet the challenges they may encounter in future life including education[1]. PISA's approach is somewhat different to more traditional curriculum-based methods of assessment in that it focuses on the extent to which students are able to demonstrate skills in real-life novel contexts. The emphasis is on demonstrating mastery of processes, understanding of concepts, and ability to function in various situations within each assessment area (OECD, 2010a).

PISA is conducted in three-yearly cycles and assesses students in three subject areas or domains: reading, mathematics, and science. In each cycle, one domain is the main focus, or the 'major domain', of the assessment, while the other domains are 'minor domains' (see Table 1.1).

Table 1.1: Assessment domains across PISA cycles (2000-2009)

Year	Major domain	Minor domain
2000	Reading	Mathematics, Science
2003	Mathematics	Reading, Science, Problem-solving
2006	Science	Mathematics, Reading
2009	Reading	Mathematics, Science

About 470,000 students in 65 countries/economies participated in PISA 2009 (see Table 1.2). About 50,000 students from nine additional countries/economies took part in a second round of the assessment in 2010[2].

Table 1.2: Countries/economies participating in PISA 2009

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

*Chile, Estonia, Israel and Slovenia joined the OECD in 2010.

[1] The age definition used in PISA is all students enrolled in education programmes aged between 15 years and 3 months to 16 years and 2 months (OECD, 2011b).

[2] In this report, the term 'countries' is used interchangeably with 'countries/economies/provinces'. Costa Rica, Georgia, Himanchal Pradesh-India, Malaysia, Malta, Miranda-Venezuela, Netherlands-Antilles, Tamil Nadu-India, United Arab Emirates, and Vietnam carried out the assessment in 2010 (Walker, 2011).

Reading was assessed as a major domain for the second time in 2009, providing the first opportunity to evaluate in detail changes that may have occurred in the nine years since PISA was first administered. Inset 1.1 summarises the elements of PISA 2009 that are new, and that build on previous PISA cycles.

Inset 1.1: What is different about the PISA 2009 survey?

- PISA introduced an assessment of how well students read digital texts in 2009, which was administered in 19 countries, including Ireland.
- In 2009, PISA enhanced the way in which reading was assessed by revising the framework used in PISA 2000 and tailoring it to incorporate reading of both print and digital texts.
- Some countries opted in 2009 to include a new set of reading items, which were designed to measure more basic reading skills. These items were developed to describe the performance of lower-performing students. They were not administered in Ireland.
- The reading proficiency levels were extended to obtain more detailed descriptions of the knowledge and skills of high- and low-performing students.
- In 2009, reading was the first PISA domain to be revisited as a major domain, facilitating an in-depth examination of changes in students' reading achievements and attitudes since 2000.
- The definition of reading was extended in 2009 to include engagement in reading and metacognition as components of reading literacy. Questions relating to reading engagement and techniques used to learn were enhanced and modifications were made to the questionnaires to better reflect the ways in which 15-year-olds use new technologies.

Source: OECD (2010a).

This chapter is divided into three main sections. The first considers the content of the PISA 2009 assessments of reading, mathematics, and science, including, where relevant, changes that have been made to the assessment since previous cycles. The second describes the PISA context questionnaires that were administered to students and school principals. Third, we describe the implementation of PISA in Ireland, covering areas such as sampling and test administration. Fourth, there is a description of the scaling of achievement data. The chapter concludes with a guide to interpreting the analyses that will be presented in this report (in Inset 1.2).

Content of the Assessment

The assessment instruments in PISA were developed on the basis of units, which consist of stimulus material (which include texts, diagrams, tables and/or graphs) followed by questions on various aspects of the stimulus. A variety of item types was used, about half of which were multiple-choice questions. Some were simple multiple-choice, in which students were required to choose one from among four or five alternatives; others were complex multiple-choice, in which students were asked to choose one of two possible responses (e.g., yes or no) to a series of statements. The remaining questions required students to construct (write) their own responses, either as a brief answer (short constructed response), an answer based on a very limited range of possible responses (closed-constructed response), or a longer response (open constructed response) (OECD, 2010a). Each domain is underpinned by a framework that both defines the domain and guides test development. The remainder of this section considers the content of the frameworks for reading, mathematics, and science.

Framework for Reading

Although the PISA 2009 reading framework retains much of the substance of the PISA 2000 framework, there are two major modifications in the new framework: it incorporates the reading of digital texts, and elaborates on the constructs of reading engagement and metacognition.

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, 2009c, p. 23)

The term 'reading literacy' is used to express the active, purposeful, and functional application of reading in a range of situations and for various purposes. The PISA 2009 definition builds on the definition from PISA 2000 by adding engagement in reading as a constituent of reading literacy. Engagement in this context implies the motivation to read. The phrase 'written texts' is meant to include all those coherent texts in which language is used in its graphic form: hand-written, printed, and digital.

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 of material that is read; and *aspect* – the cognitive approach that describes how readers engage with a text. All three contribute to ensuring broad coverage of the domain.

Reading Situations/Contexts

The reading situations refer to the contexts and uses for which the author constructed a text. Four main situations are described for PISA texts:

- *Personal:* reading to satisfy personal interests (e.g., letters, e-mail, fiction).
- *Public:* reading that relates to activities and concerns of wider society (e.g., official documents, newspapers, forms).
- *Occupational:* reading that involves the accomplishment of some immediate task, or *reading to do* (e.g., job application forms, manuals, instructions).
- *Educational:* reading for instruction (e.g., text books, maps, schematics, graphs).

Types of Reading Texts

There are four main text classifications for PISA 2009: medium, environment, text format and text type.

Medium refers to the form in which texts are presented – print (paper) or digital (hypertext). 'Digital' refers to a text or texts with navigation tools and features that make possible and require non-sequential reading, i.e., each reader constructs his or her own customised text.

Environment applies only to digital-medium texts. Two broad kinds of digital environment were identified. An *authored* environment is one in which the content cannot be modified (e.g., homepages, government information sites). A *message-based* environment is one in which the reader has the opportunity to add to or change the content (e.g., e-mails, blogs, chat rooms).

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 and include graphs and tables. Mixed texts contain elements in both a continuous and non-continuous format (e.g., a prose explanation including a graph or table). Multiple texts are defined as ones which have been generated and make sense independently but are juxtaposed for a particular occasion.

Text type is another way of classifying texts. Five text types are identified for PISA 2009:

- *Description* – refers to properties of objects in space (e.g., information report in prose, catalogue, blog diary, flight schedule).
- *Narration* – refers to properties of objects in time (e.g., novel, comic strip story).
- *Exposition* – provides an explanation of how different elements interrelate (e.g., book review, graph showing population trends, rating of online shopping item).
- *Argumentation* – presents the relationship among concepts or propositions, including persuasive and opinionative texts (e.g., letter to the editor, advertisement, blog in an online forum).
- *Instruction* – provides directions on what to do (e.g., recipe, instructions for operating software, booking system for online flight schedule).

It is acknowledged that both continuous and non-continuous texts can have a descriptive, narrative, expository, argumentative, or instructional purpose.

Reading Aspects or Processes

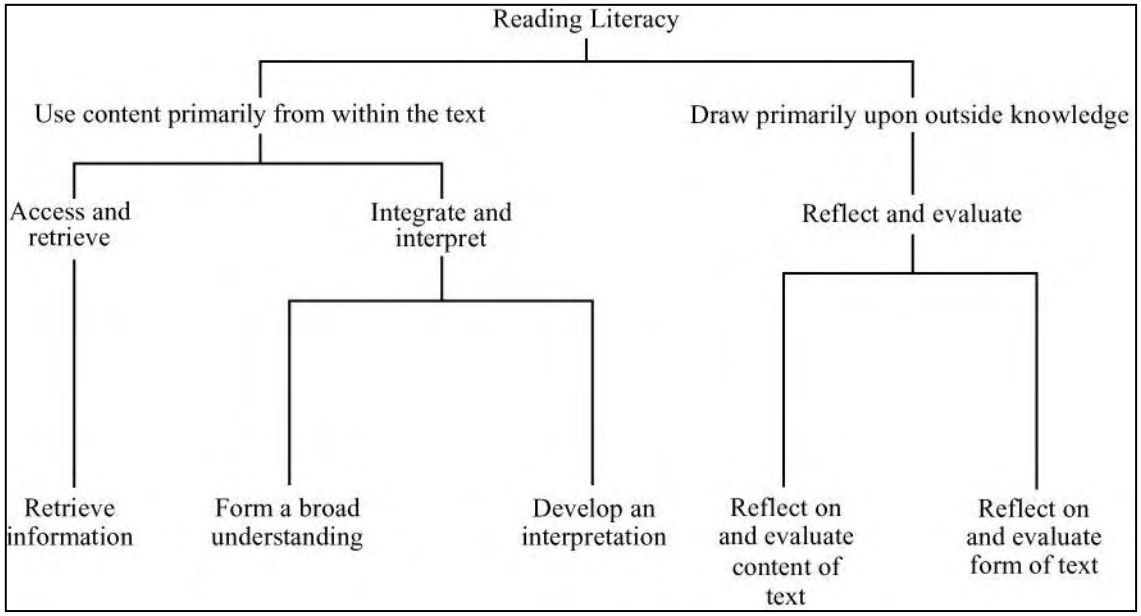
Aspects are the mental strategies, approaches, or purposes that readers use to negotiate their way into, around, and between texts. Five aspects guided the development of reading literacy assessment tasks:

- Retrieving information.
- Forming a broad understanding.
- Developing an interpretation.
- Reflecting on and evaluating the content of a text.
- Reflecting on and evaluating the form of a text.

For reporting purposes these five aspects were organised into three broad aspect categories: *access and retrieve; integrate and interpret;* and *reflect and evaluate* (Figure 2.1). The three aspects are considered to be interrelated and interdependent. Indeed they can be considered semi-hierarchical: it is not possible to interpret and integrate information without having first retrieved it, and one cannot reflect on and evaluate information without having made some sort of interpretation.

Reading in the digital medium is different from print reading in that the reader has greater control and therefore constructs his or her own sequence of reading. Since this type of reading requires the use of a variety of skills, it cannot be assigned to a single aspect. This required the identification of, a fourth aspect, *complex reading*, for digital texts.

Figure 1.1: Relationship between the PISA 2009 reading framework and the aspect subscales



Source: OECD, 2009c, p. 35.

Motivational and Behavioural Constituents of Reading Literacy

The PISA 2009 framework recognises the findings of recent research on the importance of reading practices and metacognition in relation to reading proficiency (OECD, 2009c). These aspects of reading are assessed in the student questionnaire rather than the assessment part of PISA.

Reading Engagement

Reading engagement is measured using two constructs: individual engagement and educational context[3].

Individual engagement refers to the motivational attributes and behavioural characteristics of students' reading. Four characteristics of individual reading engagement are identified:

- *Interest in reading* – disposition to read literature and information text for enjoyment and the satisfaction of curiosity;
- *Perceived autonomy* – perceived control and self-direction of one's reading activities, choices, and behaviours;
- *Social interaction* – social goals for reading and interactive competence;
- *Reading practices* – behavioural engagement referring to the amount and types of reading activities.

The educational context, or classroom reading engagement, refers to students' perceptions of support from teacher, classroom, and school for the motivational attributes and behavioural characteristics associated with reading. Two characteristics of classroom reading engagement are identified:

[3] In practice, these elements were not actually measured in PISA 2009 exactly as described here; see later in this chapter and Chapters 6 and 7.

- *Relevance*: interest in reading is facilitated by classroom and school contexts that emphasise the relevance of texts to student background knowledge and experience.
- *Support for autonomy*: perceived autonomy, which is a major element of intrinsic motivation, can be increased by classroom opportunities for choice and control.

Metacognition

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 also involves an understanding of the differential processing demands associated with various kinds of tasks and how to apply this understanding. The focus of the metacognition construct in PISA 2009 is on reading to learn – that is, reading in the educational situation. Metacognition is assessed by evaluating the quality and usefulness of different reading and text comprehension strategies presented in short vignettes or reading scenarios. Specifically, two strategy clusters are assessed in PISA through the context questionnaires – understanding and remembering texts, and summarising texts.[4]

PISA 2009 Reading Test Characteristics

Both the print and digital reading questions (items) can be classified along the situational and aspect features of the reading literacy framework (Table 1.3). In both assessments, reflecting the age of PISA participants, less weight is given to occupational situations than to the other situations. The items based on print texts are mostly categorised as continuous, while 70% of items for digital texts are based on multiple texts. Half of the print items assess interpreting and integrating skills, with the remainder evenly split between the access-and-retrieve and the reflect-and-evaluate aspects. The digital reading tasks are spread more equally across the three processes and also include the new composite aspect, *complex*. For a discussion of the similarities and differences between print and digital reading as assessed by PISA, see OECD (2009c, pp. 43-44). Sample questions from the PISA print and digital reading assessment are presented in Appendix B.

The PISA 2009 print reading assessment consists of 101 questions, while the digital reading assessment contains 29 questions. Performance on print reading is reported on the basis of an overall scale as well as for two clusters of subscales (three subscales assess cognitive processes [access and retrieve; integrate and interpret; reflect and evaluate], while two subscales assess text type [continuous and non-continuous]). Performance is reported on an overall digital reading scale for the 19 countries that implemented the assessment of digital reading. Changes in performance since PISA 2000 are reported on the basis of the overall print reading scale. It should be noted that the OECD (2011a) has also reported the results of a composite reading scale, which is an average of performance on the overall print and digital reading scales.

[4] 'Metacognition' may not be the most appropriate way to classify these activities. Awareness/use of reading strategies may be preferable. It should be noted that PISA examines two of many possible strategies related to reading.

Table 1.3: Distribution of 2009 reading items by text structure, situation and aspect: print and digital reading assessments

Text Structure	%	Situation	%	Aspect	%
Print Assessment					
Continuous	60	Personal	30	Access and retrieve	25
Non-continuous	30	Public	30	Integrate and interpret	50
Mixed	5	Occupational	15	Reflect and evaluate	25
Multiple	5	Educational	25	Complex	0
Total	100	Total	100	Total	100
Digital reading assessment					
Continuous	10	Personal	30	Access and retrieve	25
Non-continuous	10	Public	40	Integrate and interpret	35
Mixed	10	Occupational	15	Reflect and evaluate	20
Multiple	70	Educational	15	Complex	20
Total	100	Total	100	Total	100

Source: OECD, 2009c, pp. 32 and 43.

Framework for Mathematics

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, 2009c, p. 84). The definition and major features of the mathematics assessment have remained unchanged since 2003, when mathematics was the major domain in PISA.

The PISA mathematics assessment aims to assess performance on real-world problems, moving beyond the kinds of situations and problems typically encountered in school. Central to the PISA mathematics framework is the idea of mathematising. Mathematisation involves starting with a problem in a real-world context, identifying the mathematics relevant to solving the problem, following which the problem is reorganised 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; (iii) and competencies.

Mathematics Situations and Contexts

An important aspect of mathematical literacy is the ability to use and do mathematics in a variety of situations. The type of mathematics employed often depends on the situation in which the problem is presented. The situation is the part of the student's world in which the problem is placed. Four categories of mathematical problem situations and contexts are defined and used in PISA: personal, educational/occupational, public, and scientific. Context reflects the specific setting within that situation.

Mathematics Content Areas

PISA 2003 measured student performance in four areas of mathematics (also called 'overarching ideas'). These areas were also assessed in 2009, though in less detail, since in 2009 mathematics was a minor domain:

- *Space and Shape* – recognising and understanding geometric patterns and identifying such patterns in abstract and real-world representations.
- *Change and Relationships* – recognising relationships between variables and thinking in terms of and about relationships in a variety of forms including symbolic, algebraic, graphical, tabular, and geometric.
- *Quantity* – understanding relative size, recognising numerical patterns and using numbers to represent quantities and quantifiable attributes of real-world objects.
- *Uncertainty* – solving problems relating to data and chance.

Mathematics Competencies and Processes

PISA identifies eight types of cognitive processes involved in mathematisation – reasoning; argumentation; communication; modelling; problem-posing and solving; representation; using symbolic, formal and technical language and operations; and using aids and tools. A mathematical task may involve one or more of these processes at various levels of complexity. These processes are represented at different levels of complexity in three broad competency clusters:

- *Reproduction:* reproduction of practised knowledge (e.g., knowledge of facts and common problem representations, recollection of familiar mathematical objects and properties, performing routine procedures, application of standard algorithms, manipulation of formulae and carrying out computations).
- *Connections:* application of problem solving to non-routine situations, i.e. 'integration and connection of material from the various overarching ideas or from different mathematical curriculum strands, or the linking of different representations of a problem' (OECD, 2009c, p. 110).
- *Reflection:* advanced reasoning and the ability to abstract and generalise in new contexts.

PISA 2009 Mathematics Test Characteristics

The mathematics assessment is based on the main elements of the mathematical literacy framework and consists of 35 mathematics questions. For PISA 2009, results are reported on a combined mathematics scale only. About half of the mathematics items in PISA 2009 (51%) assess connections, 26% reproduction, and 23% reflection processes. Almost a quarter (23%) of questions assess the content area of space and shape, 31% assess quantity, 26% assess change and relationships, and 20% assess uncertainty. Close to half of the items (46%) are multiple-choice or complex multiple-choice in format, 32% require a short written response, and the remaining 23% require a longer written response. Sample mathematics questions from PISA 2003 can be found in Appendix B.

Framework for Science

The 2006 PISA framework defines scientific literacy in terms of:

- *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*
- *Willingness to engage in science-related issues, and with the ideas of science, as a reflective citizen.* (OECD, 2009c, p. 128)

Four interrelated dimensions are central to this definition:

- *Context:* Recognising life situations that involve science and technology.
- *Knowledge:* Understanding the natural world on the basis of scientific knowledge that includes knowledge of the natural world and knowledge about science itself.
- *Competencies:* Displaying the ability to identify scientific issues, explain phenomena scientifically, and draw evidence-based conclusions.
- *Attitudes:* Indicating an interest in science, support for scientific enquiry and motivation to act responsibly towards, for example, natural resources and environments.

The science assessment framework has remained essentially unchanged since PISA 2006, when science was the major domain.

Science Contexts

The PISA 2006 framework for scientific literacy focused on 'real-life' science contexts rather than on school science programmes. Assessment items were situated in a variety of contexts or situations that were considered relevant to students' lives and interests relating to the self, family and peer groups (personal), the community (social), and life across the world (global).

Science Knowledge

Scientific literacy refers to both *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. Test items were selected from the major fields of science using the following criteria: relevance to real-life situations; representativeness of important scientific concepts and their enduring utility; and appropriateness to the developmental level of 15-year-olds.

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 – how scientists get data. Scientific explanations follow from the results of scientific enquiry – how the data are used.

Science Competencies

PISA describes scientific literacy in terms of three scientific competencies. These are considered to be important skills for scientific investigation and analysis as they require logic, reasoning, and critical analysis.

- *Identifying scientific issues:* Recognising issues that can be investigated scientifically, identifying keywords to search for scientific information, and recognising the key features of a scientific investigation. Students demonstrating this competency need knowledge of science and knowledge about science.
- *Explaining phenomena scientifically:* Applying knowledge of science in a given situation, describing or interpreting phenomena scientifically and predicting changes, and recognising and identifying appropriate descriptions, explanations, and predictions.
- *Using scientific evidence:* Interpreting scientific evidence, drawing conclusions, identifying the assumptions, evidence and reasoning behind conclusions, and reflecting on the societal implications of science and technological developments. Students demonstrating this competency must make sense of scientific findings and be able to draw conclusions from them.

PISA 2009 Science Test Characteristics

The science assessment was based on the main elements of the PISA science framework, as outlined above. For PISA 2009 science results are reported on an overall science scale only. In total, 53 science items were included in the PISA 2009 assessment. Two-fifths (42%) of questions assessed *explaining phenomena scientifically*, 34% assessed *using scientific evidence*, and 25% assessed *identifying scientific issues.* The questions were almost evenly split between knowledge of science (49%) and knowledge about science (51%). Two-thirds (66%) of science items were multiple-choice or complex multiple-choice in format, while the remainder required a written response. Examples of science questions from PISA 2006 can be found in Appendix B.

The PISA Context Questionnaires

A major goal of PISA is to relate data on student achievement to background or contextual factors that (a) may be posited as explanations for patterns of achievement, and (b) are perceived to be amenable to adjustment through educational policy measures. This background information is conceptualised at four levels: the educational system as a whole; the school; the class; and the student (see OECD, 2009c, pp. 151-162).

In PISA 2009, information on background characteristics was collected via the administration of school and student questionnaires. The international school and student questionnaires consisted of a common set of core questions which individual countries were permitted to add to. In Ireland, a small set of national additions was made, in consultation with the PISA national committee. Forty-five countries, including Ireland, opted to administer an additional set of questions focusing on student familiarity with ICT as part of the student questionnaire. A second optional set of questions asking students about their experience at school was also administered in Ireland. PISA does not offer an international-level teacher questionnaire. However, as in previous cycles, Ireland took this opportunity to administer a nationally-developed

questionnaire. The target population was Third Year English teachers in participating schools. Data produced were analysed and published as part of *Reading Literacy in PISA 2009: A Guide for Teachers* (Perkins et al., 2011). The findings of analyses of the school and student questionnaires are described in the current report.

In addition to reporting the results of individual questionnaire items, PISA makes use of 'indices', which summarise responses to a set of related items. For ease of interpretation, each index is standardised to have an OECD mean of zero and a standard deviation of 1. It is important to note that a negative mean score on an index does not equate to a negative response to a set of items. It does mean, however, that the average of responses to individual items at national level is less than the OECD average. Thus, for example, a negative score on an index of sense of belonging does not necessarily imply a lack of sense of belonging in that country, but that the country had a higher level of disagreement on average with the items contributing to the index of sense of belonging, than the average level of agreement at OECD level. The construction of indices is described in detail in the *PISA 2009 Technical Report* (OECD, 2011b).

As well as the information collected during the course of the survey, the OECD makes use of PISA-developed indicators (see, for example, the yearly OECD publication of *Education at a Glance*) as a source of data on system characteristics.

The following sections describe international and national components of the student and school questionnaires.

Student Questionnaire

A student questionnaire was administered to all students who responded to the print assessment. Core items common to all participating countries sought information on students' educational background, family and home situation, reading activities (both print-based and digital), strategies for reading and understanding texts, learning time, school characteristics, classroom and school climate, language classes, and library access and activities. The section on student familiarity with ICT, an international optional part of the questionnaire which was administered to all students in Ireland, focused on the availability of ICT devices at home, availability of ICT equipment at school, use of computers for educational activities in school, use of computers for educational activities outside of school, student capability at computer tasks, and attitudes towards computer use. The educational career section focused on student absence from school, participation in out-of-school lessons, and educational career expectations.

Questions judged by the PISA national committee (membership of which is shown in Appendix A) to be of national policy interest were developed for inclusion in the Irish version of the student questionnaire by the national centre. These included questions on involvement in paid work, number of family members living at home, early school-leaving intent, immigration and integration, involvement with parents, sense of belonging, and bullying. Results from the national questions are presented in Chapters 6 and 8 of this report.

School Questionnaire

Principals of participating schools were asked to complete a school questionnaire which addressed topics such as the structure and organisation of the school, student and teacher body, school resources, school instruction, curriculum and assessment, school climate, school policy and practices, and characteristics of the principal. Irish national

additions related to retention, integration of immigrant students, and school ICT resources. Information on a small number of school-level variables (e.g., school sector) were obtained from the databases of the Department of Education and Skills for national analyses.

Implementation of PISA 2009 in Ireland

This section describes the implementation of PISA 2009 in Ireland, including the field trial in 2008 and the main study in 2009. The field trial and main study were carried out by the Educational Research Centre (ERC) on behalf of the Department of Education and Skills (DES) in accordance with PISA's rigorous set of technical standards (OECD, 2011b). Some aspects of PISA's implementation are not considered here, such as the test design for PISA 2009 and the procedures used to compile the international database. For a complete description of all aspects of the implementation of PISA 2009, readers are referred to the *PISA 2009 Technical Report* (OECD, 2011b).

Development of Test Materials and Questionnaire Items

In advance of the field trial, participating countries were invited to develop and submit units (texts) and items (questions) for the print and digital reading assessments. Additional very easy and very difficult reading items were developed for PISA 2009, with the aim of improving measurement at the highest and lowest proficiency levels. No new items were developed for the minor domains of mathematics and science. New items were reviewed by subject experts in participating countries based on their perceived relevance to the target cohort, possible sensitivity issues (e.g., culture/ gender bias), and technical aspects (e.g., problems with translation, coding guides, question intents).

Following consideration of framework fit and coverage and revisions by national experts, the international consortium selected 36 print reading and 13 digital reading units for the field trial. A subset of test items for inclusion in the main study was selected through national and international analyses of their psychometric properties as evidenced by their performance in the field trial. The development of core international items for use in the school and student questionnaires proceeded in a similar fashion. This process is documented in detail in OECD (2011b).

Field Trial 2008

As part of the PISA 2009 quality assurance programme, a field trial was conducted in 2008 in all participating countries, to pilot new test and questionnaire items and to test the operational procedures for sampling students and conducting assessments within schools. In Ireland, 33 schools were randomly sampled in the greater Dublin area. The print assessment was completed by 672 students in 27 schools, and a subset of 236 students in 25 schools completed the assessment of digital reading. The method of selection and sample size were in accordance with the PISA field trial sample guidelines. Ireland opted to administer the assessment using the School Associate Model, whereby assessments are administered in schools by teachers who had undergone training. The digital reading assessment was delivered via CD-ROM on school computers, with test data being automatically stored on a USB key. As the test operated from a Linux platform, some reconfiguration of computers was required before testing. Open-ended test items were scored at the Educational Research Centre by trained coders, using scoring rubrics developed by the international consortium.

Feedback from School Associates indicated that the print assessment ran smoothly, although response rates, particularly at student level, were relatively low mainly due to student absenteeism on the day of the assessment. This led to the decision to provide incentives for student participation in the main study in the form of a raffle for three 'one4all' vouchers in each school.

Administration of the assessment of digital reading presented a variety of technical difficulties, both in Ireland and in other participating countries. The problems, which related to hardware recognition, the test-delivery software, and suitability of school computers for running the tests, contributed to a low rate of test completion in the field trial in Ireland. A number of strategies were adopted by the international consortium to address these issues, e.g., improvement of test-delivery software and the provision of a hardware diagnostic tool to determine the suitability of each computer for delivering the assessment of digital reading *prior* to testing. In cases where these trouble-shooting methods failed, national centres were advised to implement logistic solutions, such as providing schools with laptops.

Main Study 2009

The PISA 2009 main study in Ireland ran for five weeks, from March 2nd to April 3rd. Although international standards stipulate that the assessment should be administered exactly three years after the last cycle, changes to the school year and public holidays in the intervening period made this impossible in Ireland. The testing period was moved forward by 11 days, which was the closest match to the 2006 test dates that could be achieved. Two schools conducted the assessment almost three weeks after the end of the official test window due to conflicting schedules. This deviation was sanctioned by the international PISA consortium.

Population

The target population for PISA consists of 15-year-old students attending all educational institutions within the country in grade 7 (equivalent to first year of post-primary school) or higher. The PISA age definition covers students who are aged 15 years and 2 months to 16 years and 3 months at the time of the assessment. For PISA 2009, the age definition was operationalised in Ireland as all students born in 1993, since testing took place in March 2009.

The national school-going population of 15-year-olds was estimated at 55, 464, based on data provided by the DES on the number of students born in 1993 who were enrolled in post-primary schools, special educational needs schools, and non-aided schools (i.e., commercial schools in which the salaries of teaching staff are not paid by the DES). The target population excluded an estimated 453 students (0.8% of the total population) enrolled in non-school-based programmes (i.e., YouthReach and Senior Traveller Programmes), along with 718 students (1.3%) enrolled in grades 6 (Sixth Class) or below (almost all of whom would have had special educational needs). Students enrolled in island schools were also omitted from the sampling process for logistic reasons (estimated as 18 students).

After excluding students in schools on the islands, this leaves a national desired target population of 55, 446 (estimated), which is 99.97% of the total national population of 15-year-olds enrolled in school-based programmes. Exclusions from the national desired population are categorised into school-level and within-school exclusions. At the school level, Ireland excluded 276 students in 12 non-aided schools, an estimated 0.5% of

the desired population. The sampling framework thus covered 99.5% of the desired population which is in accordance with PISA 2009 technical standards (OECD, 2011b).

Sample

Sampling took place in two stages: school level and student level. Samples for all countries were drawn by the international PISA consortium (OECD, 2011b). First, schools were divided into groups based on all possible combinations of two school-level stratification variables (school size and sector) each containing three categories, creating nine explicit strata (groups). School size was operationalised as the number of 15-year-olds in the school. Schools were defined as small (1 to 40 15-year-olds), medium (41-80 15-year-olds), or large (81 or more 15-year-olds). Schools were divided by sector into community/comprehensive, secondary, or vocational. Within each size/sector stratum, schools were ordered by two implicit stratification variables: gender composition and socioeconomic status (SES). Schools' status on each of these variables was defined on the basis of the quartile they fell into with regard to percentage of 15-year-old students who were female for the former, and percentage of students whose families held a medical card for the latter.

This approach to sampling at the school level departed from the method used in PISA 2006, when school size was the sole explicit stratification variable, and sector and gender composition were implicit stratification variables. The change arose because post-primary schools in Ireland were participating in two international surveys in Spring 2009 – PISA and the International Civics and Citizenship Education Study (ICCS) (Cosgrove, Gilleece & Shiel, 2011). It also provides greater precision than sampling in previous PISA cycles.

To prevent overlap of sampled schools in the two studies, the pool of post-primary schools was split into equivalent halves, and each sample was drawn from half of all schools. The ICCS sample was drawn first and then the PISA sample. No schools selected for ICCS were selected for PISA (or vice versa).

This arrangement was supported by the international PISA consortium, which had previously made arrangements with other countries that were participating in concurrent studies, such as the Trends in International Mathematics and Science Study (TIMSS) (www.iea.nl). A careful analysis of the samples indicates that this did not have a detectable effect on the validity or representativeness of the PISA 2009 sample (LaRoche & Cartwright, 2010).

The number of schools selected within each explicit stratum is based on the number of students in that stratum in the population and the number in the expected sample. The probability of a school being selected is in proportion to the number of students in the target population in the school. Overall, 160 schools were sampled to participate. Of these, 144 schools agreed to participate, including two replacement schools. This yielded a weighted school-level response rate of 88.4% after replacement (three schools had a within-school response rate of below 50% and were excluded from the school and student level response rates but are included in the international database).

The second phase of the sampling procedure involved selecting students within schools that had agreed to participate. In schools where the number of students born in 1993 exceeded 35, 35 students were sampled with equal probability of being selected. In Ireland, the majority of students (about 60%) were in Third Year, with smaller numbers

of students from Second, Fourth (Transition) and Fifth Years eligible for selection. In schools where there were 35 students or fewer in the target population, all students were selected. Of the students selected in each school for participation in the print assessment, a subset of 15 was randomly selected to participate in the assessment of digital reading. If there were fewer than 15 eligible students, all were selected. After discounting the three schools which did not reach the response rate cut-off of 50%, 4,654 students were sampled to take part in the print assessment, and 1,710 to complete the assessment of digital reading.

Of the 4,654 students sampled to participate in the print assessment, 78 (1.7%) were ineligible. Nine students (0.2% overall) did not meet the age requirement, and 69 (1.5% overall) were no longer attending the school. There was also a within-school exclusion rate of 2.8% (136 students). These students were deemed by principals to be unable to participate owing to special educational needs or limited experience of the language of the assessment, in accordance with PISA guidelines. This left 4,440 students eligible to sit the assessment. The print assessment was completed by 3,896 students, giving a weighted response rate of 83.8%. Non-response was due in the most part to absences, which accounted for 619 students (13.9%). The remaining 158 students (3.6%) did not participate due to student or parent refusal. Irish response rates at school and student level met international standards (which are 85% and 80%, respectively; OECD, 2011b). A total of 139 schools took part in the assessment of digital reading and 1,407 students (82.3% of all students sampled for the digital reading component) completed the assessment. Only students who had completed the print assessment were eligible to take part in the assessment of digital reading.

Five participating schools were Irish medium. These were provided with both English and Irish versions of all materials, with the exception of the reading literacy texts and items, which were in English only. Students themselves chose on the day of testing the language in which they wished to respond to the test and questionnaire.

Administration of the Assessment

As in the field trial, it was intended that a member of staff from each school would administer the assessment in schools. However, due to staffing constraints and technical issues in some schools, external administrators (employed by the ERC) administered the print assessment in 32 schools and the digital reading assessment in 45 schools. Further, computer resources were supplied to 48 schools.

As PISA uses a rotated test design, each student was presented with just a portion of the items that make up the entire pool of items for the print assessment. Items were distributed across 13 test booklets, with items repeated across booklets. Mathematics items appeared in nine booklets, as did science items, while reading items appeared in all 13. As new assessment materials were not developed for minor domains, all 35 mathematics and 53 science items were from previous cycles of PISA. Forty-one of the 101 reading items were taken from PISA 2000, but just 26 of these items had been used in all previous PISA cycles, and hence contributed to the linking of performance across them.

Two hours were allocated to the administration of the cognitive assessment and a further 45 minutes for completion of the student questionnaire. The duration of the digital reading assessment itself was 40 minutes, with an additional 20 minutes needed for preparation, including a 10-minute practice session. Generally, schools completed

the print assessment in the morning and the digital reading assessment in the afternoon of the same day. In cases where this wasn't possible, the digital reading assessment was administered at a later date within the agreed PISA testing window.

It is an international requirement that a person who has been trained by the international PISA consortium should monitor and observe a number of assessment sessions in each participating country. In Ireland, a retired school inspector was employed as a PISA quality monitor. Seven sessions were monitored in Ireland, and observations were communicated directly to the international consortium. The administration of PISA 2009 was judged to have met international standards on the basis of the quality monitor's observations. Trained coders scored responses to open-ended test items at the ERC, following a detailed coding rubric. Inter-rater reliability was assessed by having four coders independently mark a subset of booklets, the data from which was sent to the international PISA consortium for analysis. Analysis suggests that marking reliability was high in Ireland (OECD, 2011b).

Scaling of Achievement Data in PISA 2009

PISA data were scaled using a one-parameter Item Response Theory (IRT) model (specifically, a mixed coefficient multinomial logit model). This model uses estimates of item difficulty to predict the probability that a student will answer a question correctly (assuming items behave the same way across countries). In PISA, this model was used in three steps: national calibrations, international scaling, and student score generation. IRT places item difficulty and student ability on the same metric, meaning that student ability at a specific level can be described in terms of task characteristics of items associated with that level.

As PISA uses a rotated booklet design, each student completed only part of the assessment item pool. This means there are missing data that must be inferred from the observed item responses. To produce achievement scores for all students in all assessment domains, PISA uses an imputation methodology. These scores are referred to as plausible values, and are a selection of likely proficiencies for students who attained each score. Plausible values contain random error variance components and are not optimal for reporting scores at the level of the individual student but, when combined, can be used to describe the performance of groups of students. In PISA, five plausible values are assigned to each student for each overall scale (print reading, digital reading, mathematics, science) and for each reading subscale (access and retrieve, integrate and interpret, reflect and evaluate, continuous texts, and non-continuous texts).

Plausible values were produced from country-by-country regressions, based on principle components analyses of dummy-coded student questionnaire variables and student gender, grade, and parental occupation status. Full details on the development of achievement scales in PISA 2009 can be found in the *PISA 2009 Technical Report* (OECD, 2011b). Essentially, this scaling process produces student-level achievement estimates which, in theory, are unbiased estimates that can be used to compare the performance of students across countries participating in PISA, as well as to compare the performance of sub-groups of students (e.g., by gender or socioeconomic background) within and across countries.

The treatment of achievement data to report trends is discussed in detail in OECD (2011b; see also Cosgrove et al., 2010, Appendix B). For PISA 2009, achievement

scales were reported on the basis of previous cycles where the domain in question was a major domain. Thus, in reading, achievement is linked to 2000 (where the OECD average of 500 and standard deviation of 100 was established for the reading scale); in mathematics, it is linked to 2003; and science is linked to 2006. Linking of achievement across cycles is done through equating the properties of items administered in 2009 to the properties that they had when they were administered in a previous cycle as part of the major domain. Four steps are involved:

- *Step 1:* Item parameter estimates for reading and mathematics were obtained from the PISA 2009 calibration sample (i.e., a random sample of 1,000 students from each OECD country).
- *Step 2:* The above estimates where transformed through the addition of constant, such that the mean of the item parameter estimates for the link items was the same in 2009 as it was in 2006.
- *Step 3:* The 2009 student abilities where estimated with item parameters anchored at their 2009 values.
- *Step 4:* The above estimated student abilities were then transformed with the shift estimated in step 2.

In addition to sampling and measurement error, the PISA trend estimates have a linking error. This is mainly because a sample of items, rather than all items as administered when the domain was a major domain, was used to establish trends. There is a lack of agreement on the best method in which to estimate the size of this error (Gebhardt & Adams, 2007) and LaRoche and Cartwright (2010) argue that the linking error that is used in the OECD published trends analyses (OECD, 2010e) is too small; in other words, the OECD risks reporting that a change in achievement is statistically significant if it assumes that the link error is smaller than it actually is. Link error estimates as used by the OECD are documented in the *PISA 2009 Technical Report* (OECD, 2011b, Chapter 12), and range from 1.3 to 5.3, depending on the domain and particular comparison being made.

Treatment of Measurement and Sampling Error in Analyses

The standard errors associated with mean achievement scores in this report were computed in a way that took into account the two-stage, stratified sampling technique used in PISA. The approach used for calculating sampling variances for PISA estimates is known as Fay's Balanced Repeated Replication (BRR), or balanced half-samples, which takes into account the clustered nature of the sample. Using this method, half of the sample is weighted by a K factor, which must be between 0 and 1 (set at 0.5 for PISA analyses), while the other half is weighted by 2-K. Procedures described in OECD (2009d) were used to produce standard errors that take both sampling and measurement error into account. Inset 1.2 provides some additional information on how to interpret the analyses presented in this report.

Inset 1.2: How to interpret the analyses in this report

OECD average

A key benchmark that is used in this report is the OECD average. This is the arithmetic mean of all OECD countries that have valid data on the indicator in question. The OECD (2010a-e, 2011a) includes both OECD average and OECD total in its reports. The OECD total is the mean score on an indicator in which each student in the OECD area contributes equally so that countries with larger PISA populations contribute proportionately more than countries with smaller PISA populations. In this report, reference is made to the OECD average but not the OECD total. Where references are made to 'OECD' in tables and figures, this always refers to the OECD average. Also in this report, 'mean' and 'average' are used interchangeably.

Comparison countries

In Chapter 2, we compare achievement results for Ireland on previous cycles of PISA with a number of comparison countries. These are countries with high average performance, and those with performance that was similar to that of Ireland. Since countries may perform somewhat differently across assessment domains, the set of comparison countries in Chapter 2 varies depending on the domain under discussion. In Chapters 3, 4, 5, 6, and 7 when we report the results of PISA 2009, we also compare the results for Ireland, where relevant and where valid data are available, with a set of 10 comparator countries/regions. These were selected on the basis of high average performance, cultural/linguistic similarities with Ireland, and/or recent educational reform. The decision to select a number of countries for comparative purposes was made because of the high number of countries that participated in PISA 2009. The 10 comparators are Finland, France, Germany, Korea, New Zealand, Northern Ireland, Poland, Shanghai-China, the United Kingdom, and the United States. Note that the United Kingdom includes Northern Ireland.

Data Sources

For international comparisons, results are generally taken from the OECD reports on PISA 2009 (OECD, 2010a-e; 2011b). National analyses, especially those reported in Chapters 6 to 8, were conducted by the ERC.

Comparing mean scores

Because PISA assesses samples of students, and because students only attempt a subset of PISA items, achievement estimates are prone to uncertainty due to sampling and measurement error. The precision of these estimates is measured using the standard error, which is an estimate of the degree to which a statistic, such as a country mean, may be expected to vary about the true (but unknown) population mean. Assuming a normal distribution, a 95% confidence interval can be created around a mean using the following formula: *Statistic ± 1.96 standard errors.* The confidence interval is the range in which we would expect the population estimate to fall 95% of the time, if we were to use many repeated samples. For example, the mean score for print reading in Ireland is 495.6, with a standard error of 2.97. Therefore, it can be stated with 95% confidence that the population mean lies within the range of 489.8 to 501.4.

Statistical significance

Correlations and differences between groups are said to be significant when there is a 95 in 100 (i.e. 95%) chance that a difference remains, even after allowing for error. In the text in this report, we sometimes compare mean scores of countries or groups of students. When it is noted that these scores differ from one another, readers can infer that the difference is statistically significant.

Standard deviation

The standard deviation is a measure of how much variation there is in the scores of a particular group. The smaller the standard deviation, the less dispersed the scores are. The standard deviation provides a useful way of interpreting the difference in mean scores between groups, since it corresponds to percentages of a normally distributed population, i.e., 68% of students in a population have an achievement score that is within one standard deviation of the mean and 95% have a score that is within two standard deviations of the mean. In PISA 2009 reading literacy, Ireland achieved a mean score of 496 and the standard deviation was 95. Therefore, 68% of students in Ireland obtained an achievement score between 401 and 591 (496$\pm$*95*1*), while 95% of students had achievement scores between 306 and 696 (496 ± *95*2*).

Proficiency levels

PISA constructs a single scale for each domain assessed, in which each question is associated with a particular point on the scale that indicates its difficulty, and each student's performance is associated with a particular point on the same scale that indicates his or her estimated proficiency (OECD, 2010a). Each scale is divided into proficiency levels which describe the competencies that students obtaining scores at varying score intervals can demonstrate. In 2009, seven proficiency levels are described for print reading, five for digital reading, six for mathematics, and six for science. In each domain, Level 2 is considered the basic level of proficiency needed to participate effectively and productively in society and in future learning (OECD, 2010a). All students within a level are expected to answer half of the items at that level correctly (and fewer than half of the items at a higher level). A student scoring at the bottom of a proficiency level has a .62 probability of answering the easiest items at that level correctly, and a .42 probability of answering the most difficult items correctly. A student scoring at the top of a level has a .62 probability of getting the most difficult items right, and a .78 probability of getting the easiest items right.

Correlations

Correlation coefficients describe the strength of a relationship between two variables (e.g., the relationship between socioeconomic status and reading achievement). They do not indicate, however, which causes the other. The value of a correlation can range from -1 to +1. A value of 0 indicates that there is no relationship between variables, while the closer a value is to ±1, the stronger the relationship. 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.

Bivariate Versus Multivariate, Multilevel Analyses

Results in Chapters 3 to 7 are largely based on bivariate analyses, in that they examine statistics, such as mean achievement scores, by groups or subgroups of interest (e.g., country, gender, school sector). These provide a description of how an outcome, mainly achievement, varies along one variable at a time. In Chapter 8, analyses are multivariate (examining the associations of multiple explanatory variables with achievement at the same time) and multilevel (taking the nested structure of the data into account, i.e. students grouped into schools). The analysis of multiple explanatory variables in their simultaneous associations with achievement provides a more nuanced understanding of individual differences in achievement, since an observed relationship between one variable and achievement (such as gender and reading scores) may be partly or wholly accounted for by other variables (such as engagement in reading). The multilevel structure of the data needs to be taken into account since treating school-level variables (such as indicators of school climate) as if they were student-level attributes increases the chances of incorrectly inferring that a school-level variable is significantly associated with the outcome when it is not.

Specific Analyses

In some parts of this report, results are analysed and presented in a particular way, such as in the tables comparing subgroups in Chapter 6, and the results of multilevel models of reading performance shown in Chapter 8. The specifics of these analyses and their presentation are described in the relevant chapters.

Chapter 2: PISA – Previous Findings

In this chapter, we review of findings for Ireland from previous cycles of the OECD Programme for International Student Assessment (PISA), i.e., 2000, 2003, and 2006, to provide a context for considering the results for PISA 2009, particularly in Chapters 3, 5, 6 and 8. The review consists of two main sections. First, we consider the achievement results associated with previous cycles. Following a presentation of results for reading, we describe results for mathematics, cross-curricular problem-solving and science, and then provide a summary picture of Irish performance on PISA 2000-2006. In reviewing achievement from previous cycles, we compare the performance of students in Ireland with that of students in other countries. The comparisons focus on countries with high achievement and ones in which performance is similar to Ireland. Since countries vary in their achievement across the PISA domains, the countries to which Ireland is compared depend on the particular domain under consideration (as well as the PISA cycle in question). Second, we review the background characteristics that have consistently shown associations with achievement outcomes in Ireland. The chapter concludes with a brief summary.

Achievement in Previous Cycles of PISA

As outlined in Chapter 1, PISA assesses the achievements of 15-year-old students in three core skill areas of reading, mathematical, and scientific literacy. In each cycle, all three areas are assessed, with a main focus on one of the three (the so-called 'major domain') with less of a focus on the others (the so-called 'minor domains'). Thus, PISA has assessed achievement in the three domains as follows:

- 2000: Reading (major), mathematics, science (minor)
- 2003: Mathematics (major), reading, science (minor)
- 2006: Science (major), reading, mathematics (minor)
- 2009: Reading (major), mathematics, science (minor).

In PISA 2003, an additional minor domain, cross-curricular problem-solving, was assessed.

When an assessment domain is first a 'major' one, performance on an overall or combined achievement scale, as well as on subscales, is reported, and the OECD average for the combined scale is set at 500 with a standard deviation of 100[5]. The subscales are generally reported in terms of the *format or content area* and/or *cognitive processes*. The subscales developed in PISA are as follows:

- PISA 2000 reading: processes of retrieve, interpret, and reflect and evaluate; and formats of continuous texts and non-continuous texts. The same item set contributes to both the process and format subscales.
- PISA 2003 mathematics: content areas of shape and space, change and relationships, quantity, and uncertainty. The mathematics items were also classified in terms of the cognitive processes of reproduction, connections, and reflection, but subscales for these were not constructed.

[5] In 2006, the OECD average for science was 500 but the standard deviation was 94 due to a change in the manner in which it was computed (OECD, 2009f).

- PISA 2006 science: processes of identifying scientific issues, explaining phenomena scientifically, and using scientific evidence; and the content areas of earth and space systems, living systems, and physical systems. The same item set contributes to both the process and content subscales. A further distinction was made between knowledge about science and knowledge of science, and content area subscales were formed from items assessing the latter.

When an assessment area is a major domain, proficiency levels are developed to describe the knowledge and skills that are associated with various points on the achievement scale. Because knowledge and skills differ across domains, the cut-points on the scales that are used to establish the proficiency levels also differ. Cross-curricular problem-solving in 2003 is an exception: although it was a minor domain, given its once-off status, proficiency levels were developed and reported. The cut-points associated with the proficiency levels for reading (2000), mathematics (2003), problem-solving (2003) and science (2006) are shown in Table 2.1. It should be noted that the cut-points for problem-solving are quite different than those for the other three domains.

Table 2.1: Score-point intervals for proficiency levels for print reading (2000), mathematics (2003), problem-solving (2003), and science (2006)

Reading 2000		Mathematics 2003		Problem-Solving 2003		Science 2006	
Level	Interval	Level	Interval	Level	Interval	Level	Interval
		Level 6	>669			Level 6	>708
Level 5	>625	Level 5	607-669			Level 5	633-708
Level 4	553-625	Level 4	545-606			Level 4	559-632
Level 3	480-552	Level 3	482-554	Level 3	>592	Level 3	484-558
Level 2	407-479	Level 2	420-481	Level 2	499-592	Level 2	410-483
Level 1	335-406	Level 1	358-419	Level 1	405-498	Level 1	335-409
< Level 1	<335	< Level 1	<358	< Level 1	<405	< Level 1	<335

Source: OECD, 2001, 2004a, 2004b, 2007.

PISA also provides information on achievement trends, e.g., comparisons of achievement in reading in 2006 with reading achievement in 2000 and 2003. However, given PISA's test design (described in Chapter 1), detailed trend comparisons link back to when an assessment area was last a major domain. Hence, detailed comparisons of reading achievement can be made from 2000, mathematics from 2003, and science from 2006. In making comparisons across PISA cycles, it should be borne in mind that the composition of the OECD average is not the same. This is for two reasons: first, the number of OECD countries has increased[6], and second, some countries may be omitted from the results due to inadequate participation rates or technical problems in the implementation of PISA[7].

PISA collects a rich and detailed set of information on student and school background characteristics through school and student questionnaires administered in each cycle. Broadly speaking, the questionnaires consist of a 'core' component that remains unchanged across cycles and includes areas such as student demographics and

[6] The Slovak Republic joined the OECD in December 2000, while Chile, Estonia, Israel and Slovenia joined the OECD in 2010; Turkey did not participate in PISA 2000.

[7] Data for the Netherlands were omitted from international comparisons of achievement in 2000; trend estimates were not available for Luxembourg in comparisons of 2000 and 2003; data for the United Kingdom were omitted from international comparisons of achievement in 2003; reading data for the United States were omitted from international comparisons of achievement in 2006.

socioeconomic backgrounds, school management and school resources; and a 'focus' component that is designed to elicit information that is particularly relevant to the major domain. In 2000 (and again in 2009), for example, students were asked a number of questions relating to their attitudes to, and engagement in, reading.

The results presented in this chapter are selective, focusing mainly on achievement. In addition to these results, a wide variety of topics have been reported on, both nationally and internationally. For example, the ERC has produced reports aimed at teachers and school management for PISA 2000, 2003, 2006, and 2009 (Cosgrove et al., 2003; Eivers, Shiel & Pybus, 2008; Perkins et al., 2011; Shiel et al., 2007). The OECD reports results for each PISA cycle in an initial report (OECD, 2001; 2004a, b; 2007; 2010a-e, 2011a), and subsequently, specific themes are addressed in thematic reports. For example, a report on students' engagement in reading was published following the PISA 2000 main report (Kirsch et al., 2002). For PISA 2003, thematic reports included one on the achievements of immigrant students (OECD, 2006) and another on teaching and learning strategies in mathematics (OECD, 2010f). One of the thematic reports for PISA 2006 focused on students and the environment (OECD, 2009a). Some thematic reports draw on multiple cycles of PISA; e.g., a report that examined gender differences in achievement, attitudes, and engagement in PISA 2000, 2003, and 2006 (OECD, 2009b).

National reports can be accessed at www.erc.ie/pisa and OECD reports at www.pisa.oecd.org.

Reading Achievement in Previous PISA Cycles

PISA 2000 represented the first time that Ireland had participated in an international comparative study of reading achievement since the IEA Reading Literacy Survey in 1991 and the International Adult Literacy Survey (IALS) in 1994. Since Ireland did not fare particularly well on either of these assessments (see Shiel et al., 2001), results from PISA 2000 were anticipated with some trepidation. However, PISA 2000 indicated that the reading literacy achievements of Irish 15-year-olds were generally of a high standard.

In PISA 2000, Irish students achieved a mean score of 527 on the combined reading literacy scale, placing Ireland fifth of 27 OECD countries (OECD, 2001). Just one country, Finland, achieved a mean score (547) that was significantly higher. Ireland's score was significantly higher than the OECD average score of 500, and did not differ significantly from the scores of eight other countries including Canada, Australia, and the United Kingdom. Ireland's performance on all three cognitive subscales (Retrieve, Interpret, and Reflect and Evaluate) was also strong, particularly on the Reflect and Evaluate subscale, where Ireland's score was not significantly different from that of the country with the highest score on that subscale, Canada. Reading achievement was also reported on two subscales based on text type – Continuous Texts and Non-Continuous exts (Kirsch et al., 2002). The mean scores for Ireland on these two subscales (528 and 530, respectively) were significantly above the OECD averages (501 and 500, respectively), consistent with performance on the combined reading scale.

Greater proportions of Irish students achieved at the top end of the distribution of achievement scores, with 14% scoring at the highest level of proficiency (Level 5) compared to 9.5% of students across the OECD. Ireland also had a relatively low proportion of low achievers in PISA 2000. Just 11%, compared to 18% on average across the OECD, scored below proficiency Level 2 (OECD, 2001).

One very consistent finding to emerge from PISA 2000 (and all subsequent cycles) was that girls, on average, outperformed boys in all countries on reading. In Ireland, the gender difference on the combined reading scale was 29 points, which is marginally though not significantly lower than the OECD average of 32 points. Across OECD countries, the size of the gender difference in 2000 ranged from 14 points in Korea to 51 points in Finland. The magnitude of the gender difference also varied somewhat on the various subscales. For example, the gender difference in Ireland was smaller on the Retrieve (22 points) and Non-Continuous (17 points) subscales and larger on the Reflect and Evaluate subscale (37 points). These gender differences were also evident in the distribution of male and female students across proficiency levels. In Ireland, on the combined reading scale, 13.5% of males compared to just over 8% of females scored below Level 2 (compared with 22% of males and 13% of females on average across the OECD), while at the other end of the scale, 11% of boys and 17.4% of girls scored at Level 5 (compared with OECD averages of 7% and 12%, respectively).

Results for reading in PISA 2003 and 2006 are not as detailed as those for 2000, since reading was a minor domain in those two cycles. Performance was reported only in terms of an overall combined reading scale, but comparisons of average achievement across all cycles are possible. It should be noted that the design of the assessment booklets was changed between 2000 and 2003, and that the effects that such changes may have on student achievement are complex and difficult to quantify (Beaton, 1988). Furthermore, the achievement scores for reading for 2003 (and 2006) were based on 28 test questions; a larger number of questions would be required for more stable trend estimates (Mazzeo & von Davier, 2008; Monseur & Berezner, 2007).

In 2003, Ireland's overall score (516) was again significantly higher than the OECD average (492) (OECD, 2004a); it was also significantly above the OECD average in 2006 (517 compared with 492) (OECD, 2007). These results indicate an 11-point drop in average achievement between 2000 and 2003, but the change was not statistically significant[8]. What did emerge as statistically significant was the decline in performance at the upper end of the achievement distribution: between 2000 and 2003, the score at the 95th percentile dropped by 22 points. None of the other changes in achievement, whether in comparisons of mean scores or scores at percentiles, was statistically significant (Eivers, Shiel, & Cunningham, 2008). In 2003, 11% of students in Ireland scored below Level 2, and just over 9% at Level 5 (the OECD averages were 19% and 8%, respectively). In 2006, 12% of students in Ireland scored below Level 2, and 12% at Level 5. The respective OECD averages were 20% and 9%. These percentages indicate a relatively stable profile of performance in Ireland, with the exception of the performance of high achievers, which showed a slight decline.

Gender differences in reading remained significant in PISA 2003 and 2006. In Ireland, the gender difference in 2003 (29 points) was the same as it was in 2000, increasing marginally (though not significantly) in 2006 to 34 score points (Eivers et al., 2008). In 2003, 14% of boys and 8% of girls in Ireland scored below Level 2, while 6% of boys and 12% of girls scored at Level 5. In 2006, 17% of boys and 8% of girls scored below Level 2, while 9% of boys and 15% of girls scored at Level 5. Thus, the distribution of male and female students across proficiency levels remained reasonably

[8] In the international report for 2003 (OECD, 2004a), the difference was deemed to be statistically significant, but following changes in the methods used to compare achievement estimates across cycles, the international report for PISA 2006 (OECD, 2009f) indicated that this difference was not statistically significant.

stable, although between 2000 and 2003, there was a slight reduction in the percentages of both males and females scoring at Level 5.

Mathematics Achievement in Previous PISA Cycles

In 2000, results for mathematics were not reported in detail, as it was a minor domain. The Irish mean, 503, did not differ significantly from the OECD average of 500 (OECD, 2001). Ireland's mean score did not differ from that of Sweden, the Czech Republic, Norway, the USA, and Germany. Top-performing OECD countries in mathematics in 2000 included Japan, Korea, New Zealand, Finland, Australia, and Canada.

Irish students scoring at the lower end of the achievement distribution (at the 10th percentile) achieved a score (394) that was significantly higher than the corresponding OECD average (367). In contrast, high-achieving Irish students (at the 90th percentile) had a score that was significantly lower than the OECD average (606 compared with 625). In 2000, boys in Ireland significantly outperformed girls, by about 13 score points (compared to an OECD average gender difference of 11 points, also in favour of boys).

In 2003, mathematics was the major domain, and results were reported in terms of a combined mathematics scale, as well as four content area subscales: Space and Shape, Change and Relationships, Quantity, and Uncertainty (OECD, 2004a). As in 2000, Ireland's average mathematics score (503) did not differ from the OECD average score (500), even though the 2000 mathematics assessment had consisted of items from just two of the four subscales (i.e. Change and Relationships, and Space and Shape). Ireland's mean score on mathematics in 2003 did not differ from those of Austria, Germany, or the Slovak Republic. Finland, Korea, the Netherlands, Japan and Canada were among the highest performing OECD countries in mathematics in 2003.

There was considerable variation between the Irish mean scores on the four subscales. Students in Ireland performed least well on the Space and Shape subscale (476, significantly below the OECD average), about average on the Quantity subscale (502, not different from the OECD average), better on the Change and Relationships subscale (506, significantly above the OECD average) and on the Uncertainty subscale (517, significantly above the OECD average). In Ireland, 11% of students scored at Level 5 or 6, while 17% scored below Level 2 on the combined scale. The respective OECD averages are 15% and 21.4%. Hence, as in 2000, mathematics achievement in Ireland in PISA 2003 was characterised by fewer students at both the lower and higher ends of the achievement distribution, relative to the corresponding OECD averages.

Boys significantly outperformed girls in Ireland in 2003, and the gender difference on the combined mathematics scale (15 points) was similar to that reported in 2000 (OECD, 2004a). The OECD average gender difference on mathematics in 2003 was 11 points, also in favour of boys. The higher performance of boys compared to girls on PISA mathematics stands in contrast to the superior reading achievement displayed by girls on PISA reading. Gender differences were found to vary depending on mathematics subscale, although on all subscales, boys significantly outperformed girls. The gender difference in Ireland was largest for the Space and Shape subscale (26 points), followed by the Uncertainty (16 points) and Change and Relationships (13 points) subscales, with the smallest gender difference associated with Quantity (9 points). On the combined mathematics scale, 15% of boys and 19% of girls scored below Level 2 (the respective OECD averages are 19% and 22%), while 14% of boys and 9% of

girls scored at Levels 5 or 6 (respective OECD averages are 17% and 12%). Therefore, the higher average achievement of males in Ireland is reflected in the lower percentage of low achievers and the higher percentage of high achievers relative to females.

In 2006, the Irish average on the PISA mathematics scale was 502, which again did not differ from the OECD average of 498 in that year (OECD, 2007). In 2006, Ireland's mean mathematics score was not significantly different to those of Germany, Sweden, France, the UK, and Poland. High performing OECD countries included Finland, Korea, the Netherlands, Switzerland, and Canada. Also in 2006, 11% of students in Ireland scored at Levels 5 or 6, and 16.4% scored below Level 2. The respective OECD averages were 13% and 21%. Thus, once again in 2006, Irish performance was characterised by average overall achievement with fewer students at the extremes of the achievement distribution.

The gender difference in Ireland on the combined mathematics scale in 2006 was 12 points (significantly in favour of boys), compared with an OECD average gender difference of 11 points (also significantly in favour of boys). In 2006, 15.5% of boys and 17% of girls in Ireland scored below Level 2 (compared to OECD averages of 19% and 21%, respectively), while 12% of Irish boys and 8% of Irish girls scored at Levels 5 or 6 (with OECD averages of 15.5% and 11%, respectively). Thus, as with overall achievement in mathematics in 2006, the achievement of both boys and girls in Ireland was characterised by fewer students at the high and low ends of the achievement distribution, with slightly more high-achieving boys than girls.

Cross-Curricular Problem-Solving Achievement in PISA 2003

As part of the PISA 2003 assessment, an additional minor domain, cross-curricular problem-solving, was assessed. Although the assessment comprised only 19 questions, comparisons across countries and between subgroups (e.g., gender) were possible (OECD, 2004b). Results were also reported in terms of proficiency levels, though these differed somewhat from those established for the other three domains, being limited to Levels 3, 2, 1 and below Level 1. The mean performance in Ireland on the problem-solving scale was 498, which is not significantly different to the OECD average of 500. Ireland's mean score was not significantly different from those of Germany, Sweden, Austria, Iceland, Hungary, Luxembourg, and the Slovak Republic. The highest performing OECD countries included Korea, Finland, Japan, New Zealand, Australia, and Canada.

In Ireland, 13% of students scored below Level 1 (below 405 score points) on the problem-solving scale, while 12% scored at Level 3 (above 592 score points). On average across the OECD, 17% of students scored below Level 1, and 18% scored at Level 3. As in the case of mathematics, Irish performance on problem-solving was characterised by average overall performance and a narrower achievement distribution.

The gender difference on average performance on the problem-solving scale in Ireland was negligible, at less than one score point. On average across the OECD, females outperformed males by just 2 score points. A large gender difference was found in Iceland, where girls outperformed boys by 30 score points; otherwise, gender differences in OECD countries were small, in favour of boys, and less than 10 score points. Mirroring the negligible gender difference in overall performance, similar percentages of males and females in Ireland scored below Level 1 and at Level 3 (around 13% for both genders below Level 1, and 12% each at Level 3).

The results for problem-solving in PISA 2003 do not appear to have received as much attention as those for the other assessment domains. This may be partly because it was a once-off minor assessment domain; furthermore, problem-solving is not generally considered as a separate subject area in school curricula, whereas reading, mathematics and science are. However, the fact that achievement on problem-solving was similar to mathematics achievement (OECD, 2004b) served to confirm the Irish profile of performance in mathematics (which, in itself, requires problem-solving skills) as average overall, with relatively few high and low performing students.

Science Achievement in Previous PISA Cycles

In PISA 2000 and 2003, results for science were reported only on a combined scale. In 2000, the Irish average score on science was 513, which was significantly above the OECD average of 500 (OECD, 2001). Ireland's mean score in 2000 was not significantly different to those of Australia, Austria, Sweden, the Czech Republic, France, Norway, and the USA. The highest performing countries included Korea, Japan, Finland, the UK, Canada and New Zealand.

An examination of the distribution of achievement on PISA science in 2000 indicates that the Irish score at the 10th percentile (394) was about 25 points higher than the corresponding OECD average score (367), while the score for Ireland at the 90th percentile (630) was about the same as the average across the OECD (627). Hence, in 2000, the achievement of students in Ireland was characterised by above-average performance at the lower and middle points of the achievement distribution, and average performance at the upper end. The gender difference in science in Ireland (6 points in favour of females) was not significant (the OECD average gender difference was 0 points).

In 2003, Ireland's average performance on the combined science scale (505) was again significantly above the OECD average (500), if only just (OECD, 2004a). High-performing countries included Finland, Japan, Korea, Australia, the Netherlands, and the Czech Republic. Ireland's average performance did not differ from those of Switzerland, France, Belgium, Sweden, Hungary, Germany, Poland, and the Slovak Republic. The performance of Irish students at the 10th percentile (348 points) was above the corresponding OECD average (324), as in 2000. Also consistent with 2000, Irish performance at the 90th percentile (625) was only slightly below the OECD average of 634. However, performance in Ireland at the 5th and 10th percentiles was deemed by the OECD to be significantly lower than it had been in 2000. Hence, the slight overall decline in science performance between 2000 and 2003 was due to declines at the lower end of the achievement distribution. The gender difference on the science scale in Ireland on PISA 2003 was just 2 score points in favour of girls and not statistically significant, which is marginally smaller than the gender difference of 6 points (also in favour of girls) across the OECD.

As with reading in 2000 and mathematics in 2003, it became possible to report science achievement in more detail in 2006, when it became a major domain. Results were reported on a combined science scale, as well as on five subscales, i.e., three process subscales (Identifying Scientific Issues, Explaining Phenomena Scientifically, Using Scientific Evidence), and three content subscales (Earth and Space Systems, Living Systems, and Physical Systems).

In 2006, Ireland's mean performance on the combined science scale (508) was almost identical to its mean in 2003, and significantly above the OECD average of 500 (OECD, 2007). Mean achievement in Ireland did not differ from Germany, the UK, France, Austria, the Czech Republic, or Hungary. High-achieving OECD countries on science in 2006 included Finland, Japan, Canada, Korea, New Zealand, and Australia.

Some variation in the mean scores of students in Ireland was evident in comparisons across subscales. Students had the highest mean score on Identifying Scientific Issues (516), which was significantly higher than the OECD average. Irish students also scored above the OECD average on the Using Scientific Evidence (506) and Earth and Space Systems (508) subscales. On the remaining three scales, Irish average performance did not differ significantly from the OECD averages (Explaining Phenomena Scientifically, 506; Living Systems, 506; and Physical Systems, 505).

In 2006, on the combined science scale, 9.4% of students in Ireland scored at Levels 5 and 6, compared with an OECD average of 9%, while 15.5% of students scored below Level 2, compared with 19% on average across the OECD. Again, this confirms the profile of Irish performance in science as being slightly above average overall, with comparatively fewer low achievers, and a similar number of high achievers. Performance on proficiency levels for the various science subscales did not vary substantially, tending to reflect variations in average performance on these scales.

Gender differences in 2006 in Ireland on the combined science scale were small, and amounted to less than one score point. On average across OECD countries, there was a small but nonetheless significant 2 score-point difference on the combined science scale favouring females. There was, however, some variation in males' and females' performance across the science subscales. Females in Ireland outperformed males on the Identifying Scientific Issues subscale (by 16 points). In contrast, males in Ireland outperformed females on three subscales: Explaining Phenomena Scientifically (10 points), Earth and Space Systems (14 points), and Physical Systems (23 points). On the remaining two subscales (Using Scientific Evidence and Living Systems), the gender differences in Ireland were not significant.

The distributions of males and females across the combined science proficiency levels were very similar. For example, 10% of males and 9.5% of females in Ireland scored at Levels 5 and 6 (compared to OECD averages of 10% and 8%, respectively), while 16.6% of males and 14.5% of females scored below Level 2 (compared to 20% and 19%, respectively, across the OECD on average). The parity in performance of males and females on PISA science contrasts with performance on the other two domains, especially reading.

Following the report of the main PISA 2006 results, the OECD (2009a) published a report that examined students' knowledge of, and attitudes towards, the environment that included achievement results on two new science subscales – Environmental Science and Geoscience. The average performance of students in Ireland on these two subscales (506 and 508, respectively) was very similar to their performance on the overall science scale.

Performance in Ireland on PISA: Summing Up

Table 2.2 summarises the performance of students in Ireland on PISA reading, mathematics, and science relative to the OECD average when each assessment area was the major domain. Overall mean scores for Ireland on each of the scales and subscales are marked in bold in the table if they differ significantly from the respective OECD averages. Significant gender differences are marked in grey.

Table 2.2: Summary of performance in reading (2000), mathematics (2003), and science (2006): Ireland and OECD

	Ireland					OECD				
2000	Mean Score	% Below Level 2	% Level 5/6	Gender diff (F-M)	Between-school variance	Mean Score	% Below Level 2	% Level 5/6	Gender diff (F-M)	Between-school variance
Combined reading	**526.7**	11.0	14.2	28.7	17.8	500.0	17.9	9.5	31.6	34.7
Retrieve	**524.3**	12.7	15.2	26.9	N/A	497.6	20.4	11.6	25.5	N/A
Interpret	**526.5**	11.8	15.2	27.2	N/A	501.0	17.7	9.9	28.0	N/A
Reflect and Evaluate	**533.2**	9.0	14.5	37.2	N/A	501.8	18.2	10.9	43.2	N/A
Continuous	**528.0**	11.2	14.4	33.6	N/A	501.0	17.9	9.8	39.1	N/A
Non-Continuous	**530.0**	11.7	17.1	16.9	N/A	500.0	19.5	11.2	17.6	N/A
2003										
Combined mathematics	502.8	16.8	11.3	-14.8	16.7	500.0	21.4	14.6	-11.1	32.7
Space and Shape	**476.2**	27.6	8.6	-25.5	N/A	496.3	24.8	14.5	-16.7	N/A
Change and Relationships	**506.0**	16.3	12.5	-12.6	N/A	498.8	23.2	16.4	-11.0	N/A
Quantity	501.7	17.9	11.7	-8.9	N/A	500.7	21.3	15.0	-6.2	N/A
Uncertainty	**517.2**	13.8	16.4	-15.5	N/A	502.0	20.7	14.8	-12.6	N/A
2006										
Combined science	**508.3**	15.5	9.4	0.4	17.2	500.0	19.3	9.0	2.0	32.7
Identifying Scientific Issues	**515.9**	13.7	11.0	16.2	N/A	498.8	18.7	8.4	17.0	N/A
Explaining Phenomena Scientifically	505.5	17.1	10.3	-9.7	N/A	489.1	19.6	9.8	-15.0	N/A
Using Scientific Evidence	**505.9**	17.9	10.4	6.7	N/A	499.2	22.0	11.8	3.0	N/A
Earth and Space Systems	**508.1**	N/A	N/A	-14.0	N/A	499.9	N/A	N/A	-17.0	N/A
Living Systems	505.6	N/A	N/A	1.9	N/A	501.8	N/A	N/A	-4.0	N/A
Physical Systems	504.5	N/A	N/A	-22.8	N/A	500.0	N/A	N/A	-26.0	N/A

Note: Ireland country means are in bold where they differ significantly from the OECD averages. Significant gender differences are shaded in grey. Performance by proficiency levels on the three knowledge of science subscales is not available. Between-school variance is not available for domain subscales.

The strongest performance by students in Ireland is in the domain of reading in 2000, with all mean scores significantly above the OECD averages. This domain is also characterised as having the largest gender differences, in favour of females. Performance across the distribution of achievement is consistently strong, as evidenced in the lower proportions of students in Ireland scoring below Level 2 and higher proportions scoring at Level 5 relative to the OECD averages.

In mathematics in 2003, overall performance is similar to the OECD average, and there is comparatively more variation in mean performance on the mathematics subscales compared to the reading subscales, with about 40 points separating Irish average performance on the Space and Shape (476) and Uncertainty (517) subscales.

Boys in Ireland and across the OECD on average consistently outperformed girls on mathematics, particularly in the case of the Space and Shape subscale. This contrasts with reading, where girls significantly outperformed boys. Also unlike reading, mathematics performance in Ireland is characterised by a narrow achievement distribution, with few high and low achievers relative to the OECD averages.

In science in 2006, overall Irish performance was above the OECD average, with stronger performance evident on some subscales (Identifying Scientific Issues, Earth and Space Systems) compared with others (Explaining Phenomena Scientifically, Living Systems, and Physical Systems). Unlike reading and mathematics, gender differences on the science subscale varied, with girls scoring significantly higher on the Identifying Scientific Issues subscale, and boys scoring significantly higher on Physical Systems, Earth and Space Systems, and Explaining Phenomena Scientifically.

The columns headed 'between-school variance' in Table 2.2 shows the percentage of variance in achievement that is between schools and can be interpreted as a measure of the extent to which schools differ with respect to average achievement. In all domains, between-school variance in achievement in Ireland was low relative to the OECD average. For example, between-school variance in Ireland in reading in 2000 was 18% compared to 32% across the OECD on average. This indicates that schools in Ireland differed less to one another with respect to average achievement than the majority of countries in the OECD.

Although performance on PISA varies by domain, some countries, notably Australia, Canada, Finland, Korea, Japan, and New Zealand had high average scores in all three domains. However, even in this small subset of countries, the size of the gender differences in performance as well as the distribution of achievement between students and between schools varied considerably.

Framework for Considering Characteristics Associated with Achievement

Many studies have assessed the relative importance of various characteristics in terms of their associations with achievement, and numerous theoretical models of learning have been proposed. The better-known and more well-established models are perhaps those developed by Bennett (1978), Bloom (1976), Bruner (1966), Carroll (1963), Glaser (1976), and Harnischfeger and Wiley (1976) (see Haertel, Walberg & Weinstein, 1983). Wang, Haertel and Walberg (1993) have developed a framework of educational achievement that is based on the theoretical work cited above, also drawing on the work of Walberg (1980), Edmonds (1979), and other literature on effective schools (cited in Wang et al., 1993), and more specifically-focused models (again, cited in Wang et al.). The resulting framework distinguishes six theoretical constructs, under which 30 categories are classified (Table 2.3). These are shown here to provide a framework for considering the background contextual factors that are measured in PISA. This framework was selected for illustrative purposes because it was developed on the basis of a meta-analysis of a large number of studies covering 50 years of research in the area.

As Table 2.3 indicates, both distal and proximal factors can be associated with student achievement. Distal factors include funding and management structures, and policies relating to curriculum and assessment. Research indicates that distal factors

tend to be less closely related to performance outcomes than proximal ones (Wang, Haertel & Walberg, 1993).

Table 2.3: Theoretical framework for learning

Construct	Category
State and district governance and organisation	District (region) demographics
	Teacher qualification requirements
Home and community educational contexts	Community
	Peer group
	Home environment and parental support
	Student use of out-of-school time
School demographics, culture, climate, policies and practices	School demographics
	Teacher/administrator decision-making
	School culture
	Schoolwide policy and organisation
Design and delivery of curriculum and instruction	Programme demographics
	Curriculum and instruction
	Curriculum design
Classroom practices	Implementation support
	Quality of instruction
	Quantity of instruction
	Classroom assessment
	Classroom management
	Student and teacher social interactions
	Student and teacher academic interactions
	Classroom climate
Student characteristics	Student demographics
	Educational history
	Social and behavioural characteristics
	Motivational and affective characteristics
	Cognitive characteristics
	Metacognitive characteristics
	Psychomotor characteristics

Source: Adapted from Wang, Haertel & Walberg, 1993, Table 1.

The PISA 2009 assessment framework (OECD, 2009c) also classifies characteristics in terms of their proximity to individual students, distinguishing between system level, school level, instructional settings, and individual student level. Examples of specific characteristics at each of these levels are:

- System level: public and private management, structures for accountability, country-level measures of wealth and societal inequality
- School level: composition of student body, school size, curricular emphasis
- Home and classroom settings: class size, teacher quality, classroom environment, classroom activities
- Individual students: socioeconomic and demographic characteristics, attitudes and activities.

The interaction of characteristics within and between levels is acknowledged in the PISA 2009 questionnaire framework (OECD, 2009c). For example, curricular emphasis at the school level is likely to be influenced by system-level policies on curricular content and assessment.

It should be noted that the limitations associated with any cross-sectional survey apply to PISA, most importantly the inability to make causal inferences and the use of indirect measures which in some cases may be prone to systematic measurement error arising from sources such as socially desirable responding. Observational data are lacking, for example, with respect to teaching and learning practices and processes. PISA provides only indirect measures of variables that are related to teaching and learning at classroom level. The PISA sample design (which selects students on the basis of age across different year levels and classrooms; see Chapter 1) further limits the extent to which inferences may be made concerning teaching and learning characteristics.

Characteristics Associated with Achievement in Previous Cycles of PISA

For both PISA 2000 and 2003, multilevel models of Irish achievement on reading, mathematics and science were constructed (Cosgrove et al., 2005; Shiel et al., 2001), while in 2006, multilevel modelling was confined to science (Cosgrove & Cunningham, in press). Some additional national analyses were carried out using the PISA 2000 data (Sofroniou, Cosgrove & Shiel, 2002; Sofroniou, Shiel & Cosgrove, 2002). Multinomial models that compare and contrast the characteristics of high and low achievers in reading (2000, 2003, 2006), mathematics (2006) and science (2006) have also been described (Cosgrove & Gilleece, 2009; Gilleece, Cosgrove & Sofroniou, 2010). The results of these analyses form the main focus of the remainder of this section, which highlights characteristics that have been found to be consistently related to achievement in Ireland.

Table 2.4 summarises the variables that were initially considered in establishing the Irish PISA 2000 models of reading, mathematics, and science achievement, highlighting those variables that survived to the final models[9]. At the school level, sector and designated disadvantaged status remained in the models for all three domains. Note, however, that designated disadvantaged status is a binary measure of school socioeconomic composition. This can be viewed as a weakness in the modelling for PISA 2000, since a more precise measure of socioeconomic intake (e.g., school average parental occupation) could have been applied at the school level.

Measures of student socioeconomic background tended to be significant in the models, and consistently so with respect to parental occupation. Other demographic characteristics of students that remained in the models were number of siblings and lone parent family (though the latter did not remain in the final model in the case of reading). Newcomer status/language spoken by the student was not included in the models in 2000 due to the very small numbers of students in the newcomer group at that time. The number of books in the home, which is a proxy for home educational environment, remained in all three models.

[9] Following the conventions in analyses such as those described here, variables were discarded prior to finalising the models if their association with achievement was no longer significant ($p \leq .05$) when considered in conjunction with the other variables, and/or they did not interact significantly with other variables.

Over and above these, three student attitudinal and behavioural characteristics remained significant in all three models: early school leaving intent, absenteeism, and completion of homework on time. Grade or year level also remained, but is difficult to interpret, since PISA students may be enrolled in a particular grade level for various reasons including school starting age, grade repetition, and availability/uptake of Transition Year.

The model for reading achievement indicates the relevance of students' engagement in reading: even after adjusting for other characteristics, frequency of leisure reading and students' reported enjoyment of reading were significantly associated with achievement (Table 2.4). These two variables were not included in the models for mathematics and science as they were considered to be more closely aligned to reading.

The fact that between-school variance in achievement in Ireland is generally quite low, particularly with respect to the OECD average, implies a limit to the explanatory power of school-level variables in Irish models that use the PISA data. In practical terms, this means that schools in Ireland differed less from one another with respect to achievement in all three achievement domains relative to the OECD averages. Note, however, that between-classroom variation in achievement *within* schools may be a feature of the system.

Table 2.4: Summary of results from modelling of Irish PISA 2000 achievement in reading, mathematics and science

PISA 2000 Reading	*PISA 2000 Mathematics*	*PISA 2000 Science*
School sector	School sector	School sector
School designated disadvantaged status	School designated disadvantaged status	School designated disadvantaged status
School gender composition	School gender composition	School gender composition
School size	School size	School size
Student-teacher ratio	Student-teacher ratio	Student-teacher ratio
School average disciplinary climate	School average disciplinary climate	School average disciplinary climate
Student gender	Student gender	Student gender
Parental occupation	Parental occupation	Parental occupation
Parental education	Parental education	Parental education
Lone parent family	Lone parent family	Lone parent family
Number of siblings	Number of siblings	Number of siblings
Parental engagement with student	Parental engagement with student	Parental engagement with student
Number of books in the home	Number of books in the home	Number of books in the home
Student early school leaving intent	Student early school leaving intent	Student early school leaving intent
Frequency of absenteeism	Frequency of absenteeism	Frequency of absenteeism
Completion of homework on time	Completion of homework on time	Completion of homework on time
Grade (year) level	Grade (year) level	Grade (year) level
Diversity of reading		Studies science for Junior Certificate
Frequency of leisure reading		
Enjoyment of reading		

Note: Characteristics shaded in grey were significant in the final models.

Some further aspects of the model for PISA 2000 reading may be noted. First, gender interacted with books in the home: the association between books and achievement was stronger for females than for males. Second, parental occupation and enjoyment of reading both had positive curvilinear relationships with reading achievement: the association became stronger with increasing levels of parental occupation and enjoyment of reading. Third, while small amounts of leisure reading were positively associated with reading achievement, higher amounts were negatively associated. This finding is perhaps counter-intuitive; however, the OECD (2010c) suggests that it is not only time spent reading that is relevant: quality of material read is as important, if not more so. Finally, the effects associated with early school-leaving intent varied across schools. The PISA 2000 model for reading explained 78% of between-school variance and 44% of within-school variance.

In a follow-up study to the PISA 2000 model of reading, Sofroniou et al. (2002) examined the associations between a number of attitudinal and engagement variables and reading achievement, when added to the final model described by Shiel et al. (2001). Some of the additional variables were specific to reading, while others measured more general attitudes, beliefs, and preferences in relation to learning (e.g. use of control strategies, diversity of reading, self-efficacy for learning, verbal self-concept, and instrumental motivation). The follow-up study was conducted principally to investigate associations between indicators of self-regulated learning and reading achievement when taking other background characteristics into account (see Sofroniou et al., 2002, for an overview of research on self-regulated learning).

Sofroniou et al. (2002) found that, of the additional variables, the following remained in the final model: enjoyment of reading, instrumental motivation, competitive learning, co-operative learning, and academic self-concept. However, the effects of these variables tended to be quite small, with the exceptions of enjoyment of reading and academic self-concept. The model explained 78% of between-school variance, and 47% of within-school variance. Hence, the addition of these variables resulted in very little additional explained variance at the student level, and none at the school level. Sofroniou et al. noted that the gender difference in reading achievement was not significant in the presence of these additional variables, implying that gender differences in attitudes and beliefs accounted for a significant portion of the (unadjusted) gender difference in achievement. The nature of the relationships between attitudes, beliefs and achievements is complex, however, and recent research suggests a circularity which appears to be a cross-cultural phenomenon (Williams & Williams, 2010). Any inferences drawn about measures of interest, enjoyment and self-belief or self-concept should be mindful of this.

Table 2.5 summarises the variables that were considered in Irish PISA 2003 models of reading, mathematics, and science achievement, highlighting those that remained in the final models. In contrast to PISA 2000, which used the binary classification of school designated disadvantaged status, the models for 2003 used average Junior Certificate Examination fee waiver, a continuous (and more precise) measure of school socioeconomic composition. This indicator was also more up-to-date than disadvantaged status, which had originally been used to classify schools for the Department of Education and Science Disadvantaged Areas Scheme (DAS; see Weir & Archer, 2004). As in 2000, no indicator of the newcomer/language status was included, due to a very small number of immigrant students in PISA 2003.

There are high levels of consistency across the variables remaining in the final models for reading, mathematics, and science in 2003. At the school level, Junior Certificate Examination fee waiver and disciplinary climate remained significant in all three models. In contrast to PISA 2000, school sector was no longer significant in the final models, suggesting that the improved measure of school socioeconomic status accounted for achievement differences between the school sectors. At the student level, the following variables remained in the final models for 2003: gender, parental occupation, lone parent family, number of siblings, books in the home, home educational resources, frequency of absenteeism, and grade level.

The final model of reading in 2003 explained 81% of between-school variance and 35% of variance within schools. Comparisons between 2000 and 2003 are complicated by the fact that the set of variables in 2003 differed from those in 2000. The model for reading had slightly less explanatory power in 2003 than in 2000, probable because the model for 2000, but not for 2003, included measures of engagement in and enjoyment of reading.

Table 2.5: Summary of results from modelling of Irish PISA 2003 achievement in reading, mathematics and science

PISA 2003 Reading	*PISA 2003 Mathematics*	*PISA 2003 Science*
School size	School size	School size
School sector	School sector	School sector
Average Junior Certificate Examination fee waiver	Average Junior Certificate Examination fee waiver	Average Junior Certificate Examination fee waiver
School average disciplinary climate	School average disciplinary climate	School average disciplinary climate
Student gender	Student gender	Student gender
Parental occupation	Parental occupation	Parental occupation
Lone parent family	Lone parent family	Lone parent family
Number of siblings	Number of siblings	Number of siblings
Books in the home	Books in the home	Books in the home
Home educational resources	Home educational resources	Home educational resources
Frequency of absenteeism	Frequency of absenteeism	Frequency of absenteeism
Grade level	Grade level	Grade level
		Studies science for Junior Certificate

Note: Characteristics shaded in grey were significant in the final models.

Cosgrove et al. (2005) reported that the addition of two mathematics-specific variables to those shown for the model of mathematics in Table 2.5 (self-efficacy in mathematics and anxiety towards mathematics) explained an additional 5% of between-school variance and 15% of within-school variance. However, they also cautioned that the nature of the relationships between these variables and mathematics achievement was likely to be recursive or circular.

Analyses of science achievement only were conducted in the modelling of the Irish PISA 2006 data. The results of this model are described in brief here, since the approach to partitioning explanatory variables into conceptually-related blocks is one which is also applied to analyses of PISA 2009 in this report. Treating groups of variables that share a common theme as separate blocks has the potential to help disentangle and understand the extent to which various characteristics explain achievement differences, for example those that may be considered 'fixed' (such as

socioeconomic status) and those that may be amenable to policy or other intervention (such as student attitudes and behaviours). Cosgrove and Cunningham (in press) classified explanatory variables for analyses of science achievement in PISA 2006 as follows:

- Student level: demographic, socioeconomic, home climate, engagement in school, general engagement in science.
- School level: structural features, social composition, resources, selectivity, promotion of science.

There are some commonalities and differences in the variables that were included in the analyses for PISA 2006 and those used in 2000 and 2003. Language spoken at home was included in 2006, but not in previous cycles; measures of home educational resources were more detailed than in 2003; more variables were included at the school level than previously; and the set of variables considered for the 2006 model included a number of measures that were specific to science achievement.

The final model of science in 2006 included the following variables: gender, grade level, number of siblings, parental occupation, language spoken, books in the home, study of science for the Junior Certificate, intention to leave school early, engagement in science activities, enjoyment of science, science self-efficacy, and at the school level, social composition and the promotion of science through science competitions.

This model explained 79% of between-school variance and 42% of the variance within schools. As in the case of PISA 2000 and 2003, between-school variance in 2006 was again low. Cosgrove and Cunningham (in press) found that student demographics, socioeconomic factors, and home climate explained 24% of the total variance in science achievement. They also found that, over and above the student variables in the final model, school variables explained only an additional 1% or so of the total variance in science achievement. Variables related to engagement in science, enjoyment in science, and science self-efficacy explained an additional 5% of variance, over and above the other variables in the model.

The results of multilevel models for reading for PISA 2009 are presented in Chapter 8. For the first time in reporting associations between background characteristics and achievement, we analyse changes (2000 to 2009) within a multilevel modelling context. We also compare multilevel models of print and digital reading in an effort to gain a better understanding of how achievement on these two measures differs. As well as general background characteristics, we draw extensively on reading-specific variables available in PISA 2009. We use an analytic strategy similar to that used for PISA 2006 science to determine the extent to which variance in achievement is explained jointly or separately by groups of related background characteristics.

Chapter Summary and Conclusions

This chapter considered the achievements of students in Ireland in previous cycles of PISA to provide a context for interpreting the results for PISA 2009, particularly the results that compared achievement in reading in 2000 and 2009. Analysing and interpreting trends, however, is complex and should take changes in the wider educational and social contexts into account. Interpretation of results should also be mindful of the complexities inherent in a large-scale cross-sectional international

assessment such as PISA, as well as limitations to the design of PISA itself (see Gebhardt & Adams (2007) for an overview of some of these issues). With respect to PISA 2000, limitations include the manner in which the test booklets were designed, which resulted in the non-balanced administration of reading questions. Furthermore, trends in reading achievement have been estimated on the basis of a relatively small number of test items; consequently, results for are likely to be unstable (see Monseur & Berezner, 2007).

The review of results from previous cycles of PISA indicated that achievement in reading has been characterised by higher-than-average performance, average-sized (though substantial) gender differences (in the region of three-tenths of a standard deviation), and relatively strong performance at the lower end of the achievement distribution. In PISA 2000, students in Ireland performed particularly well on the Reflect and Evaluate subscale, relative to the Retrieve and Interpret subscales, though mean scores for Ireland on each of these three subscales were significantly above the respective OECD averages.

In mathematics, overall achievement in Ireland may be classified as average. Irish performance in 2003 on the Space and Shape subscale was lower than the OECD average, while performance on the Uncertainty subscale was above it. Performance of students in Ireland on the Change and Relationships and Quantity subscales was at the OECD average. Gender differences favoured boys in mathematics, though not to the same extent as they favoured girls in reading. A consistent finding with respect to Ireland's performance on PISA mathematics is the narrow achievement distribution; that is, the gap in the achievement scores of high and low achievers was relatively small.

Performance of Irish students on PISA science can be described as just above average, with evidence of relatively strong performance by lower achievers. Consistent with the OECD on average, gender differences in the science assessment in Ireland have tended to be minimal, which contrasts with the large gender differences in reading. In 2006, results on the science subscales indicated particularly strong performance on the Identifying Scientific Issues subscale, with some variations in the size of the gender difference across these subscales. For example, girls outperformed boys on Identifying Scientific Issues, while boys achieved higher mean scores on Earth and Space Systems, Physical Systems, and Explaining Phenomena Scientifically.

A review of the multilevel models of achievement for Ireland based on data in PISA 2000, 2003, and 2006 revealed some variation across cycles in the explanatory variables used. However, some broad conclusions can be drawn from these analyses.

First, unadjusted performance differences between students in the different school sectors could be accounted for by socioeconomic intake. Second, consistent evidence for a social context emerged, regardless of the domain considered: school socioeconomic composition is significantly associated with achievement over and above individual student characteristics. Third, the size and the direction of the gender difference varied, depending on the domain. In reading, there was some evidence that home educational climate was differently experienced by male and female students, since the numbers of books in the home was more strongly associated with achievement for girls than for boys in PISA 2000. Differences in attitudes to, and engagement in, reading explained much of the gender difference in reading achievement in 2000. This finding lends support to the view that sociocultural factors play an important role in the development of reading literacy, highlighting a need to acknowledge the complexity of gender differences when formulating proposals to improve the standards of students'

reading (e.g., Murphy, 2009). Fourth, in addition to socioeconomic and demographic characteristics, indicators of students' engagement in, and commitment to, education are generally associated with achievement. These include frequency of absenteeism and intent to leave school early. Fifth, a number of variables that measure attitudes, beliefs and behaviours are associated with achievement (such as enjoyment of reading and academic self-concept in PISA 2000 reading, and enjoyment of science and science self-efficacy in PISA 2006 science), though the relationships between such variables and achievement are complex and probably circular.

Finally, between-school variance in achievement as measured in PISA has tended to be low in Ireland relative to the OECD average. For example, in 2000, between-school variance in reading was about 18%, which is much lower than the OECD average of 35%, indicating that schools in Ireland differ less from one another in achievement than in the majority of countries in the OECD. It may be noted, however, that the PISA design does not allow for a partitioning of variance in achievement into school, class and student components, which might have revealed considerable between-classroom variance in Irish schools (see Beaton et al., 1996a, b; Kellaghan, Madaus, & Rakow, 1979).

Chapter 3: Performance on Print Reading

This chapter presents the findings from the PISA 2009 assessment of print reading. First, the performance of students in Ireland on the overall print reading scale is described, with reference to mean performance, variation in performance, and performance across proficiency levels. Second, performance on each of five reading subscales – Access and Retrieve, Integrate and Interpret, Reflect and Evaluate, Continuous Texts and Non-continuous Texts – is presented in the same way. The third section describes gender differences on overall print reading and on the reading subscales. The fourth section outlines changes in print reading performance since 2000.

Where relevant, results for Ireland are presented alongside the results for other participating countries or for a subset of countries that includes the three countries/economies with the highest mean scores on the print reading scale (*Shanghai-China, Korea, and Finland*) and five additional comparison countries (*New Zealand, Poland, the United States, Germany, France, and the United Kingdom*). Results for *Northern Ireland* are also included in the comparison tables and referred to throughout the text but are not presented in the country ranking tables as they are included in the mean scores for the United Kingdom. Countries were selected on the basis of high performance, cultural or linguistic similarity, similar population sizes, and/or recent educational reforms.

Readers are referred to Chapter 1 for an explanation of the proficiency levels used in PISA and for information on how to interpret the achievement outcomes. Sample questions from the PISA print reading assessment are provided in Appendix B.

Performance on Overall Print Reading

Ireland achieved a mean score of 495.6 on the overall print reading scale, which is above but not significantly different from the mean of 493.4 across OECD countries (Table 3.1). Ireland is ranked 17th out of 34 OECD countries and 21st out of all 65 countries that participated. Applying a 95% confidence interval, which takes into account sampling and measurement error, Ireland's true rank ranges from 12th to 22nd among OECD countries, and from 15th to 27th among all participating countries. Shanghai-China achieved the highest mean score (555.8) and significantly outperformed every other country. Korea (539.3) and Finland (535.9) are the highest performing OECD countries.

Fifteen countries, including Norway, the United States, Germany, France and the United Kingdom, achieved mean scores that are not significantly different from Ireland's, while 11 countries, including eight OECD countries, performed significantly better than Ireland (Table 3.1). Twelve OECD countries, including Italy, Spain, the Czech Republic, and Austria, achieved mean print reading scores that are significantly below Ireland's. While the mean score of Northern Ireland (499.4) is somewhat higher than both the mean score for Ireland and the OECD average score, differences are not significant.

Table 3.1: Mean country scores and standard errors (SE) for the overall print reading scale and positions relative to the OECD and Irish means – all participating countries

	Mean	SE	SD	SE	IRL		Mean	SE	SD	SE	IRL
Shanghai-China	555.8	(2.40)	80.2	(1.67)	▲	Slovak Republic	477.4	(2.54)	90.2	(1.91)	▼
Korea	539.3	(3.46)	79.2	(2.14)	▲	*Croatia*	475.7	(2.87)	87.6	(1.65)	▼
Finland	535.9	(2.25)	86.4	(0.95)	▲	Israel	474.0	(3.63)	111.5	(2.71)	▼
Hong Kong-China	533.2	(2.12)	84.0	(1.65)	▲	Luxembourg	472.2	(1.25)	103.7	(0.93)	▼
Singapore	525.9	(1.06)	97.5	(1.05)	▲	Austria	470.3	(2.95)	100.1	(2.00)	▼
Canada	524.2	(1.48)	90.3	(0.89)	▲	*Lithuania*	468.4	(2.39)	86.4	(1.59)	▼
New Zealand	520.9	(2.35)	102.8	(1.69)	▲	Turkey	464.2	(3.52)	81.9	(1.71)	▼
Japan	519.9	(3.47)	100.4	(2.93)	▲	*Dubai (UAE)*	459.4	(1.14)	106.7	(0.88)	▼
Australia	514.9	(2.34)	98.9	(1.35)	▲	*Russian Fed.*	459.4	(3.34)	89.7	(1.95)	▼
Netherlands	508.4	(5.15)	88.6	(1.64)	▲	Chile	449.4	(3.13)	82.7	(1.74)	▼
Belgium	505.9	(2.35)	101.8	(1.74)	▲	*Serbia*	442.0	(2.43)	83.8	(1.53)	▼
Norway	503.2	(2.58)	91.2	(1.25)	O	*Bulgaria*	429.1	(6.68)	113.2	(2.55)	▼
Estonia	501.0	(2.64)	83.3	(1.65)	O	*Uruguay*	425.8	(2.60)	99.3	(1.85)	▼
Switzerland	500.5	(2.44)	93.5	(1.42)	O	Mexico	425.3	(1.95)	84.6	(1.20)	▼
Poland	500.5	(2.60)	89.2	(1.28)	O	*Romania*	424.5	(4.09)	90.0	(2.30)	▼
Iceland	500.3	(1.41)	96.0	(1.19)	O	*Thailand*	421.4	(2.64)	71.9	(1.89)	▼
United States	499.8	(3.65)	96.6	(1.59)	O	*Trinidad & Tobago*	416.5	(1.24)	112.9	(1.26)	▼
Liechtenstein	499.3	(2.80)	83.0	(3.46)	O	*Colombia*	413.2	(3.74)	86.6	(1.95)	▼
Sweden	497.4	(2.88)	98.6	(1.51)	O	*Brazil*	411.8	(2.73)	94.0	(1.46)	▼
Germany	497.3	(2.66)	94.8	(1.84)	O	*Montenegro*	407.5	(1.72)	92.9	(1.13)	▼
Ireland	495.6	(2.97)	95.1	(2.18)		*Jordan*	405.0	(3.31)	90.8	(1.98)	▼
France	495.6	(3.44)	105.5	(2.84)	O	*Tunisia*	403.6	(2.88)	85.2	(1.80)	▼
Chinese Taipei	495.2	(2.60)	86.3	(1.91)	O	*Indonesia*	401.7	(3.74)	66.5	(1.97)	▼
Denmark	494.9	(2.07)	83.6	(1.16)	O	*Argentina*	398.3	(4.63)	108.2	(3.43)	▼
United Kingdom	494.2	(2.28)	95.4	(1.18)	O	*Kazakhstan*	390.4	(3.07)	91.0	(1.58)	▼
Hungary	494.2	(3.17)	90.2	(2.35)	O	*Albania*	384.8	(4.04)	99.8	(1.85)	▼
Portugal	489.3	(3.07)	86.8	(1.58)	O	*Qatar*	371.7	(0.76)	115.4	(0.79)	▼
Macao-China	486.6	(0.89)	76.2	(0.79)	▼	*Panama*	370.7	(6.54)	99.3	(3.48)	▼
Italy	486.1	(1.57)	95.9	(1.39)	▼	*Peru*	369.7	(3.95)	98.3	(2.41)	▼
Latvia	484.0	(2.96)	80.0	(1.53)	▼	*Azerbaijan*	361.5	(3.33)	75.5	(1.79)	▼
Slovenia	483.1	(1.03)	90.9	(0.86)	▼	*Kyrgyzstan*	314.0	(3.19)	98.8	(2.11)	▼
Greece	482.8	(4.32)	95.2	(2.39)	▼	OECD average	493.4	(0.48)	93.1	(0.30)	
Spain	481.0	(2.02)	87.5	(1.13)	▼						
Czech Republic	478.2	(2.89)	92.3	(1.63)	▼						

	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

Note: OECD countries are in regular font, partner countries are in italics.

Variation in Performance on the Overall Print Reading Scale

Student performance can be described in terms of the distribution of achievement within countries. The standard deviations in Table 3.1 provide an indication of the spread of scores. Countries with similar average scores can have quite different score distributions. For example, the standard deviations for Germany (94.8) and the United Kingdom (95.4) are quite similar to Ireland's (95.1), while France (105.5) has a much larger standard deviation. In contrast, Denmark (83.6) and Portugal (86.8) have smaller standard deviations. All of these countries have mean scores that do not differ from Ireland's, or from the OECD average.

Another indication of how achievement is distributed is provided by the extent of the gap between scores at the 95th and 5th percentile. Table 3.2 presents the print reading scores of students at key percentile markers on the overall print reading scale. The spread between the highest (95th percentile) and lowest (5th percentile) performing students in Ireland is 308.7, which is similar to the average across OECD countries (305.0). Of the countries represented in Table 3.2, the smallest differences between the

95th and 5th percentiles are found in the highest achieving countries – Korea (257.8), Shanghai-China (261.9), and Finland (283.8) – while the largest is found in France (346.5). Northern Ireland shows a relatively large spread of scores (314.5). The score achieved by students in Ireland at the 95th percentile is very similar to the corresponding score in Germany and on average across OECD countries, but is considerably below the scores at this percentile in Shanghai-China, New Zealand, and Finland. At the other extreme, students scoring at the 5th percentile in Ireland obtained a score which is marginally below, but not significantly different from, the corresponding scores in the United Kingdom, Germany and the average across OECD countries.

Table 3.2: Scores of students at key percentile markers on the overall print reading scale in Ireland, the OECD, and selected comparison countries

	5th		10th		25th		75th		90th		95th	
	Score	SE	Score	SE	Score	SE	Score	SE	Score	SE	Score	SE
Korea	400.4	(7.64)	434.8	(5.91)	490.4	(4.06)	595.1	(3.42)	635.2	(2.96)	658.2	(3.80)
Finland	382.3	(3.41)	419.3	(3.56)	480.8	(2.69)	597.3	(2.25)	642.2	(2.62)	666.1	(2.60)
New Zealand	343.6	(5.83)	382.6	(4.47)	451.8	(3.06)	595.1	(2.78)	649.0	(2.72)	678.5	(3.67)
Poland	346.5	(5.58)	382.4	(4.25)	441.2	(3.41)	564.6	(3.24)	612.5	(3.28)	639.8	(3.59)
United States	339.0	(4.24)	372.2	(3.93)	433.1	(3.98)	569.0	(4.58)	624.8	(5.04)	656.0	(5.81)
Germany	332.8	(4.84)	366.5	(5.06)	432.3	(4.46)	567.1	(2.77)	614.8	(3.16)	640.0	(3.08)
Ireland	329.6	(7.79)	373.4	(4.68)	435.5	(3.86)	562.4	(2.83)	610.5	(2.79)	638.3	(3.19)
France	304.5	(8.17)	351.8	(7.03)	429.1	(4.72)	572.2	(3.96)	624.1	(3.87)	651.0	(4.57)
United Kingdom	333.8	(4.10)	370.1	(3.06)	429.9	(2.82)	561.1	(3.17)	616.1	(2.61)	645.7	(3.66)
OECD	332.1	(0.96)	369.2	(0.83)	431.7	(0.65)	560.1	(0.53)	609.7	(0.57)	637.1	(0.66)
Shanghai-China	416.7	(5.20)	449.9	(4.82)	503.9	(3.52)	612.6	(2.78)	654.2	(2.73)	678.6	(3.28)
Northern Ireland	336.4	(13.18)	373.3	(9.03)	431.8	(5.51)	568.9	(3.80)	622.1	(3.76)	650.9	(5.35)

Performance on Print Reading Proficiency Levels

Proficiency levels group students' achievement scores at different points along a continuous scale into levels so that the skills of students at each level can be described. One change to the PISA reading assessment in PISA 2009 was the addition of proficiency levels at the higher (Level 6) and lower (Level 1b) ends of the reading scales. This means that seven proficiency levels are described for reading in PISA 2009 (see Table 3.3). Students who perform at Level 1b are likely to be able to correctly answer only the easiest PISA items and are unlikely to be able to respond correctly to tasks at higher levels, while students with a proficiency at Level 6 are likely to be able to respond correctly to the most difficult PISA reading tasks.

Students who do not demonstrate the skills required to answer the easiest PISA items are classified as being below Level 1b. Level 2 is considered a baseline level of proficiency. The OECD (2010e) states that

> Students below this level [Level 2] may still be capable of locating pieces of explicitly stated information that are prominent in the text, recognising a main idea in a text about a familiar topic, or recognising the connection between information in the text and their everyday experience. However, they have not acquired the level of literacy that is required to participate effectively and productively in life. (p. 42)

Table 3.3: Descriptions of the seven levels of proficiency on the overall print reading scale and percentages of students achieving each level (OECD and Ireland)

Level *(Cut-point)*	**Students at this level are capable of:**	**OECD**		**Ireland**	
		%	**SE**	**%**	**SE**
6 *(above 698)*	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	(0.03)	0.7	(0.22)
5 *(626 to 698)*	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	(0.10)	6.3	(0.50)
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	(0.16)	21.9	(0.91)
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	(0.16)	30.6	(0.91)
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	(0.16)	23.3	(1.00)
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	(0.13)	11.8	(0.71)
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	(0.08)	3.9	(0.47)
Below Level 1b *(below 262)*	There is insufficient information on which to base a description of the reading skills of these students.	1.1	(0.05)	1.5	(0.36)

Source: OECD, 2010a, Figure I.2.12.

Table 3.3 provides a description of the types of skills that students at each proficiency level can demonstrate, based on the characteristics of test items on which they are likely to succeed. It also shows the percentage of students who scored at each level in Ireland and on average across OECD countries. In Ireland, 17.2% of students performed below Level 2, which is marginally lower than the corresponding average percentage across OECD countries (18.8%). The percentage of low performing students in Ireland is also similar to (but slightly lower) than in Germany (18.5%), the United States (17.6%), Northern Ireland (17.5%) and the United Kingdom (18.4%) – countries/economies that have mean scores that are not significantly different to Ireland's. Ireland has a considerably higher percentage of low performing students than Shanghai-China (4.1%), Korea (5.8%) and Finland (8.1%), the highest achieving countries/economies.

Ireland has about the same percentage of students at Level 5 or above (7.0%) as is found on average across OECD countries (7.6%) (Table 3.4). These high performing readers are regarded by the OECD as 'potential world class knowledge workers of tomorrow' (OECD, 2010a, p. 51). The percentage of highly skilled readers in Ireland is about the same as in Poland (7.2%), Germany (7.6%) and the whole of the United Kingdom (8.0%) but is marginally lower than in Northern Ireland (9.3%). Shanghai-China (19.5%), New Zealand (15.7%), and Finland (14.5%) each has over twice the percentage of high achieving readers than in Ireland.

Table 3.4: Percentage of students at each proficiency level on the overall print reading scale in Ireland, the OECD, and selected comparison countries

	Below Level 1b		Level 1b		Level 1a		Level 2		Level 3		Level 4		Level 5		Level 6	
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Korea	0.2	(0.15)	0.9	(0.30)	4.7	(0.63)	15.4	(1.01)	33.0	(1.23)	32.9	(1.42)	11.9	(0.96)	1.0	(0.20)
Finland	0.2	(0.07)	1.5	(0.20)	6.4	(0.44)	16.7	(0.62)	30.1	(0.85)	30.6	(0.88)	12.9	(0.74)	1.6	(0.24)
New Zealand	0.9	(0.22)	3.2	(0.45)	10.2	(0.58)	19.3	(0.75)	25.8	(0.76)	24.8	(0.81)	12.9	(0.76)	2.9	(0.38)
Poland	0.6	(0.15)	3.1	(0.35)	11.3	(0.66)	24.5	(1.08)	31.0	(0.98)	22.3	(0.99)	6.5	(0.55)	0.7	(0.15)
United States	0.6	(0.13)	4.0	(0.45)	13.1	(0.84)	24.4	(0.86)	27.6	(0.83)	20.6	(0.90)	8.4	(0.75)	1.5	(0.42)
Germany	0.8	(0.23)	4.4	(0.46)	13.3	(0.79)	22.2	(0.87)	28.8	(1.09)	22.8	(0.88)	7.0	(0.57)	0.6	(0.15)
Ireland	1.5	(0.36)	3.9	(0.47)	11.8	(0.71)	23.3	(1.00)	30.6	(0.91)	21.9	(0.91)	6.3	(0.50)	0.7	(0.22)
France	2.3	(0.52)	5.6	(0.53)	11.8	(0.84)	21.1	(1.03)	27.2	(1.04)	22.4	(1.07)	8.5	(0.83)	1.1	(0.25)
United Kingdom	1.0	(0.20)	4.1	(0.35)	13.4	(0.64)	24.9	(0.72)	28.8	(0.84)	19.8	(0.79)	7.0	(0.47)	1.0	(0.19)
OECD	1.1	(0.05)	4.6	(0.08)	13.1	(0.13)	24.0	(0.16)	28.9	(0.16)	20.7	(0.16)	6.8	(0.10)	0.8	(0.03)
Shanghai-China	0.1	(0.04)	0.6	(0.14)	3.4	(0.47)	13.3	(0.86)	28.5	(1.16)	34.7	(1.04)	17.0	(0.99)	2.4	(0.45)
Northern Ireland	0.9	(0.54)	3.9	(0.91)	12.7	(1.06)	23.8	(1.32)	27.8	(1.53)	21.6	(1.18)	7.9	(0.67)	1.4	(0.29)

Performance on Reading Subscales

Five reading subscales were established in the PISA 2009 reading framework (OECD, 2009d). These are based on three reading aspects (Access and Retrieve, Integrate and Interpret, and Reflect and Evaluate) and two text formats (Continuous and Non-Continuous). Each item was categorised according to the aspect of reading it assessed, and the format it mainly referred to (see Chapter 1).

Access and Retrieve

Approximately one-quarter of the print reading items in PISA 2009 were assigned to the Access and Retrieve aspect. Ireland achieved a mean score of 498.1 on this subscale, which is just marginally higher than the overall print reading score for students in Ireland (495.6). Ireland's mean score on the Access and Retrieve print reading scale does not differ significantly from the corresponding average across OECD countries (494.9) (Table 3.5). Ireland's mean score is ranked 18th out of 34 OECD countries and 22nd out of all 65 participating countries. Taking account of sampling and measurement error (applying a 95% confidence interval), Ireland's true rank on this subscale can be said to lie between 12th and 20th among OECD countries and between 16th and 26th among all participating countries.

Table 3.5: Mean country scores and standard errors (SE) for the access and retrieve print reading subscale and positions relative to the OECD and Irish means – all participating countries

	Mean	SE	SD	SE	IRL		Mean	SE	SD	SE	IRL
Shanghai-China	549.3	(2.89)	96.0	(1.91)	▲	Austria	477.2	(3.24)	109.4	(2.20)	▼
Korea	541.7	(3.56)	87.5	(2.27)	▲	*Lithuania*	476.4	(2.98)	101.5	(1.92)	▼
Finland	532.3	(2.75)	99.0	(1.22)	▲	*Latvia*	476.4	(3.57)	92.1	(1.90)	▼
Japan	529.7	(3.80)	109.7	(3.17)	▲	Luxembourg	470.5	(1.34)	114.6	(1.14)	▼
Hong Kong-China	529.6	(2.68)	94.2	(1.92)	▲	*Russian Fed.*	468.7	(3.94)	102.6	(1.99)	▼
Singapore	526.3	(1.35)	102.5	(1.22)	▲	Greece	467.9	(4.44)	103.4	(2.47)	▼
New Zealand	520.9	(2.37)	105.8	(1.72)	▲	Turkey	467.3	(4.08)	94.9	(2.20)	▼
Netherlands	519.2	(5.11)	91.9	(1.59)	▲	Israel	462.9	(4.14)	120.5	(3.13)	▼
Canada	516.7	(1.54)	95.3	(1.02)	▲	*Dubai (UAE)*	458.5	(1.42)	116.6	(1.25)	▼
Belgium	513.4	(2.41)	107.8	(1.78)	▲	*Serbia*	449.4	(3.09)	94.6	(2.04)	▼
Australia	513.4	(2.42)	100.2	(1.32)	▲	Chile	443.9	(3.36)	90.9	(2.04)	▼
Norway	511.8	(2.79)	98.7	(1.59)	▲	Mexico	432.7	(2.14)	93.9	(1.45)	▼
Liechtenstein	507.6	(4.00)	92.5	(3.75)	O	*Thailand*	431.0	(3.49)	85.6	(2.09)	▼
Iceland	506.6	(1.64)	107.6	(1.35)	▲	*Bulgaria*	429.6	(8.31)	139.0	(3.34)	▼
Switzerland	505.5	(2.67)	97.5	(1.47)	O	*Uruguay*	424.5	(2.90)	110.2	(1.73)	▼
Sweden	504.6	(2.95)	103.9	(1.54)	O	*Romania*	422.7	(4.67)	101.6	(2.69)	▼
Estonia	502.8	(2.97)	91.4	(1.66)	O	*Trinidad & Tobago*	413.4	(1.61)	124.7	(1.36)	▼
Denmark	502.3	(2.62)	94.4	(1.35)	O	*Montenegro*	407.6	(2.34)	119.0	(1.64)	▼
Hungary	501.4	(3.73)	103.6	(3.06)	O	*Brazil*	406.6	(3.29)	107.2	(1.90)	▼
Germany	500.5	(3.53)	104.5	(2.24)	O	*Colombia*	404.2	(3.68)	91.5	(2.03)	▼
Poland	500.1	(2.79)	100.9	(1.37)	O	*Indonesia*	399.1	(4.69)	90.7	(2.37)	▼
Ireland	498.1	(3.32)	99.4	(2.44)		*Kazakhstan*	397.3	(3.70)	110.3	(1.99)	▼
Chinese Taipei	496.0	(2.78)	104.8	(1.84)	O	*Argentina*	394.0	(4.78)	115.1	(3.07)	▼
Macao-China	492.8	(1.15)	87.8	(0.90)	O	*Jordan*	393.9	(3.96)	110.4	(2.23)	▼
United States	491.8	(3.59)	98.9	(1.54)	O	*Tunisia*	393.4	(3.32)	102.2	(1.71)	▼
France	491.6	(3.78)	110.1	(3.18)	O	*Albania*	379.8	(4.70)	112.3	(2.12)	▼
Croatia	491.6	(3.12)	100.5	(1.88)	O	*Peru*	363.7	(4.28)	106.4	(2.67)	▼
United Kingdom	491.4	(2.55)	101.0	(1.57)	O	*Panama*	363.4	(7.68)	119.5	(4.19)	▼
Slovak Republic	490.6	(3.03)	102.6	(2.64)	O	*Azerbaijan*	361.4	(4.53)	102.9	(2.37)	▼
Slovenia	489.1	(1.07)	98.1	(0.84)	▼	*Qatar*	353.8	(1.00)	135.3	(0.91)	▼
Portugal	488.2	(3.30)	92.6	(1.96)	▼	*Kyrgyzstan*	299.3	(4.04)	122.3	(2.42)	▼
Italy	481.8	(1.81)	105.2	(1.53)	▼	OECD average	494.9	(0.53)	101.0	(0.34)	
Spain	480.1	(2.14)	100.4	(1.23)	▼						
Czech Republic	478.9	(3.22)	99.0	(1.65)	▼						

	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

Note: OECD countries are in regular font, partner countries are in italics.

Ireland's mean score on the Access and Retrieve subscale did not differ significantly from those of 15 countries, including Estonia, Germany, Poland, the United States, and the United Kingdom. Thirteen countries, including Iceland and Norway, achieved mean scores significantly above Ireland's, while 12 OECD countries, including Italy, Spain, and Austria performed significantly less well than Ireland. Students in Northern Ireland achieved a mean score of 498.8 on this subscale, which does not differ from the corresponding score for the rest of Ireland or the average across OECD countries.

The gap between the lowest and the highest performing students (those scoring at the 5th and 95th percentiles) on the Access and Retrieve subscale is almost identical in both Northern Ireland (321.6) and the rest of Ireland (321.9). Both the highest and lowest performing students in Northern Ireland have similar, although slightly higher, scores than the corresponding students in the rest of Ireland (Table 3.6). Of the comparison countries presented in Table 3.6, France shows the largest spread of achievement for the Access and Retrieve subscale (358.6), while Korea shows the narrowest spread (286.7).

Both the lowest and highest performing students in Ireland achieve scores that are very similar to the corresponding scores across OECD countries.

Table 3.6: Scores of students at key percentile markers on the access and retrieve print reading subscale in Ireland, the OECD, and selected comparison countries

	5th		10th		25th		75th		90th		95th	
	Score	SE	Score	SE	Score	SE	Score	SE	Score	SE	Score	SE
Korea	390.8	(7.82)	428.7	(6.35)	486.0	(4.18)	602.1	(3.62)	650.4	(3.69)	677.5	(4.80)
Finland	356.9	(5.56)	400.7	(4.01)	469.7	(3.61)	602.0	(2.93)	653.1	(3.08)	682.5	(3.65)
New Zealand	337.8	(4.95)	380.8	(4.36)	452.4	(3.38)	596.8	(2.81)	650.0	(3.03)	679.6	(3.31)
Poland	326.3	(5.05)	369.0	(4.01)	434.8	(3.63)	569.4	(2.94)	626.2	(3.91)	659.6	(4.20)
United States	324.7	(5.03)	362.6	(4.61)	425.0	(3.96)	560.8	(4.40)	618.1	(4.41)	650.1	(5.41)
Germany	318.0	(7.18)	358.1	(6.02)	429.1	(5.27)	577.5	(4.00)	629.8	(4.11)	657.9	(4.49)
Ireland	321.1	(9.72)	371.6	(5.43)	438.9	(4.07)	566.7	(2.84)	616.4	(3.95)	643.0	(4.14)
France	297.6	(9.54)	346.6	(7.57)	422.3	(4.74)	570.9	(4.51)	625.4	(4.60)	656.1	(4.97)
United Kingdom	320.8	(4.63)	360.6	(4.38)	425.9	(3.26)	561.2	(2.84)	617.4	(3.45)	650.3	(4.15)
OECD	318.5	(1.17)	361.3	(0.92)	430.0	(0.69)	566.2	(0.58)	619.3	(0.64)	649.4	(0.73)
Shanghai-China	382.4	(5.95)	423.1	(5.30)	488.8	(3.84)	616.8	(3.04)	665.6	(3.42)	694.7	(4.08)
Northern Ireland	330.0	(13.92)	371.4	(10.47)	434.5	(6.61)	567.0	(3.83)	620.5	(4.64)	651.6	(4.75)

Table 3.7: Descriptions of the seven levels of proficiency on the access and retrieve print reading subscale and percentages of students achieving each level (OECD and Ireland)

Level *(Cut-point)*	**Students at this level are capable of:**	**OECD**		**Ireland**	
		%	**SE**	**%**	**SE**
6 (above 698)	Working in an unfamiliar context, combining many pieces of independent information from different parts of mixed texts accurately and in a precise sequence.	1.4	(0.05)	0.9	(0.19)
5 (626 to 698)	Locating (and possibly combining) multiple pieces of deeply embedded information, some of which may be located outside the main body of the text. Dealing with strongly distracting and competing information.	8.1	(0.11)	7.2	(0.78)
4 (553 to 625)	Locating numerous pieces of embedded information in an unfamiliar context or form. Each piece of text may need to meet multiple criteria. It is possible that verbal and graphical information may have to be combined. Dealing with prominent and/or extensive competing information.	20.9	(0.16)	22.6	(1.07)
3 (480 to 552)	Locating numerous pieces of information, each of which may need to meet multiple criteria. Combining pieces of information within a text and dealing with competing information.	27.5	(0.16)	30.2	(0.97)
2 (407 to 479)	Locating one or more pieces of information, each of which may need to meet multiple criteria. Dealing with competing information.	22.4	(0.15)	22.6	(0.94)
1a (335 to 406)	Locating one or more independent pieces of explicitly stated information meeting a single criterion by making a literal or synonymous match, with little or no competing information.	12.6	(0.13)	10.6	(0.66)
1b (262 to 334)	Locating one piece of explicitly stated information in a prominent position in a simple text, by making a literal or synonymous match, with no competing information. Making simple connections between adjacent pieces of information.	5.0	(0.08)	3.7	(0.43)
Below Level 1b (below 262)	There is insufficient information on which to base a description of the reading skills of these students.	2.0	(0.06)	2.2	(0.46)

Source: OECD, 2010a, Figure I.2.19.

The types of skills that students at various proficiency levels on the Access and Retrieve subscale demonstrate are presented in Table 3.7. Compared to the average across OECD countries, Ireland has fewer students below Level 2 or below (16.5% compared to 19.6%) (a positive outcome) and fewer students at Level 5 or above (8.1% compared to 9.5%) (a negative one).

The percentage of students below proficiency Level 2 on the Access and Retrieve subscale in Ireland (16.5%) is similar to the percentage of these students in Poland (17.7%) and Northern Ireland (17.9%) (Table 3.8). Both France (21.0%) and the United Kingdom (20.1%) have a somewhat higher percentage of such students, while Shanghai-China (7.7%) and Korea (7%), the highest performing countries/economies, have less than half the percentage. Just over 8% of students in Ireland are considered highly skilled readers on the Access and Retrieve subscale (Level 5 and above), which is similar to the percentage in the United States (8.6%), Northern Ireland (9.0%) and the United Kingdom (8.3%), and is just slightly below the average across OECD countries (9.5%).

Table 3.8: Percentage of students at each proficiency level on the access and retrieve print reading subscale in Ireland, the OECD, and selected comparison countries

	Below Level 1b		Level 1b		Level 1a		Level 2		Level 3		Level 4		Level 5		Level 6	
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Korea	0.3	(0.14)	1.2	(0.32)	5.5	(0.67)	15.9	(0.99)	30.1	(0.98)	30.3	(1.22)	13.9	(1.08)	2.7	(0.42)
Finland	0.8	(0.15)	2.5	(0.27)	7.8	(0.54)	17.2	(0.95)	27.0	(0.85)	27.4	(0.78)	14.2	(0.70)	3.1	(0.36)
New Zealand	1.3	(0.22)	3.4	(0.35)	10.0	(0.59)	18.4	(0.67)	26.0	(0.80)	24.6	(0.76)	13.3	(0.66)	3.0	(0.33)
Poland	1.5	(0.25)	4.3	(0.42)	11.9	(0.74)	22.7	(0.79)	28.6	(0.78)	21.0	(0.78)	8.3	(0.53)	1.8	(0.26)
United States	1.2	(0.26)	4.9	(0.44)	13.8	(0.83)	24.8	(0.76)	27.5	(1.03)	19.2	(0.88)	7.2	(0.67)	1.3	(0.29)
Germany	1.5	(0.33)	5.4	(0.61)	12.8	(0.83)	20.6	(0.96)	26.1	(0.95)	22.7	(1.02)	9.4	(0.75)	1.5	(0.30)
Ireland	2.2	(0.46)	3.7	(0.43)	10.6	(0.66)	22.6	(0.94)	30.2	(0.97)	22.6	(1.07)	7.2	(0.78)	0.9	(0.19)
France	3.0	(0.60)	5.5	(0.58)	12.5	(0.88)	21.8	(0.99)	26.3	(1.19)	20.9	(1.17)	8.5	(0.86)	1.4	(0.29)
United Kingdom	1.7	(0.25)	4.8	(0.40)	13.6	(0.63)	23.4	(0.87)	28.3	(0.93)	19.8	(0.93)	7.1	(0.57)	1.2	(0.24)
OECD	2.0	(0.06)	5.0	(0.08)	12.6	(0.13)	22.4	(0.15)	27.5	(0.16)	20.9	(0.16)	8.1	(0.11)	1.4	(0.05)
Shanghai-China	0.5	(0.14)	1.5	(0.31)	5.7	(0.59)	14.8	(0.77)	26.1	(0.92)	29.5	(1.07)	17.3	(0.89)	4.6	(0.45)
Northern Ireland	1.2	(0.57)	4.4	(0.89)	12.3	(1.08)	22.5	(1.23)	29.4	(1.63)	21.2	(1.34)	7.6	(0.86)	1.5	(0.43)

Integrate and Interpret

Just over half of the PISA 2009 print reading items are classified as belonging to the Integrate and Interpret print reading subscale. On this subscale, Ireland achieved a mean score of 493.8, which is marginally lower than the overall print reading mean score for students in Ireland (495.6) and is not significantly different from the OECD average for this subscale (493.4) (Table 3.9). Ireland is ranked 19th of the 34 OECD countries and 24th of all 65 participating countries on this subscale. Applying a 95% confidence interval, Ireland's true rank can be said to lie between 14th and 24th among OECD countries and between 17th and 29th among all participating countries.

Fourteen countries, including Switzerland, Norway, Iceland, and Poland (countries that did not differ significantly from Ireland on the overall print reading scale), achieved a mean score on the Integrate and Interpret subscale that is significantly higher than Ireland's score. Ireland's mean score does not differ significantly from the mean score of 17 countries (including the Netherlands, Germany, the United Kingdom,

Portugal and Greece) and is significantly higher than that of the 33 remaining countries. Students in Northern Ireland (not shown in Table 3.9) obtained a mean score of 497.2 on the Integrate and Interpret subscale, which is does not differ significantly from the corresponding mean score in Ireland or across the OECD.

Table 3.9: Mean country scores and standard errors (SE) for the integrate and interpret print reading subscale and positions relative to the OECD and Irish means – all participating countries

	Mean	SE	SD	SE	IRL		Mean	SE	SD	SE	IRL
Shanghai-China	558.1	(2.48)	81.4	(1.64)	▲	Spain	480.7	(1.96)	87.0	(1.00)	▼
Korea	540.7	(3.42)	81.1	(2.13)	▲	Luxembourg	474.9	(1.06)	104.3	(1.08)	▼
Finland	538.3	(2.35)	87.6	(0.96)	▲	Israel	473.0	(3.39)	109.5	(2.37)	▼
Hong Kong-China	530.1	(2.23)	89.3	(1.51)	▲	*Croatia*	472.3	(2.86)	83.3	(1.53)	▼
Singapore	524.8	(1.16)	101.4	(1.09)	▲	Austria	471.2	(2.89)	98.9	(1.97)	▼
Canada	522.2	(1.52)	94.1	(0.93)	▲	*Lithuania*	468.6	(2.42)	84.7	(1.48)	▼
Japan	519.5	(3.49)	101.7	(2.57)	▲	*Russian Fed.*	466.9	(3.11)	89.8	(1.72)	▼
New Zealand	517.3	(2.45)	105.4	(1.75)	▲	Turkey	459.4	(3.27)	78.1	(1.71)	▼
Australia	512.6	(2.40)	102.4	(1.56)	▲	*Dubai (UAE)*	456.5	(1.33)	105.7	(1.14)	▼
Netherlands	504.5	(5.35)	94.3	(1.76)	O	Chile	452.1	(3.06)	85.4	(1.74)	▼
Belgium	503.6	(2.50)	105.7	(1.80)	▲	*Serbia*	444.9	(2.43)	83.9	(1.50)	▼
Poland	502.9	(2.75)	90.7	(1.20)	▲	*Bulgaria*	436.2	(6.38)	106.9	(2.44)	▼
Iceland	502.6	(1.48)	98.1	(1.30)	▲	*Romania*	424.9	(3.98)	87.1	(2.17)	▼
Norway	501.9	(2.66)	93.7	(1.34)	▲	*Uruguay*	422.6	(2.56)	97.0	(1.61)	▼
Switzerland	501.8	(2.46)	97.2	(1.48)	▲	*Montenegro*	420.4	(1.60)	87.9	(1.37)	▼
Germany	500.8	(2.77)	96.3	(1.88)	O	*Trinidad & Tobago*	418.7	(1.41)	109.5	(1.19)	▼
Estonia	500.0	(2.80)	83.8	(1.51)	O	Mexico	418.5	(1.96)	87.3	(1.14)	▼
Chinese Taipei	498.8	(2.53)	86.7	(1.90)	O	*Thailand*	416.3	(2.55)	71.7	(1.78)	▼
Liechtenstein	497.6	(3.99)	90.3	(3.48)	O	*Colombia*	411.1	(3.77)	88.7	(1.96)	▼
France	497.2	(3.56)	110.5	(2.84)	O	*Jordan*	410.2	(3.14)	83.6	(1.85)	▼
Hungary	495.9	(3.17)	89.2	(2.14)	O	*Brazil*	406.2	(2.70)	94.2	(1.51)	▼
United States	495.0	(3.67)	99.8	(1.66)	O	*Argentina*	397.6	(4.69)	108.9	(3.43)	▼
Sweden	494.2	(3.01)	102.5	(1.63)	O	*Indonesia*	397.4	(3.53)	65.6	(1.78)	▼
Ireland	493.8	(3.05)	96.7	(2.15)		*Kazakhstan*	396.9	(3.03)	86.7	(1.47)	▼
Denmark	492.2	(2.14)	83.5	(1.25)	O	*Tunisia*	393.5	(2.75)	80.7	(1.56)	▼
United Kingdom	490.5	(2.37)	97.3	(1.18)	O	*Albania*	393.2	(3.84)	97.7	(1.98)	▼
Italy	489.9	(1.60)	94.2	(1.30)	O	*Qatar*	378.7	(0.88)	104.9	(0.82)	▼
Slovenia	488.6	(1.06)	90.4	(0.86)	O	*Azerbaijan*	373.1	(2.94)	68.0	(1.49)	▼
Macao-China	488.2	(0.82)	77.3	(0.72)	O	*Panama*	372.1	(5.92)	94.1	(3.28)	▼
Czech Republic	487.7	(2.94)	93.4	(1.55)	O	*Peru*	371.3	(3.98)	99.9	(2.62)	▼
Portugal	486.6	(3.03)	87.3	(1.54)	O	*Kyrgyzstan*	326.9	(2.93)	88.5	(1.86)	▼
Latvia	484.4	(2.83)	79.6	(1.53)	▼	OECD average	493.4	(0.49)	94.4	(0.29)	
Greece	484.3	(3.98)	93.2	(1.96)	O						
Slovak Republic	481.0	(2.50)	88.8	(1.91)	▼						

	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

Note: OECD countries are in regular font, partner countries are in italics.

The gap between the lowest and highest performing students (those scoring at the 5th and 95th percentiles) on the Integrate and Interpret subscale in Ireland (312.6) is similar to the average gap across OECD countries (309.1 points) and is somewhat smaller than in Northern Ireland (325.4) (Table 3.10). As was the case for the overall print reading scale, students in France showed the largest spread in achievement on the Integrate and Interpret subscale (364.3) among the countries in Table 3.10, while students in Korea displayed the narrowest spread (265.6).

Students in Northern Ireland achieved a score at the 5th percentile that is similar to the corresponding score in the rest of Ireland. However, the score of the highest performing students in Northern Ireland (656.6) is higher than the score in the rest of Ireland (641.0). The scores of the lowest and highest performing students across OECD countries are very similar to the corresponding scores in Ireland. Despite having a

similar mean score to Ireland on this subscale, low performing students in France performed considerably less well than their counterparts in Ireland. However, the highest achieving students in France outperformed the highest achieving students in Ireland by 23 points.

Table 3.10: Scores of students at key percentile markers on the integrate and interpret print reading subscale in Ireland, the OECD, and selected comparison countries

	5th		10th		25th		75th		90th		95th	
	Score	SE	Score	SE	Score	SE	Score	SE	Score	SE	Score	SE
Korea	397.9	(8.60)	434.9	(5.82)	489.4	(4.33)	598.2	(3.46)	639.2	(3.54)	663.5	(3.67)
Finland	385.2	(3.68)	421.0	(3.65)	481.5	(2.73)	600.8	(2.74)	646.8	(2.85)	673.8	(3.23)
New Zealand	338.2	(5.80)	379.1	(4.66)	445.1	(3.34)	593.2	(3.27)	651.7	(3.64)	680.7	(5.45)
Poland	349.4	(4.63)	382.6	(4.14)	442.0	(3.29)	567.0	(3.47)	617.2	(3.34)	648.0	(3.61)
United States	331.4	(3.87)	364.3	(3.83)	424.8	(4.08)	565.2	(4.63)	626.0	(5.31)	660.1	(5.96)
Germany	335.4	(5.20)	370.6	(4.43)	433.3	(4.31)	572.5	(3.07)	621.5	(3.00)	648.8	(3.73)
Ireland	328.4	(7.90)	367.1	(5.34)	432.4	(4.32)	561.9	(2.94)	612.9	(3.28)	641.0	(3.91)
France	299.9	(8.94)	348.0	(6.79)	426.1	(5.16)	576.7	(4.35)	634.4	(4.96)	664.2	(4.67)
United Kingdom	330.0	(4.03)	363.8	(3.19)	423.9	(2.98)	558.2	(2.81)	615.1	(3.18)	649.5	(3.39)
OECD	332.4	(0.94)	368.5	(0.78)	429.6	(0.64)	560.8	(0.56)	612.7	(0.61)	641.6	(0.70)
Shanghai-China	417.4	(5.69)	449.4	(4.30)	504.5	(3.38)	616.7	(2.79)	659.4	(3.03)	684.1	(3.52)
Northern Ireland	331.2	(11.50)	368.7	(9.09)	429.4	(5.69)	567.7	(4.74)	625.4	(4.95)	656.6	(5.87)

Table 3.11: Descriptions of the seven levels of proficiency on the integrate and interpret print reading subscale and percentages of students achieving each level (OECD and Ireland)

Level *(Cut-point)*	**Students at this level are capable of:**	**OECD**		**Ireland**	
		%	**SE**	**%**	**SE**
6 *(above 698)*	Making multiple inferences, comparisons and contrasts that are detailed and precise. Demonstrating a full and detailed understanding of the whole text or specific sections, integrating information from more than one text, dealing with unfamiliar abstract ideas, in the presence of prominent competing information and generating abstract categories for interpretations.	1.1	(0.04)	0.8	(0.17)
5 *(626 to 698)*	Demonstrating a full and detailed understanding of a text, interpreting the meaning of nuanced language, using high level inference to apply criteria to examples scattered throughout a text, generating categories to describe relationships between different parts of a text and dealing with ideas that are contrary to expectations.	7.2	(0.10)	6.9	(0.62)
4 *(553 to 625)*	Using text-based inferences to understand and apply categories in an unfamiliar context and to interpret the meaning of a section of text while taking into account the text as a whole. Dealing with ambiguities and ideas that are negatively worded.	20.2	(0.16)	20.9	(0.88)
3 *(480 to 552)*	Identifying the main idea of a text by integrating several parts of the text, understanding a relationship or interpreting the meaning of a word or phrase. Comparing, contrasting or categorising while taking many criteria into account. Dealing with competing information.	28.1	(0.17)	29.3	(1.12)
2 *(407 to 479)*	Indentifying the main idea of a text, understanding relationships, forming or applying simple categories or interpreting meaning within a limited part of the text when the information is not prominent and low-level inferences are required.	24.2	(0.16)	24.0	(0.87)
1a *(335 to 406)*	Recognising the author's purpose or the main theme of a text about a familiar topic, when the required information is prominent within the text.	13.6	(0.13)	12.6	(0.76)
1b *(262 to 334)*	Recognising a simple idea that is reinforced several times in the text (possibly with picture cues), or interpreting a phrase in a short text on a familiar topic.	4.6	(0.08)	4.1	(0.55)
Below Level 1b *(below 262)*	There is insufficient information on which to base a description of the reading skills of these students.	1.1	(0.04)	1.5	(0.39)

Source: OECD, 2010a, Figure I.2.22.

Table 3.11 describes some of the tasks that students at different levels of proficiency on the Integrate and Interpret subscale are likely to be able to complete. The percentages of students in Ireland below Level 2 (18.2%) and at Level 5 and above (7.7%) are similar to the corresponding average percentages across OECD countries (19.3% and 8.3%, respectively).

The percentage of lower achieving students on the Integrate and Interpret subscale in Ireland (scoring below Level 2) (18.2%) is very similar to the corresponding percentage in Northern Ireland (18.7%), and only marginally lower than in the United States (19.9%) and the whole of the United Kingdom (20.1%). On the other hand, the percentage of high achieving students (scoring at Level 5 or higher) is somewhat lower in Ireland (7.7%) than in Northern Ireland (9.8%) and the United States (10%), but is similar to the United Kingdom as a whole (8.3%) (Table 3.12).

Table 3.12: Percentage of students at each proficiency level on the integrate and interpret print reading scale in Ireland, the OECD, and selected comparison countries

	Below Level 1b		Level 1b		Level 1a		Level 2		Level 3		Level 4		Level 5		Level 6	
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Korea	0.2	(0.13)	0.9	(0.35)	4.8	(0.56)	15.7	(1.05)	31.7	(1.07)	32.4	(1.28)	12.9	(1.15)	1.4	(0.24)
Finland	0.2	(0.10)	1.3	(0.20)	6.3	(0.40)	16.8	(0.65)	29.7	(0.83)	30.0	(0.85)	13.6	(0.72)	2.2	(0.28)
New Zealand	1.0	(0.25)	3.6	(0.50)	10.9	(0.54)	20.3	(0.69)	25.2	(0.84)	23.3	(0.81)	12.5	(0.81)	3.1	(0.42)
Poland	0.5	(0.14)	3.1	(0.40)	11.5	(0.71)	24.5	(0.92)	29.9	(0.97)	22.0	(0.92)	7.5	(0.55)	1.0	(0.21)
United States	0.7	(0.22)	4.7	(0.46)	14.5	(0.80)	24.9	(0.83)	26.0	(0.78)	19.1	(0.88)	8.2	(0.73)	1.8	(0.38)
Germany	0.7	(0.24)	4.2	(0.45)	12.8	(0.77)	22.4	(0.87)	27.9	(1.18)	22.7	(1.15)	8.3	(0.69)	0.9	(0.22)
Ireland	1.5	(0.39)	4.1	(0.55)	12.6	(0.76)	24.0	(0.87)	29.3	(1.12)	20.9	(0.88)	6.9	(0.62)	0.8	(0.17)
France	2.6	(0.54)	5.8	(0.56)	12.3	(0.76)	20.4	(0.97)	25.7	(1.06)	21.6	(1.02)	9.9	(0.80)	1.8	(0.32)
United Kingdom	1.0	(0.18)	4.5	(0.44)	14.6	(0.73)	25.0	(0.76)	28.1	(0.80)	18.5	(0.71)	7.1	(0.45)	1.2	(0.19)
OECD	1.1	(0.04)	4.6	(0.08)	13.6	(0.13)	24.2	(0.16)	28.1	(0.17)	20.2	(0.16)	7.2	(0.10)	1.1	(0.04)
Shanghai-China	0.0	(0.04)	0.5	(0.15)	3.4	(0.50)	13.3	(0.75)	28.3	(1.15)	33.2	(0.90)	18.0	(0.93)	3.1	(0.40)
Northern Ireland	1.0	(0.44)	4.3	(0.94)	13.4	(1.20)	24.0	(1.45)	27.0	(1.30)	20.4	(1.28)	8.2	(0.94)	1.6	(0.30)

Reflect and Evaluate

One-quarter of print reading items in the PISA 2009 assessment were classified as Reflect and Evaluate items. Relative to other reading aspects, students in Ireland performed best on the Reflect and Evaluate print reading subscale, achieving a mean score (502.5) that is significantly above the OECD average (494.5). Nine countries (including six OECD countries) significantly outperformed Ireland on this subscale, while 13 countries (including the United States, the United Kingdom, Sweden, and Iceland) achieved a mean score that did not differ significantly from Ireland's (Table 3.13). Forty-two countries performed significantly less well than Ireland. Students in Northern Ireland achieved a mean score of 504.4 on this subscale, which is not significantly different from the mean score of students in the rest of Ireland, and is also significantly above the average across OECD countries.

Ireland is ranked 13th of the 34 OECD countries and 16th of all 65 participating countries on the Reflect and Evaluate subscale. When sampling and measurement error are taken into account, Ireland's true rank on the subscale lies between 8th and 16th among OECD countries and between 11th and 20th among all participating countries.

The score of Irish students on the Reflect and Evaluate subscale is 7 points higher than their score on the combined print reading scale. All the predominantly English speaking countries (Australia, Canada, New Zealand, the United Kingdom, and the United States) have a mean score at least 10 points higher on the Reflect and Evaluate subscale than on one or both of the other aspect subscales.

Table 3.13: Mean country scores and standard errors (SE) for the reflect and evaluate print reading subscale and position relative to the OECD and Irish means – all participating countries

	Mean	SE	SD	SE	IRL		Mean	SE	SD	SE	IRL
Shanghai-China	556.6	(2.41)	84.7	(1.64)	▲	Croatia	470.7	(3.48)	100.3	(1.98)	▼
Korea	541.9	(3.95)	85.8	(2.47)	▲	Luxembourg	470.7	(1.05)	105.5	(1.03)	▼
Hong Kong-China	539.6	(2.47)	87.0	(1.88)	▲	Slovenia	470.5	(1.18)	100.4	(0.98)	▼
Finland	535.5	(2.25)	87.2	(1.09)	▲	Slovak Republic	465.9	(2.91)	97.8	(2.14)	▼
Canada	535.2	(1.64)	91.1	(0.98)	▲	Dubai (UAE)	465.6	(1.15)	108.2	(0.94)	▼
New Zealand	530.6	(2.53)	108.4	(1.99)	▲	Lithuania	463.0	(2.50)	90.3	(1.63)	▼
Singapore	528.7	(1.11)	100.1	(1.05)	▲	Austria	462.9	(3.37)	107.4	(2.43)	▼
Australia	522.8	(2.49)	102.8	(1.41)	▲	Czech Republic	461.8	(3.12)	100.3	(1.77)	▼
Japan	520.7	(3.92)	110.6	(3.26)	▲	Chile	452.4	(3.16)	84.1	(1.78)	▼
United States	512.1	(3.96)	97.9	(1.71)	O	Russian Fed.	440.6	(3.74)	97.5	(2.27)	▼
Netherlands	510.5	(5.03)	86.3	(1.84)	O	Uruguay	435.7	(2.88)	104.1	(1.72)	▼
Belgium	505.4	(2.48)	107.6	(1.96)	O	Mexico	432.1	(1.88)	88.3	(1.24)	▼
Norway	504.9	(2.65)	92.9	(1.31)	O	Serbia	430.1	(2.62)	90.1	(1.57)	▼
United Kingdom	502.8	(2.43)	98.3	(1.24)	O	Tunisia	427.0	(3.01)	91.0	(1.91)	▼
Estonia	502.5	(2.62)	85.6	(1.68)	O	Romania	426.4	(4.49)	97.0	(2.83)	▼
Ireland	502.5	(3.14)	98.6	(1.89)		Brazil	423.7	(2.69)	92.2	(1.46)	▼
Sweden	502.1	(2.98)	99.9	(1.71)	O	Colombia	421.7	(4.25)	90.8	(2.15)	▼
Poland	497.6	(2.78)	91.2	(1.33)	O	Thailand	420.3	(2.82)	79.9	(2.11)	▼
Liechtenstein	497.6	(3.16)	87.8	(3.28)	O	Bulgaria	417.3	(7.10)	121.5	(2.61)	▼
Switzerland	497.1	(2.74)	96.4	(1.69)	O	Trinidad & Tobago	413.4	(1.34)	117.5	(1.14)	▼
Portugal	496.4	(3.31)	93.0	(1.45)	O	Indonesia	408.6	(3.84)	68.9	(1.95)	▼
Iceland	496.1	(1.37)	93.8	(1.23)	O	Jordan	407.2	(3.45)	96.9	(2.21)	▼
France	495.2	(3.43)	107.1	(2.63)	O	Argentina	402.2	(4.81)	111.4	(3.43)	▼
Denmark	493.1	(2.59)	87.5	(1.10)	▼	Montenegro	382.9	(1.87)	100.6	(1.11)	▼
Chinese Taipei	492.8	(2.81)	87.5	(1.78)	▼	Panama	377.1	(6.28)	101.1	(3.75)	▼
Latvia	492.2	(2.98)	81.7	(1.69)	▼	Albania	375.9	(4.64)	108.4	(2.29)	▼
Germany	491.0	(2.75)	97.2	(2.12)	▼	Qatar	375.7	(1.02)	123.7	(0.81)	▼
Greece	489.5	(4.90)	104.3	(3.14)	▼	Kazakhstan	372.8	(3.42)	100.8	(1.92)	▼
Hungary	488.9	(3.26)	93.3	(2.27)	▼	Peru	367.8	(4.18)	102.3	(2.47)	▼
Spain	483.4	(2.25)	94.9	(1.18)	▼	Azerbaijan	334.8	(3.76)	91.2	(2.17)	▼
Israel	482.8	(3.97)	115.3	(2.90)	▼	Kyrgyzstan	300.1	(3.98)	112.0	(2.48)	▼
Italy	481.9	(1.76)	104.7	(1.65)	▼	OECD average	494.5	(0.52)	97.3	(0.32)	
Macao-China	480.8	(0.85)	78.8	(0.74)	▼						
Turkey	472.6	(3.97)	93.8	(2.04)	▼						

	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

Note: OECD countries are in regular font, partner countries are in italics.

The highest achieving students in Ireland on the Reflect and Evaluate subscale (performing at the 95th percentile) achieved a score that was similar to that of the highest achieving students in France but was considerably lower than that of students in the United States, Finland, Northern Ireland, and the whole of the United Kingdom. The highest achieving students in Ireland, however, outperformed their counterparts in Poland, Germany, and the average across OECD countries.

As in the case of the overall print reading scale, the countries with the smallest gap between the lowest and highest achieving students on this subscale are Shanghai-China (278.0) and Korea (279.5), while France (353.0) and New Zealand (353.2) showed the largest spreads in achievement. The gap between the lowest and highest performing students in Ireland (322.3) is similar to that in Germany (318.8 points), the United States

(321.9), the United Kingdom as a whole (323.2 points) and the average across OECD countries (319.2), but is somewhat narrower than the spread of achievement in Northern Ireland (333.1) (Table 3.14).

Table 3.14: Scores of students at key percentile markers on the reflect and evaluate print reading subscale in Ireland, the OECD, and selected comparison countries

	5th		10th		25th		75th		90th		95th	
	Score	SE	Score	SE	Score	SE	Score	SE	Score	SE	Score	SE
Korea	391.7	(8.89)	428.8	(6.11)	488.5	(4.91)	601.8	(4.06)	645.7	(3.96)	671.3	(4.28)
Finland	383.6	(5.01)	419.3	(3.43)	480.5	(3.13)	597.4	(2.78)	642.5	(2.39)	667.6	(3.36)
New Zealand	343.2	(6.89)	385.2	(5.42)	457.8	(3.56)	608.7	(2.60)	665.8	(2.95)	696.4	(3.62)
Poland	340.2	(4.67)	378.8	(3.80)	439.6	(3.13)	561.6	(3.07)	610.7	(3.48)	638.8	(3.52)
United States	346.5	(5.69)	382.4	(5.09)	443.7	(4.22)	583.0	(4.81)	637.2	(5.47)	668.5	(5.81)
Germany	315.8	(7.61)	357.0	(6.13)	428.7	(4.62)	561.8	(2.77)	609.4	(2.81)	634.6	(3.45)
Ireland	330.1	(7.87)	370.9	(5.64)	439.3	(4.00)	571.9	(3.01)	623.7	(3.30)	652.4	(3.24)
France	301.0	(8.22)	349.4	(6.70)	426.7	(4.85)	572.9	(4.04)	626.9	(4.38)	654.1	(4.33)
United Kingdom	337.5	(3.67)	374.7	(3.25)	436.5	(3.03)	571.6	(3.16)	628.2	(3.32)	660.7	(3.13)
OECD	324.8	(1.11)	364.6	(0.91)	430.7	(0.71)	563.8	(0.55)	615.3	(0.60)	643.9	(0.66)
Shanghai-China	408.1	(5.85)	445.0	(4.33)	502.4	(3.27)	616.0	(2.80)	661.0	(2.87)	686.1	(3.39)
Northern Ireland	331.9	(12.71)	370.2	(9.69)	436.1	(6.51)	576.4	(3.74)	632.8	(4.22)	664.9	(5.48)

The percentage of students in Ireland who perform at Level 5 or above on the Reflect and Evaluate subscale (9.6%) is slightly higher than on average across OECD countries (8.8%), while the percentage performing below Level 2 (17.0%) is below the corresponding OECD average (19.3%) (Table 3.15).

Table 3.15: Descriptions of the seven levels of proficiency on the reflect and evaluate print reading subscale and percentages of students achieving each level (OECD and Ireland)

Level *(Cut-point)*	**Students at this level are capable of:**	**OECD**		**Ireland**	
		%	**SE**	**%**	**SE**
6 *(above 698)*	Critically evaluating or hypothesising about a complex text on an unfamiliar topic, taking into account multiple criteria or perspectives and applying sophisticated understandings from beyond the text. Generating categories for evaluating features of texts in terms of appropriateness for the audience.	1.2	(0.04)	1.1	(0.28)
5 *(626 to 698)*	Hypothesising about a text, drawing on specialised knowledge and on a deep understanding of long and complex texts that contain ideas contrary to expectations. Critically analysing and evaluating inconsistencies (potential or real) whether within a text or between the text and ideas outside of the text.	7.6	(0.10)	8.5	(0.67)
4 *(553 to 625)*	Critically evaluating or hypothesising about a text using formal or public knowledge. Showing an accurate understanding of longer or complex texts.	20.8	(0.16)	22.8	(1.01)
3 *(480 to 552)*	Making comparisons or connections, giving explanations or evaluating a feature of a text. Showing a detailed understanding of the text in relation to familiar, everyday knowledge, or drawing on less common knowledge.	28.2	(0.16)	29.2	(0.96)
2 *(407 to 479)*	Comparing or connecting outside knowledge with the text or using personal experience or attitudes to explain a feature of a text.	23.0	(0.16)	21.5	(0.80)
1a *(335 to 406)*	Making a simple connection between information in the text and common everyday knowledge.	12.8	(0.13)	11.5	(0.66)
1b *(262 to 334)*	There is insufficient information on which to base a description of the reading skills of these students.	4.9	(0.09)	4.2	(0.56)
Below Level 1b *(below 262)*	There is insufficient information on which to base a description of the reading skills of these students.	1.6	(0.05)	1.3	(0.34)

Source: OECD, 2010a, Figure I.2.25.

The percentage of students performing below Level 2 in Ireland (17.0%) is very similar to the corresponding percentage in Northern Ireland (17.4%) and in the United Kingdom as a whole (16.9%) and is marginally lower than in France (20.2%) and Germany (19.6%). Northern Ireland has slightly more students performing at or above Level 5 (11.5%) compared to the rest of Ireland (9.6%), while Poland (7.1%) has a considerably lower percentage of higher achieving students (Table 3.16).

Table 3.16: Percentage of students at each proficiency level on the reflect and evaluate print reading scale in Ireland, the OECD, and selected comparison countries

	Below Level 1b		Level 1b		Level 1a		Level 2		Level 3		Level 4		Level 5		Level 6	
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Korea	0.3	(0.12)	1.1	(0.40)	5.3	(0.70)	15.5	(1.06)	30.1	(1.35)	31.7	(1.30)	14.0	(1.10)	2.0	(0.38)
Finland	0.4	(0.09)	1.3	(0.24)	6.3	(0.56)	16.9	(0.71)	30.5	(0.91)	30.0	(0.88)	12.8	(0.73)	1.8	(0.27)
New Zealand	0.9	(0.29)	3.4	(0.45)	9.5	(0.57)	17.5	(0.61)	24.0	(0.73)	25.0	(0.74)	14.9	(0.81)	4.7	(0.47)
Poland	0.9	(0.23)	3.6	(0.38)	11.4	(0.76)	24.3	(0.94)	31.3	(0.74)	21.4	(0.86)	6.5	(0.55)	0.6	(0.17)
United States	0.5	(0.14)	3.3	(0.55)	11.1	(1.11)	22.2	(1.15)	27.4	(0.88)	23.1	(1.04)	10.2	(0.93)	2.2	(0.41)
Germany	1.5	(0.28)	5.5	(0.60)	12.6	(0.74)	22.6	(0.93)	29.3	(1.14)	22.0	(0.92)	6.0	(0.50)	0.5	(0.21)
Ireland	1.3	(0.34)	4.2	(0.56)	11.5	(0.66)	21.5	(0.80)	29.2	(0.96)	22.8	(1.01)	8.5	(0.67)	1.1	(0.28)
France	2.4	(0.47)	5.8	(0.61)	12.0	(0.87)	21.0	(1.14)	26.7	(1.02)	21.8	(1.02)	9.1	(0.82)	1.1	(0.30)
United Kingdom	0.9	(0.17)	3.8	(0.37)	12.2	(0.60)	23.5	(0.78)	28.2	(0.71)	20.9	(1.05)	8.8	(0.63)	1.8	(0.28)
OECD	1.6	(0.05)	4.9	(0.09)	12.8	(0.13)	23.0	(0.16)	28.2	(0.16)	20.8	(0.16)	7.6	(0.10)	1.2	(0.04)
Shanghai-China	0.2	(0.05)	0.6	(0.15)	4.2	(0.51)	13.2	(0.66)	27.6	(0.91)	32.9	(0.81)	17.9	(0.83)	3.4	(0.39)
Northern Ireland	1.2	(0.57)	4.2	(0.90)	12.0	(0.99)	21.9	(1.42)	27.6	(1.42)	21.6	(1.09)	9.5	(0.83)	2.0	(0.39)

Continuous Texts

Just over three-fifths of questions in the PISA 2009 pool of reading tasks are classified as relating to continuous texts. The profile of performance on the Continuous Texts subscale is very similar to that for the overall reading scale, which is not surprising considering the large percentage of all print reading questions that were classified in this subscale.

Students in Ireland achieved a mean score on the Continuous Texts subscale (496.6) that was not significantly different from the corresponding OECD average (493.8) (Table 3.17). Ireland's score is ranked 17th out of the 34 OECD countries and 20th out of all 65 participating countries and on this subscale. Allowing for sampling and measurement error, Ireland's true rank lies between 10th and 22nd among OECD member countries, and between 13th and 27th among all participating countries.

Seventeen countries, including the Netherlands and Belgium (which both significantly outperformed Ireland on the overall print reading scale) achieved mean scores that do not differ significantly from Ireland's on the Continuous Texts subscale. Ten countries, (including Korea, Finland, Canada, Japan, New Zealand, Australia, and Norway) significantly outperformed Ireland on this scale, while the remaining 37 countries performed significantly less well than Ireland.

Students in Northern Ireland performed marginally better, but not significantly so, than students in the rest of Ireland and on average across the OECD on the Continuous Texts subscale, obtaining a mean score of 498.5.

Table 3.17: Mean country scores and standard errors (SE) for the continuous texts print reading subscale and position relative to the OECD and Irish means – all participating countries

	Mean	SE	SD	SE	IRL		Mean	SE	SD	SE	IRL
Shanghai-China	564.2	(2.46)	81.8	(1.66)	▲	Czech Republic	479.2	(2.93)	92.9	(1.52)	▼
Korea	538.2	(3.47)	80.5	(2.27)	▲	*Croatia*	478.0	(2.88)	89.9	(1.69)	▼
Hong Kong-China	538.2	(2.32)	88.2	(1.68)	▲	Israel	477.0	(3.60)	111.4	(2.62)	▼
Finland	535.2	(2.28)	86.1	(1.01)	▲	Luxembourg	471.5	(1.18)	105.4	(0.99)	▼
Canada	524.2	(1.51)	94.1	(0.92)	▲	*Lithuania*	470.2	(2.45)	86.4	(1.75)	▼
Singapore	522.0	(1.08)	100.3	(1.16)	▲	Austria	470.0	(2.93)	100.0	(2.02)	▼
Japan	520.5	(3.60)	103.9	(2.85)	▲	Turkey	466.1	(3.50)	83.5	(1.62)	▼
New Zealand	518.0	(2.39)	105.8	(1.70)	▲	*Dubai (UAE)*	460.8	(1.19)	108.0	(1.06)	▼
Australia	513.0	(2.49)	102.3	(1.39)	▲	*Russian Fed*	460.6	(3.06)	88.3	(1.74)	▼
Netherlands	506.5	(5.03)	88.7	(1.66)	O	Chile	453.0	(3.15)	86.0	(1.72)	▼
Norway	505.3	(2.57)	95.3	(1.27)	▲	*Serbia*	443.8	(2.29)	82.7	(1.65)	▼
Belgium	504.3	(2.42)	102.6	(1.72)	O	*Bulgaria*	432.6	(6.84)	116.3	(2.76)	▼
Poland	502.1	(2.66)	90.1	(1.39)	O	*Uruguay*	429.0	(2.74)	102.3	(1.77)	▼
Iceland	500.6	(1.59)	99.1	(1.32)	O	Mexico	425.8	(1.96)	87.0	(1.28)	▼
United States	499.8	(3.74)	100.5	(1.64)	O	*Romania*	423.2	(4.01)	91.8	(2.40)	▼
Sweden	499.0	(2.99)	101.4	(1.55)	O	*Thailand*	423.0	(2.77)	73.4	(1.89)	▼
Switzerland	498.1	(2.48)	95.1	(1.52)	O	*Trinidad & Tobago*	417.5	(1.32)	116.8	(1.25)	▼
Estonia	497.3	(2.66)	81.2	(1.63)	O	*Jordan*	416.8	(3.24)	91.9	(2.24)	▼
Hungary	496.7	(3.29)	93.0	(2.46)	O	*Colombia*	414.9	(3.72)	87.0	(2.00)	▼
Ireland	496.6	(3.30)	98.3	(2.27)		*Brazil*	414.1	(2.79)	96.3	(1.58)	▼
Chinese Taipei	496.5	(2.58)	88.1	(1.93)	O	*Montenegro*	411.1	(1.81)	95.0	(1.26)	▼
Denmark	496.4	(2.12)	86.4	(1.01)	O	*Tunisia*	407.6	(2.85)	85.2	(1.73)	▼
Germany	495.8	(2.68)	95.4	(1.84)	O	*Indonesia*	405.3	(3.70)	68.7	(1.96)	▼
Liechtenstein	494.7	(2.95)	85.8	(3.33)	O	*Argentina*	399.8	(4.56)	110.6	(3.32)	▼
France	491.9	(3.53)	109.0	(2.76)	O	*Kazakhstan*	398.7	(3.13)	88.6	(1.53)	▼
Portugal	491.9	(3.17)	89.6	(1.51)	O	*Albania*	392.2	(4.15)	102.2	(1.99)	▼
United Kingdom	491.6	(2.41)	97.7	(1.21)	O	*Qatar*	375.2	(0.86)	118.7	(0.80)	▼
Italy	488.9	(1.60)	97.2	(1.34)	▼	*Peru*	374.1	(3.86)	100.1	(2.39)	▼
Macao-China	487.9	(0.91)	80.4	(0.69)	▼	*Panama*	373.4	(6.70)	101.3	(3.65)	▼
Greece	486.5	(4.34)	98.6	(2.29)	O	*Azerbaijan*	361.6	(3.25)	76.3	(1.78)	▼
Spain	484.5	(2.11)	90.9	(1.12)	▼	*Kyrgyzstan*	318.7	(3.15)	100.4	(2.01)	▼
Slovenia	484.1	(1.12)	94.5	(0.90)	▼	OECD average	493.8	(0.49)	95.1	(0.30)	
Latvia	483.8	(2.99)	79.7	(1.63)	▼						
Slovak Republic	479.2	(2.60)	90.6	(1.85)	▼						

	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

Note: OECD countries are in regular font, partner countries are in italics.

Students in Ireland performing at the 95th percentile on the Continuous Texts subscale achieved a score of 645, which is not significantly different to the OECD average (Table 3.18). Not surprisingly, the corresponding scores in Northern Ireland, Poland, Germany, France, and the United Kingdom as a whole (countries/economies that achieved similar mean scores to Ireland on the continuous texts subscale) do not differ substantially from Ireland. On the other hand, the performance of the lowest achieving students in Ireland (those performing at the 5th percentile) is considerably above that of the lowest achieving students in France, but is below that of the corresponding students in Poland. However, the score of Ireland's lowest achieving students does not differ significantly from the corresponding scores in Germany, the United States, New Zealand, Northern Ireland, the United Kingdom as a whole, or the OECD average.

The gap between students at the 5th and 95th percentiles on the Continuous Texts subscale in Ireland (320.8) is similar to that for the United Kingdom (320.4 pints) and Northern Ireland (328.2), but is slightly larger than the OECD average (311.3). As with the overall print reading scale, France (357.5) and New Zealand (343.5) have the

widest gaps in performance between low and high achieving students on this subscale, while Shanghai-China (266.9) and Korea (262.6) have the narrowest.

Table 3.18: Scores of students at key percentile markers on the continuous texts print reading subscale in Ireland, the OECD, and selected comparison countries

	5th		10th		25th		75th		90th		95th	
	Score	SE	Score	SE	Score	SE	Score	SE	Score	SE	Score	SE
Korea	395.2	(7.38)	430.5	(6.07)	489.1	(3.91)	594.9	(3.37)	635.2	(3.46)	657.7	(3.89)
Finland	383.5	(5.22)	419.2	(3.67)	479.9	(2.75)	596.8	(2.33)	641.0	(2.30)	665.2	(2.87)
New Zealand	336.4	(5.86)	376.5	(4.63)	446.6	(3.27)	594.1	(2.59)	650.0	(3.17)	679.9	(3.45)
Poland	348.8	(4.56)	383.7	(3.59)	442.4	(3.50)	566.2	(3.00)	615.2	(3.55)	643.2	(3.54)
United States	333.9	(4.12)	367.9	(4.76)	429.6	(4.04)	571.0	(4.55)	631.5	(5.83)	664.2	(5.17)
Germany	328.6	(5.47)	365.6	(5.15)	431.3	(4.17)	566.0	(2.88)	613.0	(2.94)	640.6	(3.11)
Ireland	324.1	(7.77)	368.0	(6.16)	435.2	(4.08)	565.2	(3.48)	616.3	(4.02)	645.0	(3.59)
France	297.0	(8.65)	343.9	(7.02)	421.6	(4.96)	571.4	(4.27)	625.4	(4.21)	654.3	(4.73)
United Kingdom	328.7	(4.13)	364.8	(3.18)	425.3	(3.42)	560.0	(3.10)	617.0	(2.99)	649.2	(4.10)
OECD	329.6	(0.97)	367.0	(0.85)	430.5	(0.66)	561.7	(0.53)	612.8	(0.59)	640.9	(0.65)
Shanghai-China	421.7	(5.59)	456.4	(4.70)	510.5	(3.54)	622.8	(2.93)	665.2	(2.80)	688.6	(2.98)
Northern Ireland	329.2	(12.42)	368.9	(10.03)	430.8	(6.05)	569.8	(3.72)	626.2	(4.94)	657.5	(5.20)

The percentage of high achieving students (at or above proficiency Level 5) in Ireland is identical to the average across OECD countries (both 8.2%). On the other hand, the percentage of lower achieving students (below Level 2) in Ireland (17.8%) is slightly lower than the corresponding OECD average (19.1%) (Table 3.19).

Table 3.19: Descriptions of the seven levels of proficiency on the continuous texts print reading subscale and percentages of students achieving each level (OECD and Ireland)

Level *(Cut-point)*	**Students at this level are capable of:**	**OECD**		**Ireland**	
		%	**SE**	**%**	**SE**
6 *(above 698)*	Negotiating single or multiple texts that may be long, dense or deal with highly abstract and implicit meanings. Relating information in texts to multiple, complex or counterintuitive ideas.	1.0	(0.04)	0.8	(0.24)
5 *(626 to 698)*	Negotiating texts whose discourse structure is not obvious in order to discern the relationship of specific parts of the text to the implicit theme or intention.	7.2	(0.10)	7.4	(0.76)
4 *(553 to 625)*	Following linguistic or thematic links over several paragraphs, often in the absence of clear discourse markers in order to locate, interpret or evaluate embedded information.	20.6	(0.16)	21.6	(1.03)
3 *(480 to 552)*	Using conventions of text organisation, where present, and following implicit or explicit logical links such as cause and effect relationships across sentences or paragraphs in order to locate, interpret or evaluate information.	28.4	(0.16)	29.8	(0.88)
2 *(407 to 479)*	Following logical and linguistic connections within a paragraph in order to locate or interpret information, or synthesising information across texts or parts of a text in order to infer the author's purpose.	23.7	(0.16)	22.6	(0.89)
1a *(335 to 406)*	Using redundancy, paragraph heading or common print conventions to identify the main idea of the text, or to locate information stated explicitly within a short section of text.	13.1	(0.13)	11.8	(0.68)
1b *(262 to 334)*	Recognising information in short, syntactically simple texts that have a familiar context and text type, and include ideas that are reinforced by pictures or by repeated verbal cues.	4.7	(0.14)	4.2	(0.49)
Below Level 1b *(below 262)*	There is insufficient information on which to base a description of the reading skills of these students.	1.3	(0.05)	1.8	(0.40)

Source: OECD, 2010a, Figure I.2.31.

The percentage of students performing below Level 2 in Ireland (17.8%) is very similar to the corresponding percentages in Northern Ireland (18.2%), Germany (18.5%), and the United States (18.7%). New Zealand (15.6%) has slightly fewer low achieving students than Ireland, but almost twice as many high achieving (at or above Level 5) students (15.8% and 8.2%, respectively). The percentage of students at or above Level 5 in Northern Ireland (10.1%) is similar to the rest of Ireland (Table 3.20).

Table 3.20: Percentage of students at each proficiency level on the continuous texts print reading subscale in Ireland, the OECD, and selected comparison countries

	Below Level 1b		Level 1b		Level 1a		Level 2		Level 3		Level 4		Level 5		Level 6	
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Korea	0.3	(0.14)	1.0	(0.28)	5.1	(0.65)	15.5	(0.96)	32.5	(1.20)	32.7	(1.23)	11.9	(0.98)	1.0	(0.23)
Finland	0.2	(0.07)	1.5	(0.23)	6.4	(0.51)	17.0	(0.94)	30.2	(0.75)	30.2	(0.82)	13.1	(0.70)	1.4	(0.24)
New Zealand	1.2	(0.25)	3.7	(0.42)	10.7	(0.60)	19.4	(0.83)	25.4	(0.77)	23.8	(0.82)	12.8	(0.68)	3.0	(0.36)
Poland	0.7	(0.23)	3.0	(0.39)	11.1	(0.61)	24.4	(0.88)	30.9	(0.84)	22.0	(0.98)	7.2	(0.61)	0.8	(0.16)
United States	0.8	(0.16)	4.3	(0.45)	13.6	(0.84)	23.7	(0.90)	26.5	(0.82)	20.0	(0.86)	9.1	(0.94)	1.9	(0.33)
Germany	0.9	(0.25)	4.7	(0.45)	12.9	(0.75)	22.9	(1.27)	28.4	(1.21)	22.8	(0.89)	6.7	(0.51)	0.6	(0.17)
Ireland	1.8	(0.40)	4.2	(0.49)	11.8	(0.68)	22.6	(0.89)	29.8	(0.88)	21.6	(1.03)	7.4	(0.76)	0.8	(0.24)
France	2.7	(0.50)	6.2	(0.63)	12.5	(0.89)	21.4	(1.21)	25.9	(1.10)	21.4	(0.97)	8.5	(0.77)	1.4	(0.36)
United Kingdom	1.1	(0.22)	4.5	(0.44)	14.2	(0.67)	25.0	(0.76)	27.9	(0.74)	18.9	(0.86)	7.2	(0.48)	1.2	(0.22)
OECD	1.3	(0.05)	4.7	(0.08)	13.1	(0.13)	23.7	(0.16)	28.4	(0.16)	20.6	(0.16)	7.2	(0.10)	1.0	(0.04)
Shanghai-China	0.1	(0.05)	0.5	(0.14)	3.1	(0.42)	11.9	(0.73)	26.5	(1.08)	34.2	(0.98)	20.1	(1.00)	3.6	(0.36)
Northern Ireland	1.0	(0.47)	4.6	(0.94)	12.6	(1.29)	24.2	(1.22)	26.5	(1.44)	21.0	(1.11)	8.4	(0.80)	1.7	(0.29)

Non-Continuous Texts

Nearly 40% of the PISA 2009 reading tasks assess students' proficiency in reading non-continuous texts. Students in Ireland achieved a mean score of 496.3 on the Non-Continuous Texts subscale (Table 3.21) which is very similar to their score on the combined print reading scale.

The mean score of students in Ireland on the Non-Continuous Texts subscale does not differ significantly from the average score on this scale across OECD countries (493.0). Ireland's score is ranked 18th of 34 OECD countries, and 23rd of 65 participating countries. Taking sampling and measurement error into account, Ireland's true rank lies between 12th and 20th among OECD countries, and between 17th and 26th among all participating countries. Students in Northern Ireland achieved a mean score of 505.7, which does not differ significantly from the mean score of students in the rest of Ireland or the OECD average.

Fifteen countries, including the United Kingdom, Switzerland and Estonia (which had mean overall print reading scores not significantly different from Ireland's) obtained mean scores that are significantly above the mean score for Ireland on the Non-Continuous Texts subscale, while ten countries (nine of which are OECD member countries) had mean scores that do not differ significantly from Ireland's. The remaining 39 countries performed significantly less well than Ireland on the Non-Continuous Texts subscale.

Table 3.21: Mean country scores and standard errors (SE) for the non-continuous texts print reading subscale and position relative to the OECD and Irish means – all participating countries

	Mean	SE	SD	SE	IRL		Mean	SE	SD	SE	IRL
Korea	542.4	(3.58)	82.2	(2.38)	▲	Greece	471.9	(4.25)	94.8	(2.65)	▼
Shanghai-China	539.4	(2.43)	84.2	(1.69)	▲	*Croatia*	471.9	(3.04)	90.1	(1.93)	▼
Singapore	538.7	(1.10)	94.6	(1.16)	▲	Luxembourg	471.6	(1.15)	102.7	(1.04)	▼
Finland	534.7	(2.45)	89.1	(1.05)	▲	Slovak Republic	471.4	(2.79)	92.1	(2.39)	▼
New Zealand	532.2	(2.34)	103.8	(1.69)	▲	Israel	467.0	(3.91)	119.7	(2.92)	▼
Canada	527.3	(1.62)	92.1	(0.92)	▲	*Lithuania*	462.3	(2.55)	90.7	(1.94)	▼
Australia	524.4	(2.34)	99.0	(1.40)	▲	Turkey	461.0	(3.79)	86.0	(1.95)	▼
Hong Kong-China	522.4	(2.25)	84.7	(1.52)	▲	*Dubai (UAE)*	459.6	(1.35)	111.5	(0.95)	▼
Japan	517.6	(3.50)	99.4	(3.00)	▲	*Russian Fed.*	452.3	(3.89)	98.5	(2.23)	▼
Netherlands	514.5	(5.07)	91.1	(1.86)	▲	Chile	443.5	(3.17)	85.3	(1.92)	▼
Estonia	511.9	(2.75)	90.7	(1.96)	▲	*Serbia*	437.6	(2.93)	94.5	(1.77)	▼
Belgium	511.0	(2.24)	104.9	(1.69)	▲	Mexico	424.5	(1.99)	86.8	(1.18)	▼
Liechtenstein	505.8	(3.16)	86.0	(3.81)	▲	*Romania*	424.4	(4.49)	95.8	(2.67)	▼
United Kingdom	505.6	(2.35)	98.8	(1.39)	▲	*Thailand*	422.9	(2.69)	74.9	(1.93)	▼
Switzerland	505.1	(2.51)	93.6	(1.44)	▲	*Bulgaria*	421.3	(7.20)	123.0	(2.95)	▼
United States	502.8	(3.51)	94.5	(1.35)	O	*Uruguay*	421.0	(2.74)	104.5	(1.86)	▼
Chinese Taipei	500.3	(2.84)	93.5	(1.87)	O	*Trinidad & Tobago*	416.7	(1.43)	113.9	(1.27)	▼
Iceland	498.9	(1.47)	95.9	(1.36)	O	*Colombia*	408.9	(4.08)	94.7	(2.29)	▼
France	498.4	(3.40)	102.8	(2.81)	O	*Brazil*	408.3	(2.81)	96.7	(1.56)	▼
Sweden	497.8	(2.82)	97.4	(1.71)	O	*Indonesia*	398.7	(4.48)	79.6	(2.31)	▼
Norway	497.5	(2.62)	88.8	(1.42)	O	*Montenegro*	397.7	(1.91)	99.0	(1.33)	▼
Germany	497.2	(2.84)	98.8	(1.81)	O	*Tunisia*	392.6	(3.28)	93.6	(2.23)	▼
Ireland	496.3	(3.02)	95.7	(2.23)		*Argentina*	391.2	(5.18)	115.4	(3.51)	▼
Poland	495.6	(2.76)	94.8	(1.56)	O	*Jordan*	386.9	(4.13)	114.2	(2.35)	▼
Denmark	492.5	(2.31)	84.7	(1.07)	O	*Kazakhstan*	370.7	(3.89)	113.1	(1.80)	▼
Portugal	487.8	(3.23)	89.6	(1.65)	O	*Albania*	366.4	(4.59)	108.0	(1.86)	▼
Hungary	487.1	(3.32)	91.9	(2.62)	▼	*Qatar*	361.4	(0.93)	124.1	(0.83)	▼
Latvia	486.9	(3.36)	87.9	(1.71)	▼	*Panama*	359.0	(6.49)	105.6	(3.28)	▼
Macao-China	480.6	(1.09)	75.8	(0.78)	▼	*Peru*	356.2	(4.43)	105.0	(2.41)	▼
Italy	476.4	(1.69)	102.0	(1.77)	▼	*Azerbaijan*	350.6	(4.19)	93.1	(2.11)	▼
Slovenia	476.2	(1.08)	88.4	(0.82)	▼	*Kyrgyzstan*	292.7	(3.72)	110.2	(2.25)	▼
Czech Republic	474.4	(3.37)	97.0	(2.24)	▼	OECD average	493.0	(0.50)	95.2	(0.32)	
Spain	472.5	(2.11)	94.0	(1.17)	▼						
Austria	472.3	(3.25)	106.9	(2.34)	▼						

	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

Note: OECD countries are in regular font, partner countries are in italics.

The lowest performing students in Ireland (at the 5th percentile) achieved a score (326.9) that is the same as the average across OECD countries, but is slightly below that of students in Poland and the United Kingdom (Table 3.22). The lowest performing students in Northern Ireland achieved the same score as the lowest performing students across the whole of the United Kingdom. Students in Ireland at the 95th percentile achieved a score which is similar to the OECD average for such students; however, their mean score is 20 points lower than their counterparts in Northern Ireland.

The gap between the lowest and highest achievers in Ireland (311.4) is almost identical to the gap in the United States (310.7), Poland (311.5), and the average gap across OECD countries (311.5). As in the case of the combined print reading scale, the largest gap between low and high achievers among the comparison countries is in France (338.0) and New Zealand (335.8), while the narrowest gaps are found in Korea (267.4) and Shanghai-China (274.2).

Table 3.22: Scores of students at key percentile markers on the non-continuous texts print reading subscale in Ireland, the OECD, and selected comparison countries

	5th		10th		25th		75th		90th		95th	
	Score	SE	Score	SE	Score	SE	Score	SE	Score	SE	Score	SE
Korea	398.8	(6.46)	435.7	(6.15)	491.2	(4.70)	599.2	(3.56)	642.7	(3.63)	666.2	(3.89)
Finland	378.4	(4.42)	417.4	(3.80)	477.8	(2.93)	597.6	(2.97)	644.6	(2.88)	670.1	(2.90)
New Zealand	354.3	(5.58)	394.3	(4.13)	462.4	(3.49)	607.0	(2.98)	661.6	(3.22)	690.1	(3.74)
Poland	333.0	(6.68)	371.6	(4.00)	434.3	(3.61)	562.0	(3.15)	614.2	(3.84)	644.5	(3.41)
United States	343.6	(5.19)	378.8	(4.23)	437.5	(4.08)	570.1	(4.14)	624.3	(4.20)	654.3	(4.08)
Germany	319.5	(6.24)	361.2	(4.68)	432.0	(4.52)	570.2	(3.26)	617.6	(2.64)	642.7	(3.22)
Ireland	326.9	(8.11)	371.6	(5.92)	438.3	(4.13)	563.3	(3.04)	611.2	(3.63)	638.3	(4.47)
France	311.2	(9.71)	359.8	(7.26)	435.1	(5.22)	572.2	(3.80)	621.3	(3.97)	649.2	(5.05)
United Kingdom	339.1	(3.66)	379.0	(3.04)	439.9	(2.86)	574.1	(3.05)	630.3	(3.77)	662.6	(4.96)
OECD	327.2	(1.10)	366.9	(0.87)	431.3	(0.68)	560.4	(0.54)	610.6	(0.60)	638.7	(0.69)
Shanghai-China	394.1	(6.23)	429.2	(4.58)	486.2	(2.98)	598.2	(2.33)	642.6	(3.40)	668.3	(3.62)
Northern Ireland	339.5	(14.16)	379.7	(9.19)	440.9	(6.66)	573.4	(3.48)	627.2	(3.83)	658.2	(4.59)

Table 3.23 describes the types of skills that students at each proficiency level of the Non-Continuous Texts subscale are capable of. The percentage of high performing students (at or above Level 5) in Ireland (7.1%) is slightly below the average proportion of such students across OECD countries (8.0%). Similarly, Ireland has somewhat fewer lower performing students (below Level 2) (17.0%) than on average across OECD countries (19.1%).

Table 3.23: Descriptions of the seven levels of proficiency on the non-continuous texts print reading subscale and percentages of students achieving each level (OECD and Ireland)

Level *(Cut-point)*	**Students at this level are capable of:**	**OECD**		**Ireland**	
		%	**SE**	**%**	**SE**
6 *(above 698)*	Indentifying and combining information from different parts of a complex document that has unfamiliar content, sometimes drawing on features of that are external to the display, such as footnotes, labels and other organisers. Demonstrating a full understanding of the text structure and its implications.	1.0	(0.04)	0.6	(0.19)
5 *(626 to 698)*	Indentifying patterns among many pieces of information presented in a display that may be long and detailed, sometimes by referring to information that is in an unexpected place in the text or outside the text.	7.0	(0.10)	6.5	(0.53)
4 *(553 to 625)*	Finding relevant information by scanning a long, detailed text, often with no assistance from organisers such as labels or special formatting, to locate several pieces of information to be compared or combined.	20.5	(0.15)	22.0	(0.97)
3 *(480 to 552)*	Judging one display in relation to a second document or display, possibly in a different format, or drawing conclusions by combining several pieces of graphical, verbal and numeric information.	28.8	(0.16)	31.0	(1.04)
2 *(407 to 479)*	Demonstrating an understanding of the underlying structure of a visual display such as a simple tree diagram or table, or combining two pieces of information from a graph or table.	23.6	(0.16)	22.9	(1.03)
1a *(335 to 406)*	Focusing on discrete pieces of information, usually within a single display such a simple map, a line graph or a bar graph that presents a small amount of information in a straightforward way and in which most of the verbal text is limited to a small number of words or phrases.	12.8	(0.13)	11.2	(0.70)
1b *(262 to 334)*	Indentifying information in a short text with a simple list structure and a familiar format.	4.8	(0.09)	4.1	(0.49)
Below Level 1b *(below 262)*	There is insufficient information on which to base a description of the reading skills of these students.	1.5	(0.05)	1.7	(0.39)

Source: OECD, 2010a, Figure I.2.34.

Although the percentage of students performing below Level 2 in Ireland (17.0%) is similar to the corresponding percentage in Northern Ireland (15.9%) and the United Kingdom as a whole (16.3%), the percentage of high achieving students (at or above Level 5) is lower in Ireland (7.1%) than in Northern Ireland (10.4%) or the United Kingdom as a whole (10.9%) (Table 3.24).

Table 3.24: Percentage of students at each proficiency level on the non-continuous texts print reading subscale in Ireland, the OECD, and selected comparison countries

	Below Level 1b		Level 1b		Level 1a		Level 2		Level 3		Level 4		Level 5		Level 6	
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Korea	0.3	(0.17)	0.9	(0.33)	4.8	(0.67)	15.2	(1.02)	30.8	(1.14)	33.1	(1.31)	13.3	(1.10)	1.6	(0.32)
Finland	0.3	(0.10)	1.7	(0.24)	6.5	(0.45)	17.3	(0.64)	29.6	(0.75)	29.6	(0.86)	12.9	(0.78)	2.1	(0.31)
New Zealand	0.9	(0.18)	2.6	(0.32)	8.9	(0.49)	17.7	(0.73)	25.2	(0.99)	25.7	(0.84)	15.0	(0.66)	4.1	(0.37)
Poland	1.1	(0.21)	4.1	(0.49)	12.2	(0.71)	24.5	(0.83)	30.0	(0.79)	20.4	(0.84)	6.8	(0.67)	1.0	(0.22)
United States	0.5	(0.13)	3.7	(0.42)	11.9	(0.77)	24.0	(0.98)	28.6	(0.85)	21.5	(1.01)	8.5	(0.76)	1.2	(0.24)
Germany	1.4	(0.30)	5.0	(0.55)	12.2	(0.79)	21.4	(1.08)	28.6	(0.95)	23.1	(0.86)	7.4	(0.55)	0.8	(0.18)
Ireland	1.7	(0.39)	4.1	(0.49)	11.2	(0.70)	22.9	(1.03)	31.0	(1.04)	22.0	(0.97)	6.5	(0.53)	0.6	(0.19)
France	2.1	(0.41)	5.0	(0.57)	11.3	(0.80)	21.1	(1.06)	28.4	(1.18)	23.1	(1.21)	8.0	(0.75)	1.1	(0.25)
United Kingdom	1.1	(0.17)	3.5	(0.35)	11.7	(0.65)	22.5	(0.65)	28.6	(0.76)	21.8	(0.79)	9.0	(0.58)	1.9	(0.26)
OECD	1.5	(0.05)	4.8	(0.09)	12.8	(0.13)	23.6	(0.16)	28.8	(0.16)	20.5	(0.15)	7.0	(0.10)	1.0	(0.04)
Shanghai-China	0.2	(0.08)	1.2	(0.28)	5.2	(0.48)	16.2	(0.72)	31.2	(0.94)	31.4	(1.22)	12.8	(0.70)	1.9	(0.33)
Northern Ireland	1.1	(0.62)	3.5	(0.71)	11.3	(1.05)	22.2	(1.21)	28.9	(1.41)	22.6	(1.15)	8.6	(0.91)	1.8	(0.47)

Gender Differences on Print Reading

Female students significantly outperformed male students in all countries on the overall print reading scale; however, the gap is much wider in some countries than in others. In Ireland, the gender difference (39 points) is similar to that in Shanghai-China, Germany, France, and the average across OECD countries (Table 3.25).

Table 3.25: Gender differences on the overall print reading scale in Ireland, the OECD, and selected comparison countries

	Males		Females		Difference (males-females)	
	Mean	SE	Mean	SE	Score diff	SE
Korea	522.5	(4.87)	558.0	(3.84)	**-35.5**	(5.91)
Finland	508.4	(2.58)	563.5	(2.39)	**-55.1**	(2.31)
New Zealand	498.5	(3.62)	544.2	(2.63)	**-45.7**	(4.27)
Poland	475.7	(2.77)	525.3	(2.89)	**-49.7**	(2.51)
United States	487.8	(4.24)	512.5	(3.77)	**-24.7**	(3.35)
Germany	477.9	(3.64)	517.6	(2.93)	**-39.7**	(3.91)
Ireland	476.3	(4.23)	515.5	(3.15)	**-39.2**	(4.73)
France	475.0	(4.30)	515.2	(3.44)	**-40.1**	(3.73)
United Kingdom	481.4	(3.49)	506.5	(2.89)	**-25.1**	(4.50)
OECD	474.1	(0.61)	513.2	(0.52)	**-39.1**	(0.63)
Shanghai-China	535.7	(3.04)	575.6	(2.28)	**-39.8**	(2.90)
Northern Ireland	484.6	(7.85)	513.3	(3.84)	**-28.7**	(9.42)

Of the comparison countries in Table 3.25, Finland has the largest gender gap in performance on the overall print reading scale, with males performing 55 points lower than their female counterparts. Both the United Kingdom and the United States had smaller gender differences (both 25 points) than Ireland. The mean scores of both male and female students in Ireland are very similar to the corresponding average scores across OECD countries.

In Ireland, female students performed significantly better than males on each of the print reading subscales (Table 3.26). The gender difference for each subscale is similar to the corresponding difference across OECD countries, with the exception of Reflect and Evaluate, for which the difference in Ireland is a little smaller. The highest gender difference in Ireland is on the Access and Retrieve subscale, and the smallest is on the Integrate and Interpret subscale.

Table 3.26: Mean scores of males and females and gender differences on print reading subscales – Ireland and the OECD

	Ireland						OECD					
	Males		Females		IRL diff		Males		Females		OECD diff	
	Mean	SE	Mean	SE	M-F	SE	Mean	SE	Mean	SE	M-F	SE
Access and Retrieve	476.1	(4.45)	520.6	(3.42)	**-44.5**	(4.63)	475.2	(0.67)	514.9	(0.57)	**-39.7**	(0.68)
Integrate and Interpret	475.8	(4.42)	512.4	(3.11)	**-36.6**	(4.85)	475.6	(0.62)	511.6	(0.54)	**-36.0**	(0.65)
Reflect and Evaluate	483.5	(4.23)	521.9	(3.45)	**-38.4**	(4.72)	472.5	(0.65)	516.9	(0.56)	**-44.4**	(0.67)
Continuous	476.4	(4.45)	517.4	(3.57)	**-41.0**	(4.94)	473.2	(0.62)	514.8	(0.54)	**-41.6**	(0.64)
Non-continuous	477.2	(4.28)	515.9	(3.08)	**-38.6**	(4.58)	475.0	(0.64)	511.3	(0.54)	**-36.3**	(0.65)

Almost a quarter (23.2%) of male students in Ireland obtained a mean score on the overall print reading scale that is below proficiency Level 2. The percentage of low achieving males (below Level 2) in Ireland is twice the percentage of low achieving female students (11.3%). On the other hand, the percentage of female students in Ireland who are highly skilled readers (Level 5 and above) (9.6%) is over twice that of male students (4.5%). The percentages of high and low achieving males and females in Ireland are marginally lower than, but not significantly different from, the corresponding average percentages across OECD countries (Table 3.27).

Table 3.27: Percentages of male and female students achieving each proficiency level on the overall print reading scale – Ireland and the OECD

	Ireland				OECD			
Level	Males		Females		Males		Females	
	%	SE	%	SE	%	SE	%	SE
Level 6	0.4	(0.2)	1.0	(0.4)	0.5	(0.1)	1.2	(0.1)
Level 5	4.1	(0.7)	8.6	(1.9)	4.8	(0.1)	8.8	(0.2)
Level 4	17.8	(1.6)	26.2	(1.3)	16.8	(0.2)	24.7	(0.2)
Level 3	29.5	(1.3)	31.7	(1.1)	27.0	(0.2)	30.9	(0.2)
Level 2	25.0	(1.6)	21.4	(1.4)	26.0	(0.2)	21.9	(0.2)
Level 1a	15.0	(1.3)	8.6	(0.8)	16.6	(0.2)	9.5	(0.2)
Level 1b	5.7	(0.7)	2.1	(0.5)	6.6	(0.1)	2.6	(0.1)
Below Level 1b	2.5	(0.6)	0.6	(0.2)	1.8	(0.1)	0.5	(0.1)

Changes in Print Reading Achievement Since 2000

Reading was the main focus of PISA in 2009, the second time that it has been assessed as a major domain since 2000. Thus, 2009 offers the first opportunity to compare in detail changes in reading across PISA cycles. Twenty-six reading items administered in 2009 (out of a total pool of 130) had appeared in all previous PISA cycles. The results between 2000 and 2009 can only be compared for 38 countries, 26 of which are OECD member states that have valid data for both cycles[10]. Comparisons are only possible for overall reading performance since there is an insufficient number of items to allow comparisons to be made on the reading subscales.

When findings that compared reading performance in PISA 2000 and PISA 2009 first appeared in Ireland, they resulted in considerable media commentary, and were the subject of a Joint Oireachtas Committee debate. This section documents the changes in performance in reading on the basis of the published achievement data (OECD, 2010e). However, it is generally acknowledged that the measurement of change is one of the most complex areas in international assessments. Chapter 9 considers the matter in greater detail in the context of PISA's implementation, demographic, and curricular changes, students' engagement on the PISA test, and PISA's methods for linking and scaling achievement data.

Changes in Overall Reading Performance

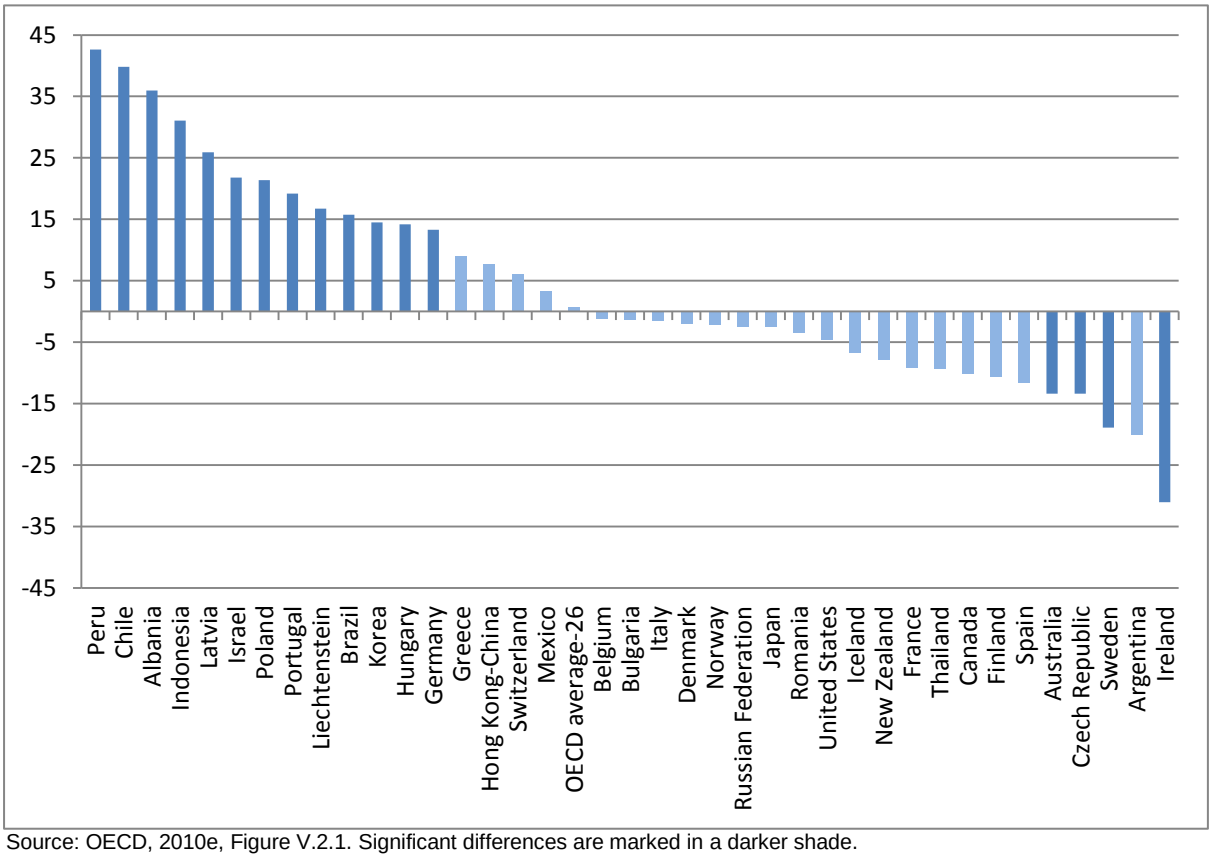
Figure 3.1 presents the changes in the mean print reading scores of the countries that have valid data for both 2000 and 2009 (the darker bars represent significant changes in achievement while the lighter bars indicate that the change was not significant). It is important to note that between 2000 and 2003, Ireland's average performance in reading declined by 11 score points which was deemed to be statistically significant in the international report on PISA 2003 (OECD, 2004a), but was deemed not significant in the international report on PISA 2006 (OECD, 2007). Since 2000, Ireland's performance in reading dropped 31 points, which is the largest drop across all 38 countries that have valid data for both cycles. Ireland is one of three countries (along with Sweden and France) that achieved a mean score above the OECD average in 2000 and a mean score that is not significantly different from the OECD average in 2009. Other countries that experienced significant declines in reading were Sweden (-19 points), Australia (-13 points) and the Czech Republic (-13 points). The Czech Republic obtained a mean score that was not significantly different from the OECD average in 2000 but is now performing significantly below the OECD average. Although the decrease in Australia's reading score is significant, Australia is still performing significantly above the OECD average.

[10] Australia, 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 analyses of changes in achievement. 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. Due to student boycotts, the Austrian data for 2009 were considered not to be comparable to those from previous assessments.

Thirteen countries had significant increases in their print reading scores between 2000 and 2009, including Peru (43 points), Chile (40 points), Poland (21 points), Portugal (19 points) and Germany (13 points). Despite experiencing large increases in their scores, students in Peru are still performing over 120 points below the OECD average. Both Portugal and Germany saw their reading scores increase from below the OECD average in 2000 to at the OECD average in 2009, while performance in Poland has moved from below the OECD average in 2000 to above the OECD average in 2009.

The average reading score across the 26 OECD countries that have valid data for both 2000 and 2009 has remained stable since 2000 (495.7 in 2000; 496.4 in 2009).

Figure 3.1: Changes in average reading scores between 2000 and 2009 – countries participating in both years, and OECD average



Source: OECD, 2010e, Figure V.2.1. Significant differences are marked in a darker shade.

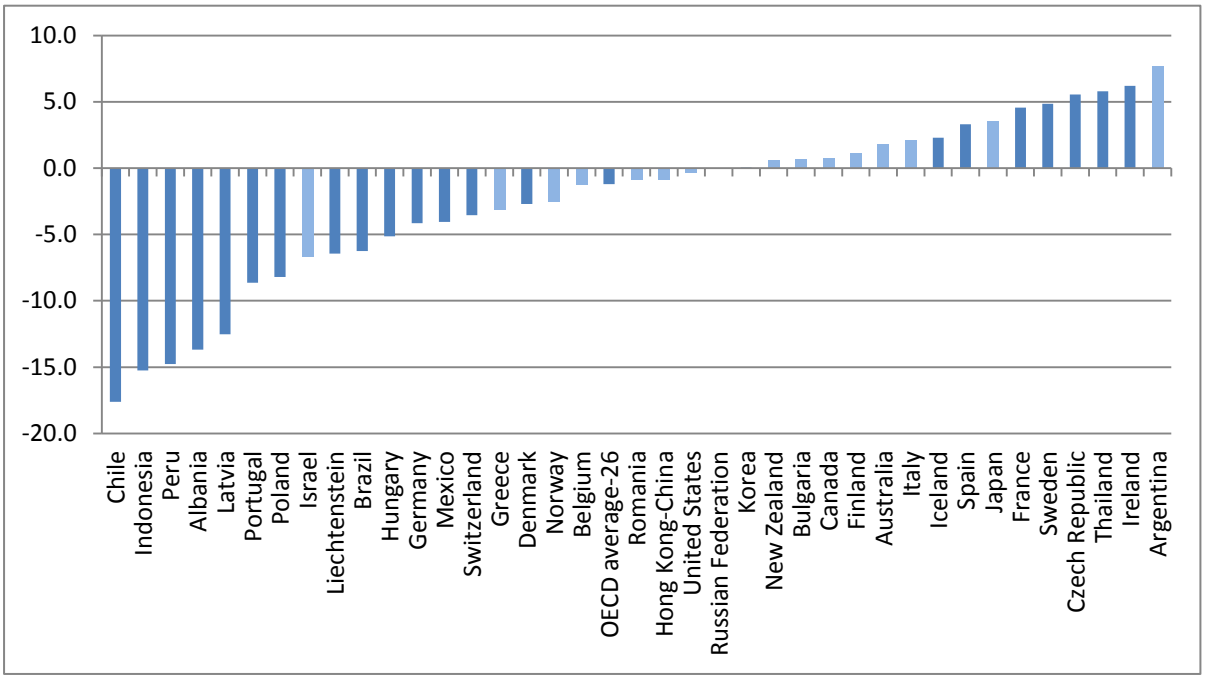
Changes in Performance Among Low and High Achieving Students

There has been a slight decrease (from 18.1% to 19.3%) in the percentage of low achieving students (below Level 2) across the 26 OECD countries that have valid data for the print reading assessment in both 2000 and 2009 (Figure 3.2). In Ireland, the percentage of students achieving a score below Level 2 increased significantly from 11.0% in 2000 to 17.2% in 2009, with the result that the percentage of such students in Ireland, which was well below the OECD average in 2000, was not significantly different from it in 2009.

The percentage of students below Level 2 also increased significantly in the Czech Republic (by 5.6 percentage points), Sweden (4.9 percentage points), France (4.6 percentage points), Spain (3.3 percentage points), and Iceland (2.3 percentage points). The percentages of low achieving students in Iceland and Sweden are still below the

OECD average; however the percentages of such students in France, Spain, and the Czech Republic are now above the OECD average.

Figure 3.2: Changes in the percentage of students below proficiency Level 2 in reading between 2000 and 2009 – countries participating in both years, and OECD average

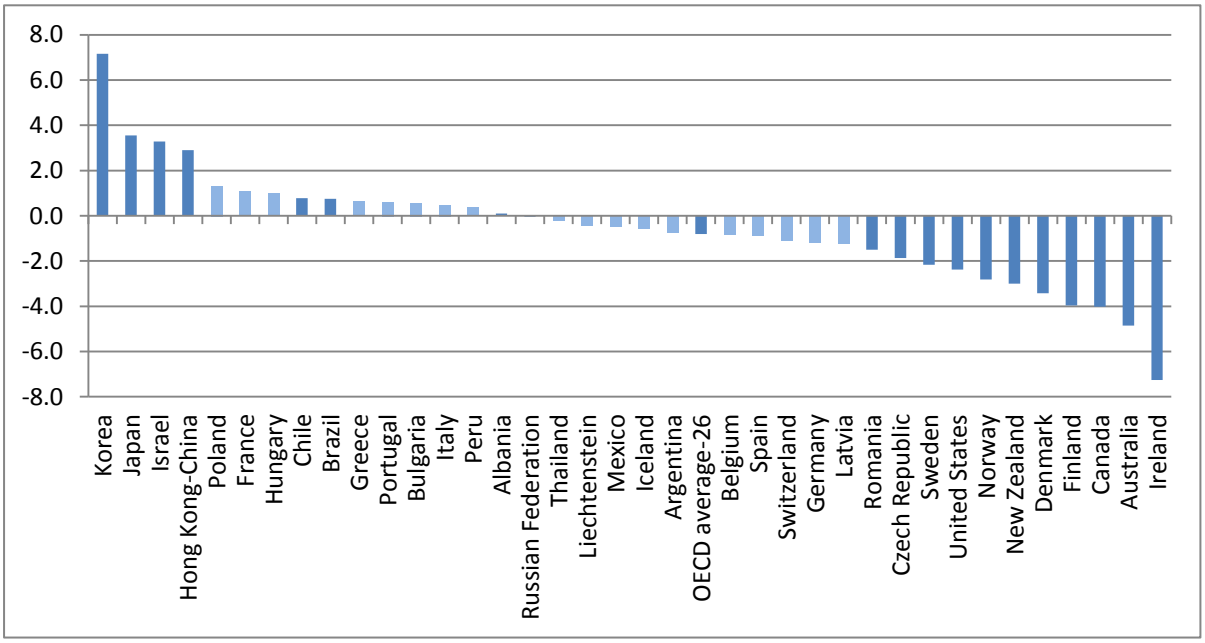


Source: OECD, 2010e, Figure V.2.4. Significant differences are marked in a darker shade.

There has been a very slight decrease in the percentage of high achieving students (at or above Level 5) across the 26 OECD countries that have comparable data for both cycles (from 9.0% in 2000 to 8.2% in 2009) (Figure 3.3). Many countries that had above-average percentages of high achievers in 2000 saw a decrease in 2009, the most noticeable being Ireland, where the percentage of students performing at Level 5 or above halved (from 14.2% to 7.0%). Ireland now has fewer high performing students than the average across 26 OECD countries. Other countries, including Australia, Canada, Finland, and New Zealand also saw decreases in the percentages of students performing at Levels 5 and 6; however, the percentage of high performers in each of these countries is still above the average across the 26 OECD countries with comparable data.

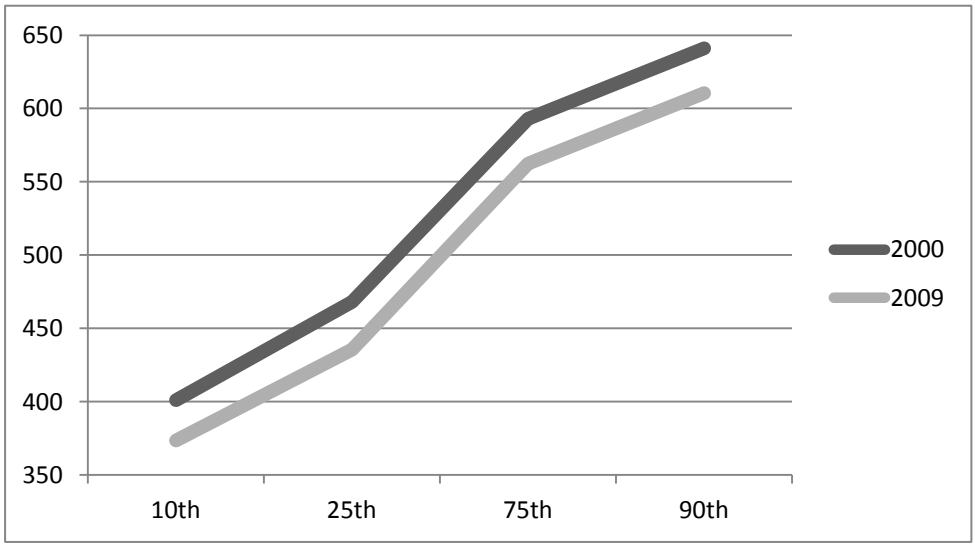
Trends in student achievement can also be described in terms of changes in the performance at key percentile points. On average across the OECD countries that have valid data for both cycles, there was very little change in the scores of students at these percentiles between 2000 and 2009. However, the performance of students in Ireland dropped uniformly across key percentile markers between 2000 and 2009 (Figure 3.4).

Figure 3.3: Changes in the percentage of students at or above proficiency Level 5 in reading between 2000 and 2009 – countries participating in both years, and OECD average



Source: OECD, 2010e, Figure V.2.5. Significant differences are marked in a darker shade.

Figure 3.4: Performance at key percentiles on the overall print reading scale – Ireland, 2000 and 2009



Changes in the Performance of Male and Female Students

On average across the 26 OECD countries that can be compared for both cycles, the achievement gap in the print reading assessment between boys and girls widened somewhat (by 7 points) since 2000. In fact, the gender gap did not narrow significantly in any of the 38 countries that have valid data for both cycles. In Ireland girls' performance advantage increased from 29 to 39 points 2000 and 2009, although this increase is not statistically significant. The difference between male and female students in Ireland is now the same as the average difference across OECD countries (39 points).

The average reading scores of both male and female students in Ireland dropped significantly between 2000 and 2009, although the drop was greater for male students (37 points) than for female students (26 points). This pattern differs from that in other

countries. On average across the OECD, while the performance of male students dropped by 4 points, the performance of female students improved by 3 points.

Across the 26 OECD countries that have valid data for both cycles, the percentage of girls performing below Level 2 decreased by two points between 2000 and 2009, while the corresponding percentage of boys did not change. The percentage of low performing males (below Level 2) in Ireland increased significantly (by 9.6 percentage points), while the percentage of low achieving females increased by just 3 percentage points (an increase that is not statistically significant). Iceland and the Czech Republic also saw significant increases in the proportion of lower performing males (by 3.8 and 7.2 percentage points, respectively), while the percentage of lower performing females in these countries remained relatively stable (with increases of 1.9 and 2.8 percentage points, respectively).

There were significant decreases in the percentages of high performing (Level 5 and above) males and females in Ireland between 2000 and 2009. The decrease in the percentage of high performing females was somewhat larger (7.9 percentage points) than the decrease in the corresponding percentage of male students (6.7 percentage points). On average across the 26 OECD countries that can be compared for 2000 and 2009, there were also small decreases in the percentages of high performing males (1.1%) and females (0.5%) since 2000, although the decrease was only significant for males. In New Zealand, only the percentage of top performing girls decreased significantly (4.3 percentage points), while in the Czech Republic and Germany, only the percentages of top performing boys decreased significantly (2.6 and 2.3 percentage points, respectively).

Chapter Summary and Conclusions

Table 3.28 presents a summary of the results presented in this chapter for mean scale scores, percentages of low and high performing students, the spread of achievement, and gender differences, for Ireland and on average across the OECD.

Ireland's mean score of 496 on the overall print reading scale in PISA 2009 is 31 points lower than its mean score in 2000, representing the largest decline among the 38 countries that have comparative data for 2000 and 2009. In 2000, Ireland's mean reading score (527) was significantly above the OECD average (500), while in 2009, it did not differ from the OECD average (493). Ireland's rank changed from 5th to 17th among the 38 countries that have valid data for both cycles. The level of the decline in Ireland goes right across ability levels.

In 2009, females significantly outperformed males in Ireland by 39 points on the overall print reading scale. The gender difference in Ireland increased by 11 points since 2000 and is now the same as the average difference across OECD countries. The mean scores of both male and female students in Ireland dropped significantly between 2000 and 2009, although the drop was greater for males (37 points) than for females (26 points).

Table 3.28: Summary of print reading performance in 2009 – Ireland and the OECD

Scale	Mean	% < Level 2	% Levels 5 and 6	95th-5th percentile	Gender difference
Overall					
Ireland	495.6	17.2	7.0	308.7	**39.2**
OECD	493.4	18.8	7.6	305.0	**39.1**
Access and Retrieve					
Ireland	498.1	16.5	9.5	321.6	**44.5**
OECD	494.9	19.6	8.1	330.9	**39.7**
Integrate and Interpret					
Ireland	493.8	18.2	7.7	312.6	**36.6**
OECD	493.4	19.3	8.3	309.1	**38.4**
Reflect and Evaluate					
Ireland	502.5	17.0	9.6	322.3	**38.4**
OECD	494.5	19.3	9.8	319.2	**44.4**
Continuous					
Ireland	496.6	17.8	8.2	320.8	**41.0**
OECD	493.8	19.1	8.2	311.3	**41.6**
Non-Continuous					
Ireland	496.3	17.0	7.1	311.4	**38.7**
OECD	493.0	19.0	8.0	311.5	**36.3**

Cells in grey in the first column represent means that are significantly higher than the OECD average. Gender differences marked in bold are statistically significant.

The percentage of students in Ireland who achieved a mean score below Level 2 (considered by the OECD to be the baseline level of proficiency) increased from 11% to 17% since 2000 and is now just slightly below the corresponding OECD average. This change has been much more marked among male students, who saw an increase of almost 10 percentage points, compared to an increase of three percentage points for females. On the other hand, the decrease in the percentage of students performing at Level 5 or above in Ireland was slightly greater for female students than for male students (8 percentage points for females compared to 7 percentage points for males). Ireland now has about the same percentage of top performing students (at or above Level 5) as is found on average across OECD countries (7% versus 8%).

Students in Ireland performed best on the Reflect and Evaluate subscale, achieving a mean score that is significantly above the OECD average (502 versus 495). Performance in Ireland on the other subscales does not differ significantly from corresponding OECD averages.

Chapter 4: Performance on Digital Reading and Comparisons with Print Reading

In this chapter, we provide a description of performance on the PISA 2009 assessment of digital reading literacy. Chapter 1 provided a description of the content of this assessment (and Appendix B contains examples of digital reading questions). The digital reading assessment can be regarded as a significant development in PISA, and in educational assessment more generally. It is the first time that an international assessment of digital reading has been conducted. This chapter is divided into six sections. First, overall performance is considered. Second, variation in achievement is described with reference to key benchmarks. Third, performance is described with reference to proficiency levels. Fourth, gender differences are described. Fifth, students' navigation behaviour is related to their performance. Finally, performance on print and digital reading is compared, both overall and by gender.

Nineteen countries took part in the assessment of digital reading, 16 of which were OECD countries. Averages and other benchmark statistics are based on the 16 participating OECD countries, including Ireland. It may be noted that the 19 participating countries included some of the highest performers on the print reading assessment. The 16 OECD countries had an average score of 499.0 on the print reading assessment, which is some 6 points higher than the average of all OECD countries that participated in print reading (493.4).

Overall Performance on Digital Reading

Ireland achieved a mean score of 508.9 on the digital reading scale, which is 10 points higher, and significantly above, the average of the 16 participating OECD countries (Table 4.1). Ireland ranks 7th among 16 OECD countries, and 8th among all 19 countries. Applying a 95% confidence interval (which takes sampling and measurement error into account), Ireland's rank ranges from 6th to 10th among OECD countries, and from 7th to 11th among all participating countries.

Four countries, all OECD member states (Korea, New Zealand, Australia, and Japan), had mean digital reading scores that are significantly higher than that of Ireland, while four countries (Hong Kong-China, Sweden, Iceland, and Belgium), three of them OECD member states, had mean digital scores that do not differ significantly from the mean score for Ireland. Eight OECD countries (Norway, France, Denmark, Spain, Hungary, Poland, Austria, and Chile) and two non-OECD countries (Macao-China, Colombia) had mean digital reading scores that are significantly lower than Ireland's.

Variation in Performance on Digital Reading

Table 4.1 provides an overall measure of variation in performance as represented by the standard deviation. The standard deviation for digital reading in Ireland (87.1) is slightly smaller than the OECD average (90.2), and similar in magnitude to those of Denmark (83.9) and Sweden (88.8). The standard deviation is very small, below 80, in

three Asian countries (Macao-China, Korea and Japan), while it exceeds 95 in France, Australia, New Zealand, Hungary, and Austria.

Table 4.1: Mean country scores and standard errors (SE) for the digital reading scale and positions relative to the OECD and Irish means – all participating countries

	Mean	SE	SD	SE	IRL
Korea	567.6	(3.02)	68.4	(1.93)	▲
New Zealand	537.4	(2.35)	98.7	(1.76)	▲
Australia	536.6	(2.77)	97.2	(1.66)	▲
Japan	519.1	(2.37)	76.4	(2.81)	▲
Hong Kong-China	514.8	(2.56)	82	(2.32)	O
Iceland	511.8	(1.42)	90.9	(1.13)	O
Sweden	510.3	(3.34)	88.8	(1.76)	O
Ireland	**508.9**	**(2.78)**	87.1	(1.62)	
Belgium	507.4	(2.10)	94.1	(1.67)	O
Norway	499.9	(2.82)	82.7	(1.49)	▼
France	494.2	(5.17)	95.7	(7.15)	▼
Macao-China	491.9	(0.73)	66.4	(0.80)	▼
Denmark	488.9	(2.57)	83.9	(1.33)	▼
Spain	475.4	(3.77)	94.6	(2.31)	▼
Hungary	468.3	(4.16)	102.5	(2.70)	▼
Poland	463.5	(3.08)	90.7	(1.50)	▼
Austria	458.6	(3.91)	102.6	(3.90)	▼
Chile	434.5	(3.57)	89.3	(1.92)	▼
Colombia	368.5	(3.42)	83.1	(1.88)	▼
OECD average	498.9	(0.80)	90.2	(0.67)	

	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

Note: OECD countries are in regular font, partner countries are in italics.

Table 4.2 presents the digital reading scores of students at the 5th, 10th, 25th, 75th, 90th, and 95th percentile markers (with countries sorted from high to low by overall mean scores, as in Table 4.1). As well as the results for Ireland and the OECD average, scores are also presented for four comparison countries (France, Korea, New Zealand, and Poland).[11] Figure 4.1 displays the score differences between the 95th and the 5th percentiles for Ireland, the four comparison countries, and the OECD average.

The score difference between the highest (95th percentile) and lowest (5th percentile) performing students in Ireland is 286.1 points, which is slightly lower than the average across 16 OECD countries (293.0). Ireland's scores at the 5th and 10th percentiles (357.2 and 397.7, respectively) are 15 and 18 points higher than the corresponding OECD averages (342.0 and 379.9, respectively). At the upper end of the performance difference, only 7 or 8 points separate the scores of Ireland and the OECD at the 90th and 95th percentiles. Thus, the high average digital reading achievement of students in Ireland relative to the OECD in Table 4.1 is partially attributable to the stronger performance of students in Ireland at the lower ends of the achievement distribution.

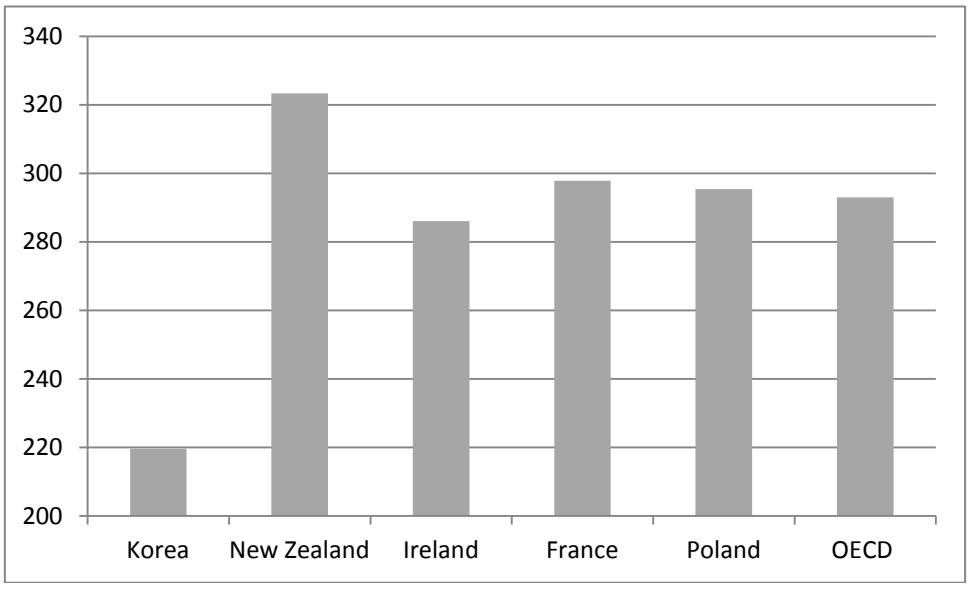
[11] These four countries represent a subset of the 10 comparison countries/economies that were included in Chapter 3. The other countries did not participate in the digital reading assessment. See also Chapter 1, Inset 1.2.

Table 4.2: Scores of students at key percentile markers on the digital reading scale in Ireland, the OECD, and selected comparison countries

	5th		10th		25th		75th		90th		95th	
	Score	SE	Score	SE	Score	SE	Score	SE	Score	SE	Score	SE
Korea	451.6	(6.24)	479.3	(5.82)	526	(3.67)	614.3	(3.39)	649.8	(4.33)	671.2	(4.84)
New Zealand	363.3	(6.71)	406.4	(4.77)	476.1	(3.55)	606.7	(2.58)	658.0	(3.04)	686.6	(3.49)
Ireland	357.2	(6.86)	397.7	(4.32)	453.2	(3.33)	570.1	(2.81)	616.2	(3.50)	643.3	(4.64)
France	328.5	(14.59)	371.2	(8.74)	439.0	(6.27)	561.0	(3.72)	603.1	(3.97)	626.3	(4.17)
Poland	305.7	(6.42)	343.0	(4.04)	404.0	(4.19)	529.2	(3.22)	577.0	(2.83)	601.1	(3.18)
OECD	342.0	(1.88)	379.9	(1.37)	442.0	(1.06)	562.4	(0.85)	608.7	(0.93)	635.0	(1.08)

Differences between scores at the 5th and 95th percentiles are similar across Ireland, France, and Poland, but considerably higher in New Zealand (323.3), and very low in Korea (219.6) (Figure 4.1).

Figure 4.1: Differences between the 95th and the 5th percentiles on digital reading in Ireland, the OECD, and selected comparison countries



Performance on Digital Reading Proficiency Levels

Four proficiency levels are described for digital reading in PISA 2009 (OECD, 2011a) (Table 4.3). Unlike print reading, there is no description of tasks that students are likely to accomplish in digital reading below Level 2; nor is there a description for Level 6. This is because a smaller number items was used to assess students' digital reading than print reading, with fewer questions that were very easy (corresponding to Level 1 task demands) or very difficult (Level 6). Future digital assessments may be expected to allow for the description of a wider range of knowledge and skills.

As in the case of print reading, Level 2 is considered by the OECD to be a baseline level of proficiency and students performing below this level can be regarded as struggling digital readers. In contrast, students performing at or above Level 5 may be considered to be advanced readers (OECD, 2010a, 2011a).

Table 4.3: Descriptions of the five levels of proficiency on the digital reading scale and percentages of students achieving each level (OECD and Ireland)

Level (*Cut-point*)	Students at this level are capable of:	OECD		Ireland	
		%	SE	%	SE
5 *(626 or above)*	Critically evaluating information from several web-based sources using criteria that they have generated themselves. They are also able to navigate across multiple sites without explicit direction, allowing them to locate information efficiently. Students at this level can be regarded as 'top performers' in digital reading.	7.8	(0.18)	7.8	(0.77)
4 *(553 to 625)*	Judging the authority and relevance of sources of information when provided with support. They can locate and synthesise information from several sites when this requires a low-level of inference. They are also capable of dealing with a range of text formats and types and can compare and contrast information from different sites and form opinions about what they read by drawing on information from their everyday life. Students at this level are considered to be able to perform challenging digital reading tasks.	22.6	(0.26)	24.0	(0.97)
3 *(480 to 552)*	Responding to digital tests in both authored and message-based environments. They are able to locate information across several pages and compare and contrast information from a number of texts when given explicit guidance. They evaluate information in terms of its usefulness for a specified purpose or in terms of personal preference. They can be considered able to perform moderately complex digital reading tasks.	30.4	(0.27)	32.7	(0.91)
2 *(407 to 479)*	Using conventional navigation tools to locate information when given explicit instructions. They can perform tasks such as selecting relevant information from search results or drop down menu, locating and transferring information from one text to another and form generalisations (e.g., recognising the intended audience of a website).	22.3	(0.25)	23.4	(1.02)
Below Level 2 *(406 or below)*	The performance of students at this level cannot be described. Students performing below Level 2 lack basic digital reading skills.	16.9	(0.28)	12.1	(0.90)

Source: OECD, 2011a, Figure VI.2.8.

Students performing below Level 2 on digital reading are unlikely to be able to use conventional navigation tools to locate information when given explicit instructions; to perform tasks such as selecting relevant information from search results or a drop down menu; to locate and transfer information; or to form generalisations (such as recognising the intended audience of a website). On the other hand, students performing at or above Level 5 are likely to be able to critically evaluate information from several sources using criteria that they have generated themselves and to navigate across multiple sites without explicit direction to locate information efficiently.

Consistent with the results shown in Table 4.2, a comparison of Ireland and the OECD averages at each proficiency level for digital reading (Table 4.3) indicates that there are proportionally fewer students in Ireland at the lower proficiency levels, and similar percentages at the upper proficiency levels, compared to the 16-country OECD average. For example, 12.1% of students in Ireland had a digital reading score that was below Level 2 (below 407) compared to 16.9% on average across the OECD. Similar percentages of students in Ireland and across the OECD on average (7.8%) had a digital reading score at or above Level 5 (626 points or higher).

Table 4.4 compares the percentages of students at each digital reading proficiency level in Ireland with the percentages in four selected comparison countries, and the 16-country OECD average. Two countries in particular stand out in this table – Korea and Poland. In the case of Korea, as well as having high average achievement and a narrow range in the distribution of achievement, only 1.8% of Korean students scored below

Level 2, and 19.2% scored at Level 5. In Poland's case, over one-quarter of students (26.3%) scored below Level 2, and just 2.0% were at Level 5.

It is also of interest to compare the distribution of Korean and New Zealand students across the proficiency levels. Of students in New Zealand, 10.2% scored at or below Level 2, while 18.6% scored at Level 5. Although the distribution of students across the higher proficiency levels is similar in Korea and New Zealand, New Zealand has five times as many low achievers as Korea. It is also noteworthy that Ireland and New Zealand have similar percentages of students scoring below Level 2, despite the fact that the mean score for New Zealand is 18 points higher than that of Ireland.

Table 4.4: Percentage of students at each proficiency level on the digital reading scale in Ireland, the OECD, and selected comparison countries

	Below Level 2		Level 2		Level 3		Level 4		Level 5	
	%	SE	%	SE	%	SE	%	SE	%	SE
Korea	1.8	(0.38)	8.3	(0.98)	28.7	(1.38)	42.0	(1.37)	19.2	(1.60)
New Zealand	10.2	(0.65)	16.1	(0.83)	27.2	(0.95)	27.8	(0.98)	18.6	(0.76)
Ireland	12.1	(0.90)	23.4	(1.02)	32.7	(0.91)	24.0	(0.97)	7.8	(0.77)
France	16.7	(1.50)	22.4	(1.12)	32.3	(1.48)	23.6	(1.21)	5.1	(0.72)
Poland	26.3	(1.28)	28.4	(0.95)	28.6	(1.00)	14.7	(0.92)	2.0	(0.26)
OECD	16.9	(0.28)	22.3	(0.25)	30.4	(0.27)	22.6	(0.26)	7.8	(0.18)

Gender Differences on Digital Reading

Females significantly outperformed male students in all countries on digital reading, with the exception of Colombia, where the difference was just 3 score points. The gender gap varied considerably across the 19 countries, ranging from less than 10 points in Colombia, Denmark, and Hong Kong-China, to 35 points or more in New Zealand and Norway. In Ireland, female students achieved a mean digital reading score (524.6) that was 31 points higher than that achieved by male students (493.6) (Table 4.5). This is larger than the corresponding average gender difference for digital reading across OECD countries (24.5 points). In fact, Ireland has the third largest gender difference among the countries in the digital reading assessment.

Table 4.5: Gender differences on the digital reading scale in Ireland, the OECD, and selected comparison countries

	Males		Females		Difference (males-females)	
	Mean	SE	Mean	SE	Score diff	SE
Korea	559.3	(4.25)	576.8	(3.54)	**-17.5**	(5.16)
New Zealand	517.5	(3.48)	558.0	(2.70)	**-40.5**	(4.10)
Ireland	493.6	(3.69)	524.6	(2.92)	**-31.1**	(3.89)
France	483.8	(5.18)	504.1	(5.67)	**-20.3**	(3.33)
Poland	448.9	(3.40)	478.2	(3.28)	**-29.3**	(2.70)
OECD	486.8	(0.96)	511.3	(0.89)	**-24.5**	(0.96)

The countries with the two highest mean scores on digital reading in Table 4.5 (Korea and New Zealand) are quite different in terms of the mean digital reading achievement of boys and girls. In Korea, the gender difference is relatively small, at 17.5 points, while in New Zealand, it is 40.5 points. Thus, the difference in achievement between males in Korea and New Zealand is 42 points, but for females, it is just 19 points.

Table 4.6 provides data on the distribution of male and female students across the digital reading proficiency levels for Ireland and across the OECD on average. In Ireland, one in six boys (16.6%) scored below the baseline Level 2, compared to just 7.4% of girls. The respective OECD averages are 20.7% and 13.1%, indicating that in Ireland, fewer students of both genders had low reading scores. At the upper end of the achievement distribution, 5.8% of boys and 9.9% of girls in Ireland had digital reading scores at Level 5, which are similar to the corresponding percentages across the OECD on average (6.3% and 9.3%, respectively).

Table 4.6: Percentages of male and female students achieving each proficiency level on the digital reading scale – Ireland and the OECD

	Ireland				OECD			
	Males		Females		Males		Females	
Level	%	SE	%	SE	%	SE	%	SE
Level 5	5.8	(0.77)	9.9	(1.24)	6.3	(0.20)	9.3	(0.26)
Level 4	20.7	(1.22)	27.5	(1.69)	20	(0.32)	25.1	(0.35)
Level 3	31.4	(1.26)	33.9	(1.52)	29.4	(0.35)	31.4	(0.37)
Level 2	25.5	(1.32)	21.3	(1.34)	23.6	(0.33)	21	(0.33)
Below Level 2	16.6	(1.34)	7.4	(0.86)	20.7	(0.36)	13.1	(0.30)

Students' Navigation During the Digital Reading Assessment

One of the distinctive features of digital text is that it consists of several pieces of text that are interconnected via hyperlinks. In this environment, the reader needs to select pieces of text and put them into an appropriate order to match both the goal of the reading task and their existing reading knowledge and skills. This process is referred to as navigation. A number of studies (cited in OECD, 2011a) have found that navigation is closely linked to understanding digital texts, which is not surprising, given that navigation choices will determine which pieces of information are accessed by the reader, and whether or not that information is relevant to the specific task being undertaken. The ordering of information produced by navigation may be more or less semantically coherent, thereby requiring varying types and amounts of cognitive processing and (re-)ordering.

The PISA 2009 digital reading assessment tasks were deliberately constructed so that navigation was frequently required to obtain the information needed to complete a task successfully. The following indices of student navigation were captured while students completed the test:

a) *Total number of page visits*: this index comprises the total number of visits to any page, regardless of its relevance to the task, and regardless of whether each is a first visit or a re-visit.

b) *Number of visits to relevant pages:* this index measures the number of times that students accessed a page containing task-relevant information and therefore indicates the overall intensity of students' task-oriented navigation behaviour. However, it does not provide information on how comprehensively a student covered the material that is potentially relevant to a task. In theory, a student could switch back and forth between two pages that are both relevant to a task, and record a large number of visits to relevant pages, despite accessing only a small part of all potentially relevant material, and without navigating in a specifically task-oriented way.

c) *Number of relevant pages visited:* this index overcomes the limitations associated with the *number of visits to relevant pages* in that it is a measure of how many discrete pages judged to be relevant to a task were accessed while the student worked on a task.

Given these definitions, one would expect total number of page visits to be least closely associated with student performance on the PISA assessment of digital reading, and the number of relevant pages visited to be most closely associated with performance. It should also be borne in mind, however, that students' navigational behaviour is likely to be influenced by their existing levels of reading knowledge and skills; in other words, more skilled readers are more likely to navigate more efficiently and effectively than less skilled readers.

The remainder of this section provides descriptive statistics relating to the three navigational indices; considers gender differences on them; and describes the relationship between the indices and performance on digital reading. Given that navigational behaviour may be a function of prior knowledge and skills, we also describe the relationship between navigational behaviour and achievement on the print reading assessment.

Table 4.7 shows the means and standard deviations for each of the three navigation indices for all countries that participated in the digital reading assessment, together with gender differences associated with these indices.

Table 4.7: Means, standard deviations and gender differences on three navigation indices of the digital reading assessment, all countries, and OECD averages

	Digital Reading	Number of relevant pages visited				Number of visits to relevant pages				Number of page visits			
	Mean	Mean	SE	SD	M-F	Mean	SE	SD	M-F	Mean	SE	SD	M-F
Australia	536.6	49.6	-0.25	9.3	**-2.3**	63.0	-0.45	15.4	**-2.8**	76.3	-0.61	22.9	-1.7
Austria	458.6	43.3	-0.43	11.1	**-2.2**	54.5	-0.68	17.2	**-2.6**	68.8	-0.98	26.4	-2.0
Belgium	507.4	47.7	-0.23	9.8	**-1.7**	60.2	-0.36	15.3	**-2.1**	73.9	-0.56	23.4	-0.3
Chile	434.5	37.7	-0.44	11.3	-0.6	51.0	-0.70	18.6	-0.4	66.3	-1.01	28.2	**3.3**
Colombia	368.5	31.5	-0.58	10.9	1.2	43.8	-0.99	20.0	**3.6**	58.2	-1.49	31.5	**7.1**
Denmark	488.9	47.2	-0.39	9.3	**-1.2**	58.6	-0.59	14.3	**-1.9**	72.6	-0.91	22.6	-0.7
France	494.2	46.1	-0.60	10.4	**-1.5**	59.0	-0.63	15.6	-0.8	72.6	-0.87	22.4	1.9
Hong Kong-China	514.8	48.1	-0.31	9.4	-0.9	68.2	-0.64	18.4	0.6	94.1	-1.16	32.4	**5.2**
Hungary	468.3	41.6	-0.53	11.5	**-2.8**	52.2	-0.82	17.8	**-3.1**	65.1	-1.19	26.9	-1.9
Iceland	511.8	47.5	-0.27	9.1	**-3.3**	61.1	-0.48	16.2	**-3.4**	78.7	-0.85	26.9	-1.6
Ireland	508.9	47.4	-0.32	10.0	**-3.1**	60.7	-0.48	16.0	**-3.7**	74.9	-0.76	24.1	-2.4
Japan	519.1	50.1	-0.55	8.7	-1.5	70.6	-0.95	17.5	-1.0	95.7	-1.62	32.7	1.0
Korea	567.6	52.8	-0.25	7.3	**-0.9**	74.2	-0.57	15.8	0.6	98.9	-1.03	29.0	3.7
Macao-China	491.9	46.5	-0.17	8.8	0.1	68.4	-0.32	17.2	**2.3**	100.0	-0.63	34.1	**8.0**
New Zealand	537.4	49.7	-0.25	9.3	**-3.3**	64.2	-0.44	14.9	**-3.9**	78.9	-0.70	23.1	-1.6
Norway	499.9	46.9	-0.28	9.4	**-2.8**	58.1	-0.41	15.3	**-3.0**	72.2	-0.70	24.1	**-2.7**
Poland	463.5	42.0	-0.38	11.1	**-1.6**	53.5	-0.61	17.5	-1.2	66.9	-0.90	26.2	0.4
Spain	475.4	44.2	-0.42	10.4	**-1.1**	57.0	-0.62	16.8	-0.4	71.9	-0.86	24.7	1.1
Sweden	510.3	47.8	-0.32	9.6	**-2.3**	61.2	-0.54	15.9	**-2.7**	77.0	-0.81	25.0	-1.3
OECD	498.9	46.3	-0.10	9.8	**-2.0**	59.9	-0.15	16.3	**-2.0**	75.7	-0.23	25.5	-0.3

Note: Significant gender differences are shown in bold.

On average, students in Ireland had 47.4 relevant page visits (as defined in (c), above) during the digital reading assessment, which is marginally, but significantly higher than, the OECD average of 46.3 pages. Students in Ireland visited an average of 60.7 relevant pages ((b), above), which is again slightly higher than the OECD average of 59.9, but not significantly so. During the assessment, students in Ireland visited an average of 74.9 pages in total ((a), above), which is slightly but not significantly lower than the OECD average of 75.7. Focusing on the number of relevant pages visited as the most direct indicator of task-oriented navigation behaviour, it can be seen that, in general, higher-performing countries had higher scores on this index.

Consistent with the overall gender difference on digital reading across the OECD on average, mean scores on the number of relevant pages visited and the number of visits to relevant pages were higher for females than for males, but the gender difference is not statistically significant for number of page visits. In Ireland, the gender differences associated with the number of relevant pages visited (-3.1) and the number of visits to relevant pages (-3.7) are both statistically significant and larger than the corresponding OECD average gender differences (-2.0 in both cases). In fact, Ireland was among the three countries that had the largest gender differences on these two indices (along with Iceland and New Zealand). Thus on these two measures at least, females were generally more effective than males in navigating through the digital reading assessment, a difference that is more pronounced in Ireland than on average across the OECD.

Table 4.8: Correlations between three navigation indices of the digital reading assessment and achievement on digital and print reading, all countries, and OECD averages

	Digital Reading						Print Reading					
	Number of relevant pages visited		Number of visits to relevant pages		Number of page visits		Number of relevant pages visited		Number of visits to relevant pages		Number of page visits	
	r	SE	r	SE	r	SE	r	SE	r	SE	r	SE
Australia	.80	(0.01)	.60	(0.02)	.37	(0.02)	.63	(0.01)	.48	(0.02)	.31	(0.02)
Austria	.84	(0.01)	.72	(0.01)	.55	(0.02)	.67	(0.01)	.57	(0.02)	.43	(0.02)
Belgium	.82	(0.01)	.63	(0.01)	.38	(0.03)	.69	(0.01)	.55	(0.01)	.35	(0.02)
Chile	.81	(0.01)	.63	(0.02)	.47	(0.03)	.64	(0.02)	.52	(0.02)	.41	(0.03)
Colombia	.76	(0.01)	.56	(0.03)	.46	(0.03)	.58	(0.03)	.47	(0.04)	.41	(0.03)
Denmark	.81	(0.02)	.63	(0.03)	.41	(0.04)	.61	(0.03)	.47	(0.03)	.30	(0.04)
France	.85	(0.02)	.62	(0.04)	.42	(0.04)	.58	(0.06)	.46	(0.04)	.32	(0.04)
Hong Kong-China	.77	(0.01)	.56	(0.03)	.35	(0.03)	.48	(0.03)	.32	(0.04)	.20	(0.04)
Hungary	.86	(0.01)	.75	(0.02)	.59	(0.03)	.72	(0.02)	.63	(0.03)	.51	(0.03)
Iceland	.79	(0.01)	.58	(0.03)	.37	(0.03)	.62	(0.02)	.47	(0.03)	.31	(0.03)
Ireland	.82	(0.01)	.64	(0.02)	.42	(0.03)	.61	(0.02)	.46	(0.02)	.29	(0.03)
Japan	.74	(0.02)	.51	(0.04)	.35	(0.04)	.48	(0.03)	.33	(0.04)	.22	(0.03)
Korea	.68	(0.03)	.39	(0.04)	.20	(0.04)	.54	(0.04)	.35	(0.04)	.18	(0.04)
Macao-China	.71	(0.01)	.42	(0.02)	.15	(0.03)	.43	(0.02)	.24	(0.02)	.06	(0.03)
New Zealand	.79	(0.01)	.56	(0.02)	.29	(0.03)	.62	(0.02)	.42	(0.03)	.19	(0.03)
Norway	.81	(0.01)	.65	(0.02)	.49	(0.02)	.58	(0.02)	.46	(0.02)	.35	(0.02)
Poland	.85	(0.01)	.70	(0.01)	.55	(0.02)	.67	(0.02)	.55	(0.02)	.43	(0.02)
Spain	.84	(0.01)	.65	(0.03)	.47	(0.03)	.64	(0.02)	.49	(0.03)	.35	(0.03)
Sweden	.79	(0.01)	.61	(0.02)	.41	(0.03)	.64	(0.02)	.48	(0.02)	.32	(0.02)
OECD	.81	(0.00)	.62	(0.01)	.42	(0.01)	.62	(0.01)	.48	(0.01)	.33	(0.01)

Note: Correlations were computed on the basis of weighted likelihood estimates (WLEs) of achievement, rather than on plausible values.

Table 4.8 displays correlations between the three navigation indices and achievement on the digital and print assessments, for all countries participating in the digital reading assessment, and on average across the OECD. As predicted, the correlation with digital reading achievement is highest for the number of relevant pages visited, followed by the number of visits to relevant pages, and weakest for the number of pages visits (with OECD average correlations of .81, .62, and .42, respectively). Correlations in the case of Ireland are very similar to what was found on average across the OECD (.82, .64, and .42, respectively).

Correlations between the three navigation indices and print reading achievement are also significant and positive (Table 4.8), though not as strong as for digital reading. The OECD average correlations for number of relevant pages visited, number of visits to relevant pages, and number of page visits are .62, .48 and .33, respectively. The correlations in the case of Ireland are similar, at .61, .46 and .29, respectively. This indicates that student navigation behaviour during the digital reading assessment is partly, and possibly, mainly, a function of their reading knowledge and skills (at least as measured by PISA print reading).

Readers are referred to the OECD (2011a) for a more detailed discussion of findings relating to navigation in the PISA 2009 assessment of digital reading.

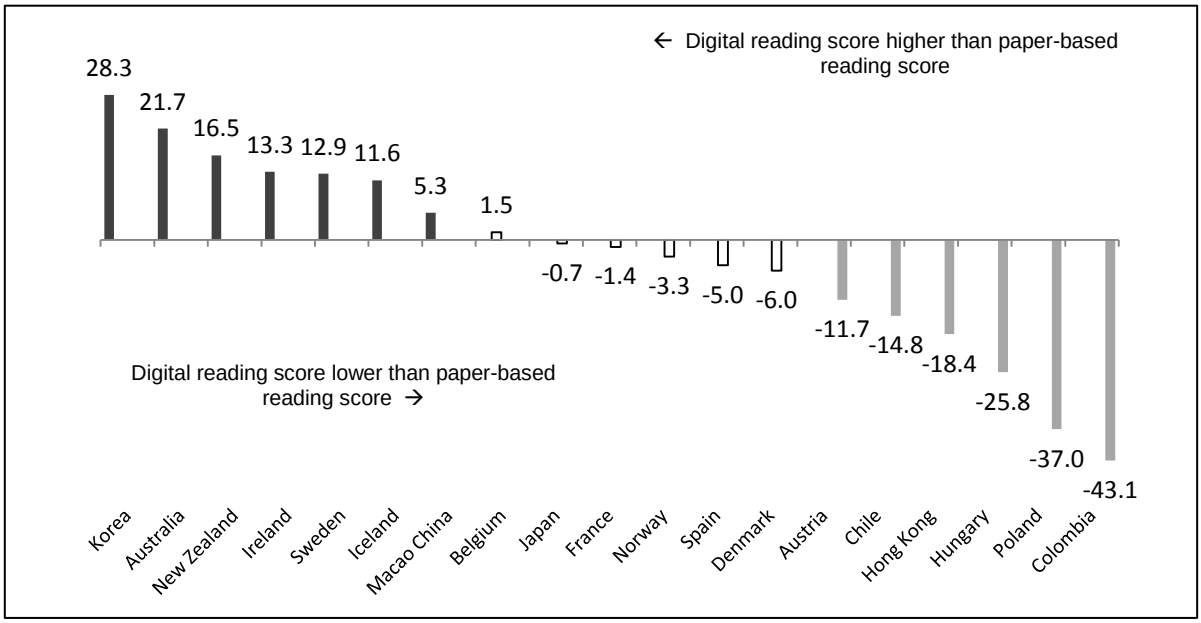
Comparison of Performance on Print and Digital Reading

In this section, the achievements of students on the print and digital assessments of reading in PISA 2009 are compared. Differences in digital and print reading achievement associated with a variety of school and student background characteristics are explored in Chapters 6 and 8.

Mean score differences between the print and digital reading assessments for the countries that participated in both are shown in Figure 4.2. In seven countries, the digital reading score is significantly higher than the print reading score, while in six countries, the digital reading score is significantly lower than the print reading score. Ireland has the fourth highest difference (13.3 points) in favour of digital reading, with higher differences recorded in New Zealand (16.5), Australia (21.7), and Korea (28.3). In Hungary, Poland and Colombia, the difference in favour of print reading was at least 25 points.

Table 4.9 shows the mean digital and print reading scores for the 19 countries that participated in both assessments. Of the four countries whose mean digital reading score did not differ from Ireland's (Hong Kong-China, Iceland, Sweden, and Belgium), two also had print reading scores that did not differ from Ireland's (Iceland, Sweden), while the other two (Hong Kong-China, Belgium) had print reading scores that were significantly higher than Ireland's. A further five countries (Norway, France, Denmark, Hungary, Poland) had a mean print reading score that did not differ from Ireland's, yet Ireland had a mean digital reading score significantly higher than these countries. The country-level correlation between mean scores on print and digital reading is quite high (.93). At the student level, on average across the OECD, the correlation between digital and print reading scores is .86, which is similar to the correlations between print reading and mathematics (.83) and between print reading and science (.87) (OECD, 2011b). Although in a general sense, countries that did well on print reading also did well on digital reading, there are exceptions to this pattern and Ireland is among them.

Figure 4.2: Differences between print and digital reading country mean scores



Note. Countries with significantly higher digital reading scores are marked in dark grey; countries with significantly higher print reading scores are marked in light grey.

Table 4.9: Mean scores on the print and digital reading assessments, all countries, and OECD averages

	Digital Reading			Print Reading		
	Mean	SD	IRL	Mean	SD	IRL
Korea	567.6	68.4	▲	539.3	79.2	▲
New Zealand	537.4	98.7	▲	520.9	102.8	▲
Australia	536.6	97.2	▲	514.9	98.9	▲
Japan	519.1	76.4	▲	519.9	100.4	▲
Hong Kong-China	514.8	82.0	O	533.2	84.0	▲
Iceland	511.8	90.9	O	500.3	96.0	O
Sweden	510.3	88.8	O	497.4	98.6	O
Ireland	508.9	87.1		495.6	95.1	
Belgium	507.4	94.1	O	505.9	101.8	▲
Norway	499.9	82.7	▼	503.2	91.2	O
France	494.2	95.7	▼	495.6	105.5	O
Macao-China	491.9	66.4	▼	486.6	76.2	▼
Denmark	488.9	83.9	▼	494.9	83.6	O
Spain	475.4	94.6	▼	481.0	87.5	▼
Hungary	468.3	102.5	▼	494.2	90.2	O
Poland	463.5	90.7	▼	500.5	89.2	O
Austria	458.6	102.6	▼	470.3	100.1	▼
Chile	434.5	89.3	▼	449.4	82.7	▼
Colombia	368.5	83.1	▼	413.2	86.6	▼
OECD	498.9	90.2		493.4	93.1	

▲	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

Table 4.9 allows a comparison of the standard deviations of the print and digital reading assessments. In five countries (Japan, Korea, Sweden, France, and Macao-China), the standard deviation for print reading is larger than for digital reading by 10 or more points, while in Chile, Spain, and Hungary, the standard deviation is smaller for print reading than for digital reading, by 5 points or more. In Ireland, the standard

deviation for digital reading is smaller than for print reading, by about 8 points. Overall, the standard deviations in Table 4.9 indicate that, in the majority of countries participating in both digital and print reading, the spread of scores was narrower on digital reading.

Table 4.10 compares the scores at the 5th and 95th percentiles, and the score differences between these two points, for digital and print reading, for Ireland and the four comparison countries and on average across the OECD. Across the OECD on average, the score difference associated with digital reading (293.0) is about 12 points lower than for print reading (305.0). In Ireland, the score difference between the 5th and 95th percentiles is also smaller for digital reading (286.1) than for print reading (308.7), by a greater margin of 22.6 points. It can also be seen that the score for Ireland at the 5th percentile on digital reading (357.2) is some 27 points higher than the equivalent score on print reading, while the score difference at the 95th percentile is much smaller, at 5 points. Hence, the stronger performance on digital reading than on print reading by students in Ireland is at least partly attributable to higher scores among low achievers.

It is clear from Table 4.10 that a narrow score distribution on one assessment is not always matched with a narrow score distribution on the other. For example, in France, the score difference at the 5th and 95th percentiles on digital reading (297.8) is much narrower than that for print reading (346.5), while in Poland, score differences for print and digital reading are almost identical (at 295.4 and 293.3, respectively).

Table 4.10: Scores at the 5th and 95th percentiles on digital and print reading, Ireland, the OECD, and selected comparison countries

	Digital Reading			Print Reading		
	5th	95th	Difference	5th	95th	Difference
Korea	451.6	671.2	219.6	400.4	658.2	257.8
New Zealand	363.3	686.6	323.3	343.6	678.5	334.9
Ireland	357.2	643.3	286.1	329.6	638.3	308.7
France	328.5	626.3	297.8	304.5	651.0	346.5
Poland	305.7	601.1	295.4	346.5	639.8	293.3
OECD	342.0	635.0	293.0	332.1	637.1	305.0

Figure 4.3 compares the percentages of students at each proficiency level on print and digital reading in Ireland and on average across the OECD. For print reading, Levels 1a, 1b, and below 1b have been combined into a single category, as have Levels 5 and 6. Perhaps the most striking feature of Figure 4.3 is the much lower percentage of students in Ireland scoring below Level 2 on digital reading than on print reading. This is consistent with the relatively strong performance of low achievers on digital reading apparent in Table 4.10.

As noted earlier, the gender difference on digital reading in Ireland was 31 points. Although this is smaller than the gender difference on print reading (39 points), it is the third highest gender difference in digital reading in the 19 countries that took part in this assessment. Figure 4.4 shows the mean reading scores of male and female students on print and digital reading in Ireland and on average across the OECD. Both female and male students in Ireland achieved significantly higher mean digital reading scores (524.6 for females and 493.6 for males) than print reading scores (515.5 for females

and 476.3 for males). The mean score on digital reading was 9.1 score points higher for females, and 17.3 score points higher for males.

Figure 4.3: Percentages of students at proficiency levels on digital and print reading, Ireland and OECD averages

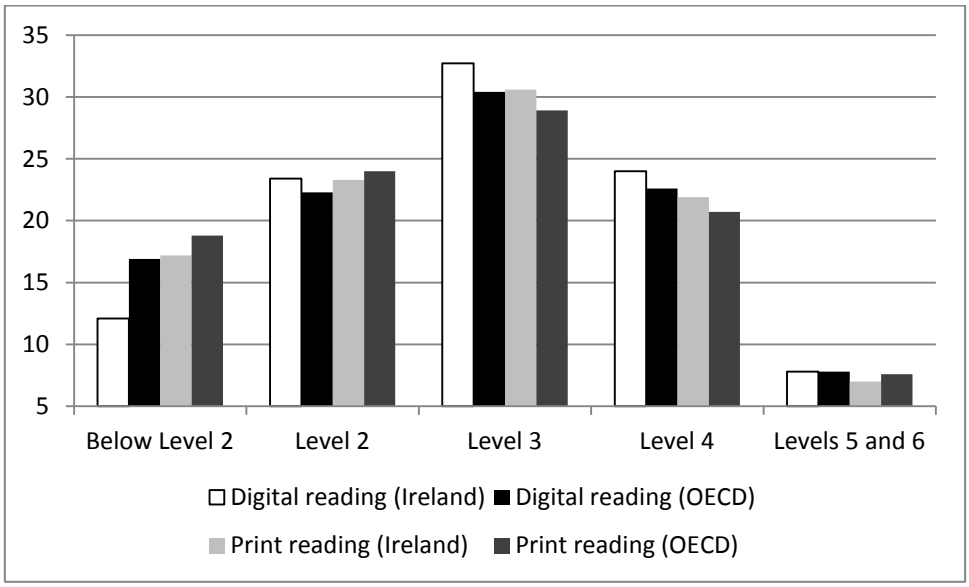


Figure 4.4: Mean digital and print reading scores by gender, Ireland and the OECD

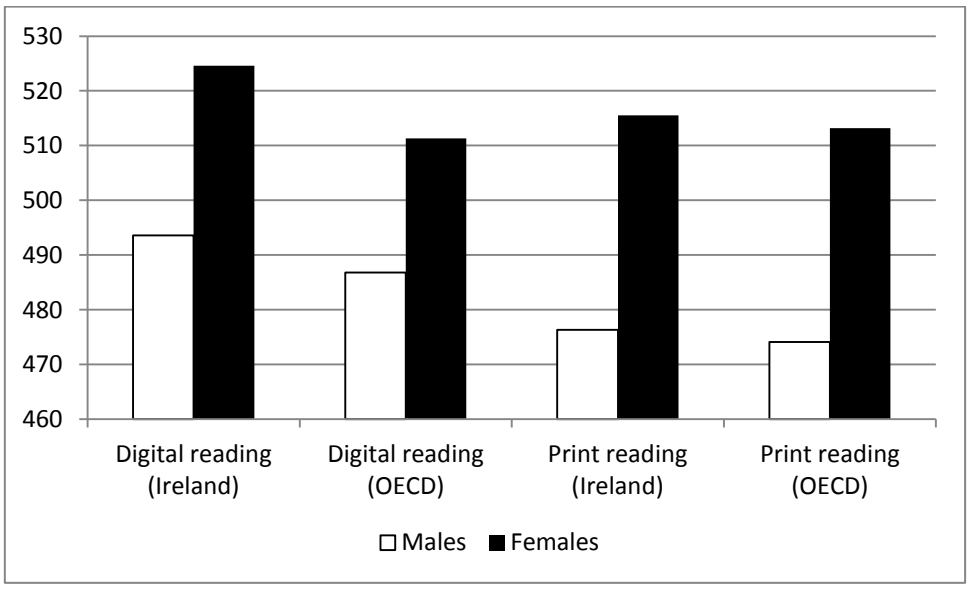
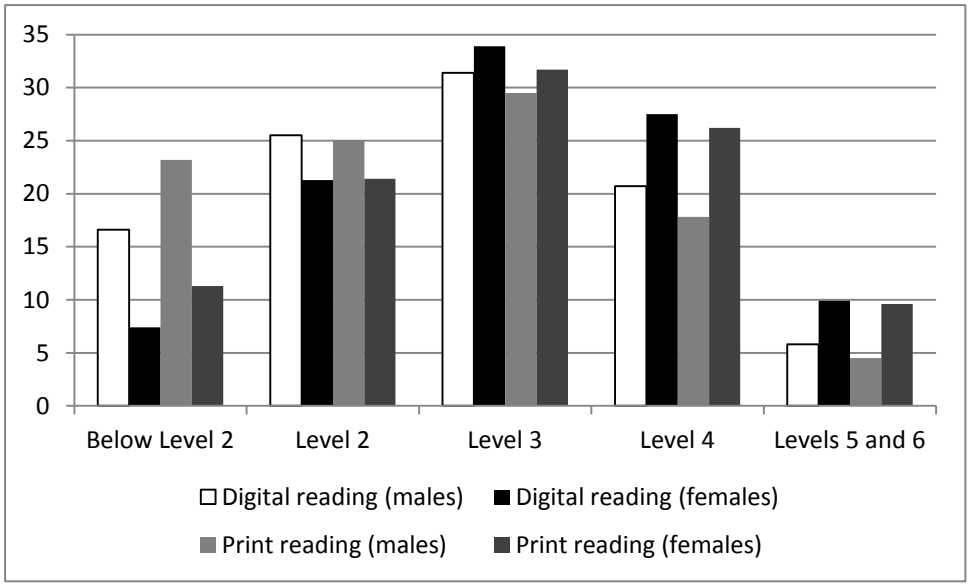


Figure 4.5 shows the percentages of male and female students in Ireland at each proficiency level in print and digital reading. As for Figure 4.3, for print reading, we combined below Level 1b, Level 1b, and Level 1a into a single 'below Level 2' category; Levels 5 and 6 are also combined. Data in the figure indicate that markedly fewer male students scored below Level 2 on the digital reading assessment (16.6%) than on the print assessment (23.2%). Although fewer females also scored below Level 2 on the digital assessment (7.4%) than on the print assessment (11.2%), the difference is not as pronounced.

The percentages of females at Levels 5 and 6 on print and digital reading are quite similar, and slightly more boys scored at or above Level 5 on the digital reading scale (5.8%) than on the print reading scale (4.5%) (Figure 4.5). While the performance of

low-achieving students was generally higher on digital reading than on print reading, the difference was particularly marked among boys.

Figure 4.5: Percentages of students at proficiency levels on digital and print reading by gender, Ireland



Chapter Summary and Conclusions

On the PISA 2009 assessment of digital reading, students in Ireland achieved a mean score of 509, which is 10 points higher than, and significantly above, the OECD average. Ireland ranked 8th out of the 19 participating countries, and was 7th of the 16 OECD countries that took part.

The score difference between the 5th and 95th percentiles on digital reading in Ireland was close to three standard deviations, at 286 points, but this is slightly less than the OECD average of 293 points. Irish students at the 5th percentile scored 15 points higher than the OECD average, while students at the 95th percentile scored 8 points higher. About 12% of students in Ireland had a digital reading score that was below Level 2, compared to 17% on average across the OECD, while similar percentages of students in Ireland and across the OECD on average had a digital reading score at or above Level 5 (around 8% in both cases).

The gender difference in favour of girls on digital reading was 31 score points, which was the third highest observed across the 19 participating countries, and higher than the OECD average gender difference of 25 score points. Consistent with this, in Ireland, one in six boys (17%) scored below Level 2 on digital reading, compared to just 7% of girls (the respective OECD averages were 21% and 13%). At the upper end of the achievement distribution, 6% of boys and 10% of girls in Ireland had digital reading scores at Level 5, similar to the corresponding percentages across the OECD on average.

During the digital reading assessment, students' navigational behaviour was captured. Three indices were produced: total number of page visits during the assessment, number of relevant page visits, and number of relevant pages visited. The last index is the most direct measure of task-oriented behaviour during the test. Countries with higher average scores in the number of relevant pages visited tended to have higher average scores on the digital reading assessment, and Ireland's average was significantly above the average across OECD countries. Girls had higher scores on this

index than boys, and the gender difference associated with the number of relevant page visits was higher in Ireland than on average across the OECD. The correlation between this index and digital reading scores was .82 in Ireland, which is about the same as across the OECD on average.

The number of relevant pages visited also strongly correlated with print reading achievement (.61 in Ireland, and .62 on average across the OECD), suggesting that students' navigational behaviour is a function of their existing reading knowledge and skills. The potentially circular nature of the relationship between navigational indices and existing reading knowledge and skills should not be underestimated. It may also be the case, however, that the navigational indices are quite specific to the digital assessment of reading used in PISA 2009, rather than representative of more general measures of efficient and task-oriented test-taking behaviour in a digital environment. PISA 2012 is likely to provide an opportunity to gain a better understanding of how students perform in computer-based environments, since, as well as digital reading, it will include computer-based assessments of mathematics and problem-solving.

A comparison of performance on digital and print reading literacy indicates that:

- Ireland scored above the OECD average on digital reading, but at the OECD average on print reading.
- The distribution of scores on the assessment of digital reading was narrower than for print reading.
- Compared with print reading, fewer students, particularly boys, scored below Level 2 on digital reading.
- The gender difference on digital reading in Ireland was smaller than for print reading.

Since the analyses in this report cannot address all of the issues raised in this chapter, it would seem important that further research is undertaken to help better understand why the gender difference is smaller on digital than on print reading; why significantly fewer boys scored below Level 2 on digital reading than on print reading; what skills underlie the scores on the navigational indices (and to what extent they can be supported by instruction); and why girls displayed more efficient usage of navigation than in the assessment.

Finally, it should be noted that the OECD (2011a) has reported results on a 'composite reading scale' for countries that participated in the digital reading assessment. This is the average of students' scores on the print and digital reading assessments and as such does not represent anything new over and above a consideration of print and digital reading separately. Readers are referred to OECD (2011a, Chapter 2) for a description of results on the composite reading scale.

Chapter 5: Performance on Mathematics and Science

This chapter describes mathematics and science performance in PISA 2009, and changes in achievement in these domains since PISA 2003 (mathematics) and 2006 (science). Several aspects of performance are examined: comparisons of average performance by country, variation in performance, performance by proficiency level, and gender differences. As in Chapter 3, results are examined with respect to ten comparison countries/economies selected on the basis of high average achievement, similarities to Ireland (e.g., in terms of population size, language, or culture), and/or recent educational reforms (see also Chapter 1, Inset 1.2). Due to smaller numbers of items than used for reading, performance on the mathematics and science assessments are reported in terms of overall scales only. The mean score for OECD countries for a domain is set at 500 in the cycle in which it was first the major domain, with this cycle then serving as a benchmark for trends in achievement over time. Thus, mathematics achievement in PISA 2009 is compared to PISA 2003, while science in 2009 is compared to 2006.

Overall Performance on Mathematics

Ireland achieved a mean score of 487.1 on the mathematics scale, which is significantly below the OECD average of 495.7 (Table 5.1). Ireland ranks 26th out of 34 OECD countries and 32nd out of 65 OECD and partner countries; however, this ranking does not take into account measurement and sampling error. We can say with a 95% level of confidence that Ireland's true rank in mathematics lies between 22nd and 29th among OECD countries, and between 28th and 35th among all participating countries.

Shanghai-China achieved the highest mean score on the mathematics scale (600.1), outscoring Singapore, the second highest-achieving economy, by 38.1 score points. Each of the three top-performing countries/economies, which are all partner countries/economies (Shanghai-China, Singapore and Hong Kong-China), had a mean score that is more than half of a standard deviation above the OECD average. The highest achieving OECD countries, Korea and Finland, rank 4th and 6th, with mean scores of 546.2 and 540.5 respectively. The top five ranked countries/economies in mathematics are also the top five ranked on the overall print reading scale, with the exception of Chinese Taipei, which ranks 23rd in print reading compared to 5th in mathematics.

Ireland's mean mathematics score does not differ significantly from that of 10 other countries, including Sweden, the United Kingdom, the United States, and Spain. Nineteen OECD countries (including Korea, Finland, Korea, New Zealand, Germany, and France) performed at a significantly higher level than Ireland, and five OECD countries (Greece, Israel, Turkey, Chile, and Mexico) achieved significantly lower mean scores than Ireland. The mean score for Northern Ireland (492.2; not shown in Table 5.1) does not differ significantly from the mean score for Ireland or from the OECD average.

Table 5.1: Mean country scores and standard errors (SE) for the mathematics scale and positions relative to the OECD and Irish means – all participating countries

	Mean	SE	SD	SE	IRL		Mean	SE	SD	SE	IRL
Shanghai-China	600.1	(2.82)	103.1	(2.11)	▲	Italy	482.9	(1.86)	93.0	(1.68)	**O**
Singapore	562.0	(1.44)	104.4	(1.22)	▲	*Latvia*	482.0	(3.07)	79.1	(1.41)	**O**
Hong Kong-China	554.5	(2.73)	95.3	(1.77)	▲	*Lithuania*	476.6	(2.62)	88.1	(1.77)	▼
Korea	546.2	(4.02)	89.2	(2.52)	▲	*Russian Federation*	467.8	(3.29)	84.9	(2.09)	▼
Chinese Taipei	543.2	(3.40)	104.9	(2.33)	▲	Greece	466.1	(3.88)	89.5	(1.99)	▼
Finland	540.5	(2.17)	82.5	(1.10)	▲	*Croatia*	459.9	(3.09)	88.2	(1.81)	▼
Liechtenstein	536.0	(4.06)	87.7	(4.37)	▲	*Dubai (UAE)*	452.5	(1.07)	98.9	(0.86)	▼
Switzerland	534.0	(3.30)	99.2	(1.59)	▲	Israel	446.9	(3.28)	104.1	(2.41)	▼
Japan	529.0	(3.33)	94.1	(2.21)	▲	Turkey	445.5	(4.44)	93.4	(3.00)	▼
Canada	526.8	(1.61)	87.5	(0.97)	▲	*Serbia*	442.4	(2.92)	90.7	(1.86)	▼
Netherlands	525.8	(4.75)	89.1	(1.66)	▲	*Azerbaijan*	431.0	(2.76)	64.0	(2.18)	▼
Macao-China	525.3	(0.92)	85.3	(0.85)	▲	*Bulgaria*	428.1	(5.86)	99.0	(2.83)	▼
New Zealand	519.3	(2.31)	96.2	(1.59)	▲	*Romania*	427.1	(3.41)	79.2	(2.12)	▼
Belgium	515.3	(2.25)	104.1	(1.76)	▲	*Uruguay*	426.7	(2.59)	91.4	(1.68)	▼
Australia	514.3	(2.53)	94.0	(1.45)	▲	Chile	421.1	(3.06)	80.1	(1.73)	▼
Germany	512.8	(2.86)	98.3	(1.67)	▲	*Thailand*	418.6	(3.23)	79.1	(2.48)	▼
Estonia	512.1	(2.57)	81.1	(1.64)	▲	Mexico	418.5	(1.83)	78.9	(1.08)	▼
Iceland	506.7	(1.39)	91.0	(1.17)	▲	*Trinidad and Tobago*	414.0	(1.28)	99.4	(1.18)	▼
Denmark	503.3	(2.60)	87.0	(1.26)	▲	*Kazakhstan*	404.9	(3.04)	83.4	(2.30)	▼
Slovenia	501.5	(1.23)	95.3	(0.87)	▲	*Montenegro*	402.5	(2.03)	84.8	(1.53)	▼
Norway	498.0	(2.40)	85.4	(1.19)	▲	*Argentina*	388.1	(4.09)	93.5	(2.90)	▼
France	496.8	(3.09)	100.9	(2.09)	▲	*Jordan*	386.7	(3.71)	82.7	(2.57)	▼
Slovak Republic	496.7	(3.08)	96.1	(2.36)	▲	*Brazil*	385.8	(2.39)	81.2	(1.64)	▼
Austria	495.9	(2.66)	96.1	(2.00)	▲	*Colombia*	380.8	(3.24)	75.4	(1.69)	▼
Poland	494.8	(2.84)	88.4	(1.39)	▲	*Albania*	377.5	(3.98)	90.8	(2.18)	▼
Sweden	494.2	(2.90)	93.8	(1.35)	**O**	*Tunisia*	371.5	(2.98)	77.5	(2.32)	▼
Czech Republic	492.8	(2.83)	93.2	(1.78)	**O**	*Indonesia*	371.3	(3.72)	70.3	(2.29)	▼
United Kingdom	492.4	(2.42)	87.2	(1.22)	**O**	*Qatar*	368.1	(0.70)	98.1	(0.85)	▼
Hungary	490.2	(3.45)	92.1	(2.81)	**O**	*Peru*	365.1	(4.00)	90.0	(2.43)	▼
Luxembourg	489.1	(1.18)	97.6	(1.19)	**O**	*Panama*	359.7	(5.25)	80.6	(3.24)	▼
United States	487.4	(3.57)	90.8	(1.61)	**O**	*Kyrgyzstan*	331.2	(2.87)	80.8	(2.12)	▼
Ireland	487.1	(2.54)	85.6	(1.59)		OECD average	495.7	(0.5)	91.7	(0.3)	
Portugal	486.9	(2.91)	91.4	(1.52)	**O**						
Spain	483.5	(2.11)	90.6	(1.05)	**O**						

	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

Note: OECD countries are in regular font, partner countries are in italics.

Variation in Performance on Mathematics

Table 5.1 provides an overall measure of variation in performance in the form of the standard deviation. The standard deviation for mathematics for Ireland (85.6) is smaller than the OECD average (91.7). It is of note that there is considerable variation in the size of the standard deviation among the highest-performing countries. For example, it is much smaller in Finland (82.5) and Korea (89.2) than in Shanghai-China (103.1), Singapore (104.4), and Chinese Taipei (104.9).

Table 5.2 presents mean mathematics scores achieved by students at key percentile markers ranging from the 5th to the 95th percentile, which accounts for the range of scores achieved by 90% of students in a population. Mean scores across percentiles are presented for Ireland, the OECD and the ten comparison countries/economies. The countries/economies are presented in descending order of mean mathematics score, with the exception of Shanghai-China and Northern Ireland, as they are provinces rather than countries.

The range of mathematics achievement between the 5th and 95th percentiles is 279.6 points for Ireland, which is below the OECD average of 300.5 points, and is the second narrowest achievement range displayed by any of the comparison countries/economies, after Finland (269.7). The United Kingdom (276.6) and Northern Ireland (289.3) also have below average achievement ranges, while the greatest variation in achievement is displayed by Shanghai-China (336.0) and France (330.8). In Ireland, the distribution of mathematics achievement (279.6) is much narrower than the distribution of achievement in print reading (308.7). Across OECD countries, there is also less variation in mathematics than in reading achievement, but the difference is much smaller (300.5 versus 305.0 points).

The score for Ireland at the 95th percentile indicates relatively poor performance by high achieving students. Students at the 95th percentile achieved a score of 617.4, which is much lower than the OECD average (643.0) and the lowest of the ten comparison countries/economies, followed by Northern Ireland (637.3), the United Kingdom (634.7) and Poland (638.4). The highest country scores at the 95th percentile were achieved in Shanghai-China (757.3), Korea (689.0), New Zealand (671.4), Finland (668.9) and Germany (666.2). It is interesting to note that, for Shanghai-China, the higher overall average mathematics score (600.1) compared to reading (555.8) is largely accounted for by achievement at the upper end of the scale; students at the 95th percentile scored 757.3 points in mathematics, and 678.6 in reading.

Table 5.2: Scores of students at key percentile markers on the mathematics scale in Ireland, the OECD, and selected comparison countries

	5th		10th		25th		75th		90th		95th	
	Score	SE	Score	SE	Score	SE	Score	SE	Score	SE	Score	SE
Korea	397.0	(8.38)	429.9	(6.82)	486.0	(5.33)	608.6	(4.27)	658.6	(4.59)	689.0	(6.51)
Finland	399.2	(4.36)	431.3	(3.66)	486.7	(2.99)	598.6	(2.50)	643.6	(2.56)	668.9	(3.59)
New Zealand	355.4	(4.93)	392.0	(4.43)	454.2	(2.76)	588.8	(3.12)	641.6	(3.92)	671.4	(3.40)
Poland	348.4	(5.18)	379.7	(3.77)	433.8	(3.34)	556.9	(3.22)	608.8	(4.12)	638.4	(4.60)
United States	337.1	(4.27)	368.5	(4.29)	424.7	(3.92)	550.6	(4.86)	606.6	(4.60)	636.7	(5.91)
Germany	346.7	(4.96)	380.2	(4.66)	443.1	(4.35)	585.2	(3.10)	637.7	(3.45)	666.2	(3.66)
Ireland	337.8	(5.75)	376.1	(4.37)	432.2	(3.13)	547.6	(2.85)	590.6	(3.07)	617.4	(4.27)
France	320.9	(5.85)	361.5	(6.26)	429.2	(4.84)	569.6	(3.70)	622.1	(3.88)	651.7	(5.39)
United Kingdom	348.1	(3.45)	380.3	(3.10)	433.8	(2.97)	552.0	(3.24)	606.1	(3.88)	634.7	(3.23)
OECD	342.5	(0.89)	376.2	(0.75)	433.4	(0.62)	560.0	(0.59)	613.1	(0.71)	643.0	(0.83)
Shanghai-China	421.3	(7.14)	461.7	(4.96)	531.4	(3.95)	674.0	(3.25)	726.4	(4.16)	757.3	(4.63)
Northern Ireland	348.0	(4.21)	377.9	(4.55)	429.0	(4.09)	557.2	(3.56)	608.5	(5.15)	637.3	(5.23)

Low achieving students in Ireland (at the 5th percentile) have a score that is about 5 points lower that of their OECD counterparts. Nevertheless, Ireland's low-achieving students have a mean score that is the third lowest of the ten comparison countries/economies, after France (320.9) and the United States (337.1). The United Kingdom and Northern Ireland both have a score of around 348 points at the 5th percentile, which is just above the OECD average.

Performance on Mathematics Proficiency Levels

The proficiency levels used to describe mathematics performance in PISA 2009 were established in PISA 2003. The mathematics scale is split into six proficiency levels, ordered from Level 6, the highest level, to Level 1, the most basic level of proficiency measured by PISA. Students who do not reach Level 1 are simply classified as below Level 1, as the test does not include items that measure mathematics proficiency below this level. As with reading, Level 2 is used as a benchmark for poor levels of performance, as the OECD (2010a) considers it a baseline level of proficiency at which students start to demonstrate the mathematical skills required for their future development. Similarly, Level 5 is considered a benchmark for high levels of achievement.

Table 5.3: Descriptions of the six levels of proficiency on the mathematics scale and percentages of students achieving each level (OECD and Ireland)

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, Figure I.3.8.

Table 5.3 provides descriptions of the types of tasks that students at the different levels of proficiency are capable of performing, the range of scores on the mathematics scale associated with each level, and the percentages of students at each proficiency level in Ireland and on average across OECD countries. The percentage of students in Ireland performing at the highest level of proficiency (at or above Level 5) (6.7%) is much lower than the OECD average (12.7%). Other countries that are below the OECD average in their percentages of high-performing students include the United States and the United Kingdom (both 9.9%), Northern Ireland (10.3%) and Poland (10.4%) (Table 5.4).

The percentage of low-performing students in Ireland (scoring below Level 2) (20.8%)[12] is just below the OECD average (22.0%). There are similar percentages of low-performing students in the United Kingdom (20.2%), Northern Ireland (21.4%), and Poland (20.5%), though, as noted above, each of these countries/economies exhibited higher percentages of high-performing students than Ireland. The three highest-performing comparison countries/economies, Shanghai-China, Korea, and Finland, have both a high percentage of high performers and a low percentage of low performers. For example, in Finland, 7.8% of students scored below Level 2 and 21.6% scored at or above Level 5.

These analyses of the distribution of performance show that Ireland's below average overall performance in mathematics is a result of relatively poor performance at the upper end of the achievement scale, both in terms of the achievement scores of high-performing students and the percentages of students who can be classified as high-achieving. They also show that, relative to the OECD average, the distribution of achievement in Ireland is quite narrow.

Table 5.4: Percentage of students at each proficiency level on the mathematics scale in Ireland, the OECD, and selected comparison countries

	Below Level 1		Level 1		Level 2		Level 3		Level 4		Level 5		Level 6	
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Korea	1.9	(0.49)	6.2	(0.72)	15.6	(0.99)	24.4	(1.21)	26.3	(1.30)	17.7	(0.97)	7.8	(0.96)
Finland	1.7	(0.25)	6.1	(0.45)	15.6	(0.83)	27.1	(0.95)	27.8	(0.87)	16.7	(0.79)	4.9	(0.53)
New Zealand	5.3	(0.53)	10.2	(0.54)	19.1	(0.84)	24.4	(0.88)	22.2	(0.98)	13.6	(0.74)	5.3	(0.45)
Poland	6.1	(0.54)	14.4	(0.75)	24.0	(0.88)	26.1	(0.77)	19.0	(0.85)	8.2	(0.61)	2.2	(0.41)
United States	8.1	(0.72)	15.3	(0.98)	24.4	(0.97)	25.2	(0.95)	17.1	(0.93)	8.0	(0.85)	1.9	(0.46)
Germany	6.4	(0.63)	12.2	(0.72)	18.8	(0.88)	23.1	(0.87)	21.7	(0.92)	13.2	(0.87)	4.6	(0.46)
Ireland	7.3	(0.63)	13.6	(0.74)	24.5	(1.09)	28.6	(1.20)	19.4	(0.92)	5.8	(0.59)	0.9	(0.20)
France	9.5	(0.88)	13.1	(1.07)	19.9	(0.94)	23.8	(1.12)	20.1	(1.01)	10.4	(0.72)	3.3	(0.48)
United Kingdom	6.2	(0.46)	14.0	(0.71)	24.9	(0.88)	27.2	(1.10)	17.9	(0.96)	8.1	(0.63)	1.8	(0.27)
OECD	8.0	(0.12)	14.0	(0.13)	22.0	(0.15)	24.3	(0.17)	18.9	(0.15)	9.6	(0.12)	3.1	(0.08)
Shanghai-China	1.4	(0.26)	3.4	(0.38)	8.7	(0.63)	15.2	(0.79)	20.8	(0.79)	23.8	(0.80)	26.6	(1.19)
Northern Ireland	6.5	(0.78)	14.9	(1.06)	24.6	(1.19)	24.9	(1.46)	18.9	(0.98)	8.5	(0.94)	1.8	(0.44)

[12] This does not equal to the sum of the percentages in Table 5.3 as multiple decimal places were used when combining percentages.

Gender Differences on Mathematics

Ireland is one of 13 OECD countries in which there was no significant gender difference in overall mathematics achievement. The remaining 21 OECD countries all have significant gender differences (in favour of male students), although there is a lot of variation in the size of the gender gap across countries. Gender differences in mathematics tend not to be as large as those in reading, with the largest gap (21.8 points) in Belgium. On average across OECD countries, there is a significant gender difference of 11.5 points in favour of males, compared to a non-significant difference of 7.5 points, also favouring males, in Ireland. Both male and female students in Ireland have significantly lower mean mathematics scores than their OECD counterparts (Table 5.5).

Table 5.5: Gender differences on the mathematics scale in Ireland, the OECD, and selected comparison countries

	Males		Females		Difference (males-females)	
	Mean	SE	Mean	SE	Score diff	SE
Korea	547.8	6.23	544.5	4.52	3.4	7.43
Finland	541.8	2.50	539.2	2.53	2.6	2.56
New Zealand	523.1	3.25	515.3	2.94	7.8	4.13
Poland	496.6	3.03	493.1	3.21	3.5	2.57
United States	497.3	4.03	477.0	3.79	**20.3**	3.23
Germany	520.4	3.57	504.8	3.32	**15.6**	3.89
Ireland	490.9	3.36	483.3	3.02	7.5	3.88
France	505.1	3.85	488.9	3.35	**16.3**	3.78
United Kingdom	502.8	3.23	482.4	3.27	**20.5**	4.37
OECD	501.4	0.61	489.9	0.56	**11.5**	0.64
Shanghai-China	599.4	3.74	600.7	3.15	-1.3	3.98
Northern Ireland	501.1	5.87	483.8	3.99	**17.3**	7.83

Note. Significant gender differences are marked in bold.

Of the comparison countries/economies listed in Table 5.5, there is a significant gender gap in favour of males in the United Kingdom (20.5), the United States (20.3), Northern Ireland (17.3), France (16.3) and Germany (15.6). The relatively large gender gap in performance in Northern Ireland may relate to the higher average performance of male students in Northern Ireland (501.1 points compared to 490.9 points in Ireland).

There is very little difference between the percentages of male and female students in Ireland scoring at the lowest proficiency level (below Level 2) (Table 5.6). The average percentage of male students performing at this level across OECD countries (20.9%) is almost identical to the corresponding Irish average (20.6%), but slightly more females perform at this level across the OECD (23.1%) than in Ireland (21.0%), which means that there is a greater gender difference among low-achieving students on average across OECD countries than in Ireland.

In contrast, gender differences among high-achieving students (scoring at or above Level 5) are evident both at OECD level and in Ireland. Just 5.1% of female students in Ireland achieve at this level, compared to 8.1% of male students. There are higher percentages of both female (10.6%) and male (14.8%) students scoring at or above Level 5 on average across OECD countries compared to Ireland, but the gender gap is similar to that in Ireland.

Table 5.6: Percentages of male and female students achieving each proficiency level on the mathematics scale – Ireland and the OECD

	Ireland				OECD			
	Males		Females		Males		Females	
Level	%	SE	%	SE	%	SE	%	SE
Level 6	1.2	(0.4)	0.5	(0.2)	3.9	(0.1)	2.2	(0.1)
Level 5	6.9	(0.8)	4.6	(0.6)	10.9	(0.2)	8.4	(0.1)
Level 4	21.1	(1.2)	17.7	(1.3)	19.5	(0.2)	18.4	(0.2)
Level 3	27.4	(1.5)	29.8	(1.6)	23.8	(0.2)	24.9	(0.2)
Level 2	22.8	(1.4)	26.3	(1.3)	21.0	(0.2)	23.1	(0.2)
Level 1	12.9	(1.1)	14.2	(1.0)	13.3	(0.2)	14.7	(0.2)
Below Level 1	7.7	(0.9)	6.8	(0.7)	7.6	(0.1)	8.4	(0.2)

Changes in Mathematics Achievement Since PISA 2003

Changes in mathematics performance are examined between PISA 2003, the cycle in which mathematics was last a major domain, and PISA 2009. Comparisons are based on the 39 countries[13] (28 of which are OECD member states) that have valid data for both these PISA cycles.

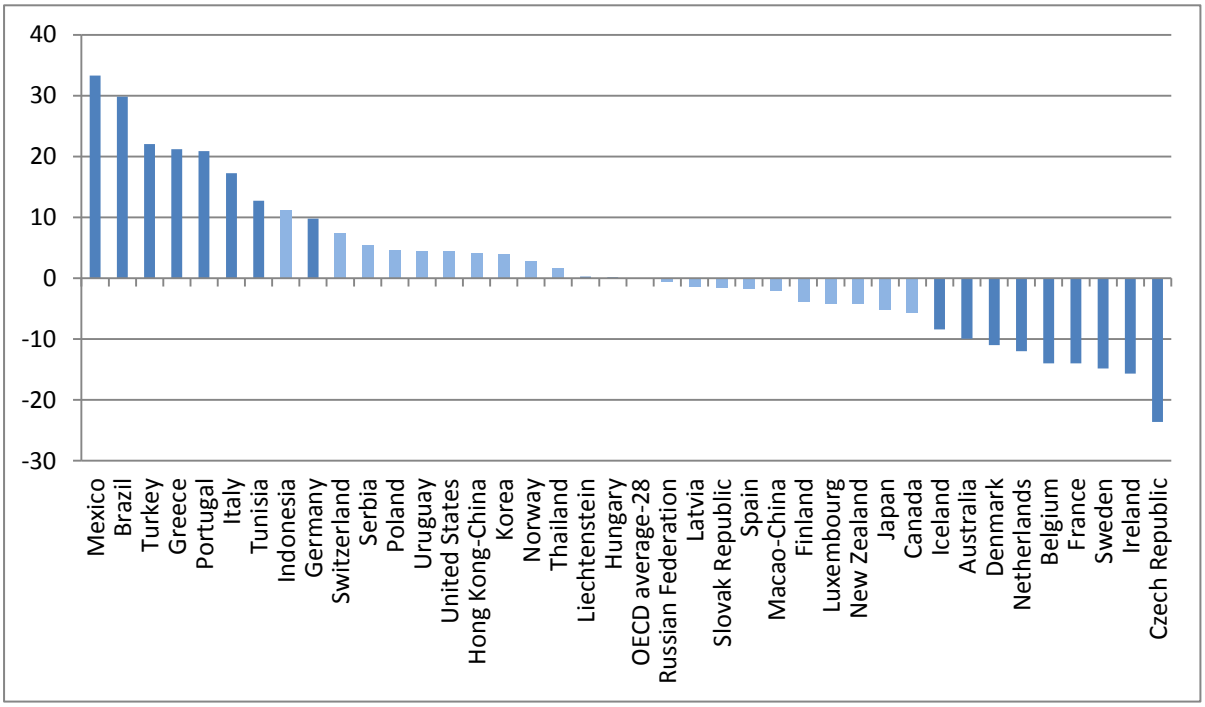
Changes in Overall Mathematics Performance

Figure 5.1 displays changes in mathematics performance between PISA 2003 and 2009 for all countries that have valid data for both cycles. On average across these 28 OECD countries, mathematics performance was almost identical (500 in 2003 and 499 in 2009). Ireland experienced a drop in achievement of close to 16 points (from 502.8 to 487.1), a decline exceeded only by the Czech Republic (24 points). Almost all of the drop in mathematics achievement in Ireland (14 of the 16 points) occurred between 2006 and 2009. Other countries which show a statistically significant decline in mathematics performance include Sweden (15 points), France (14) and Belgium (14). Northern Ireland also displays a significant drop in achievement of 22.5 points (not shown in Figure 5.1). The largest increases in performance are seen in Mexico (33 points) and Brazil (30). Germany also had a statistically significant, but more modest, increase in performance, of 10 points.

Although 17 countries have seen statistically significant changes in mathematics achievement since 2003, just three changed position in relation to the OECD average. Poland and Hungary both experienced an improvement in relative position, from being significantly below the OECD average in 2003 to not differing significantly from it in 2009. Ireland is the only country with a disimprovement in relative position: its mean mathematics score was at the OECD average in 2003, but significantly below it in 2009.

[13] Australia, 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. The United Kingdom and Austria are not included in the trends analysis for technical reasons.

Figure 5.1: Changes in average mathematics scores between 2003 and 2009 – countries participating in both years, and OECD average



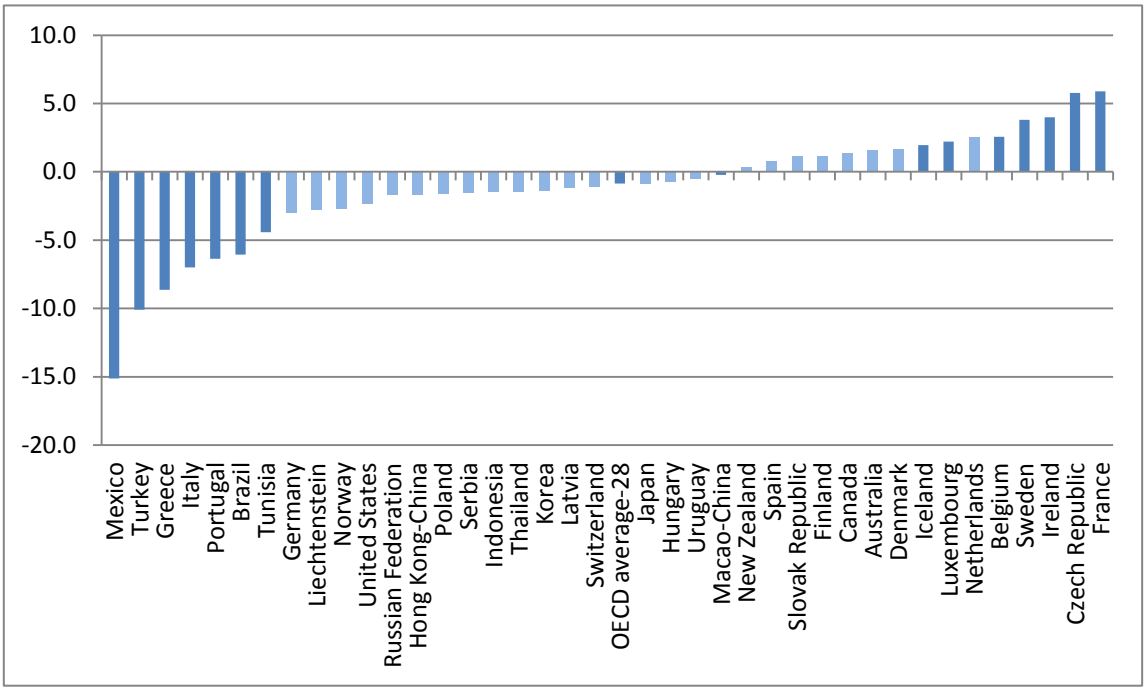
Source: OECD, 2010e, Figure V.3.1. Significant differences are marked in a darker shade.

Changes in Mathematics Performance Among Low and High Achieving Students

Figure 5.2 displays the change in the percentages of low achieving students (below proficiency Level 2) between 2003 and 2009. On average across the 28 OECD countries, the percentage of students performing below Level 2 dropped only slightly, though significantly (from 21.6% to 20.8%). Ireland was one of seven countries which had a significant increase in the percentage of low achievers (by 4.0%) between cycles. In 2003, Ireland had significantly fewer students (16.8%) scoring below Level 2 than the average across OECD countries (21.5%), but by 2009, the percentage of low achieving students in Ireland (20.8%) did not differ significantly from the OECD average (22.0%). Other countries that experienced significant increases in the percentage of low achieving students between 2003 and 2009 include France (5.9%), the Czech Republic (5.8%), Sweden (3.8%) and Iceland (2.0%). There was a significant decrease in percentage of students achieving below Level 2 in seven countries, including Greece (8.6%), Italy (7.0%), and Portugal (6.4%).

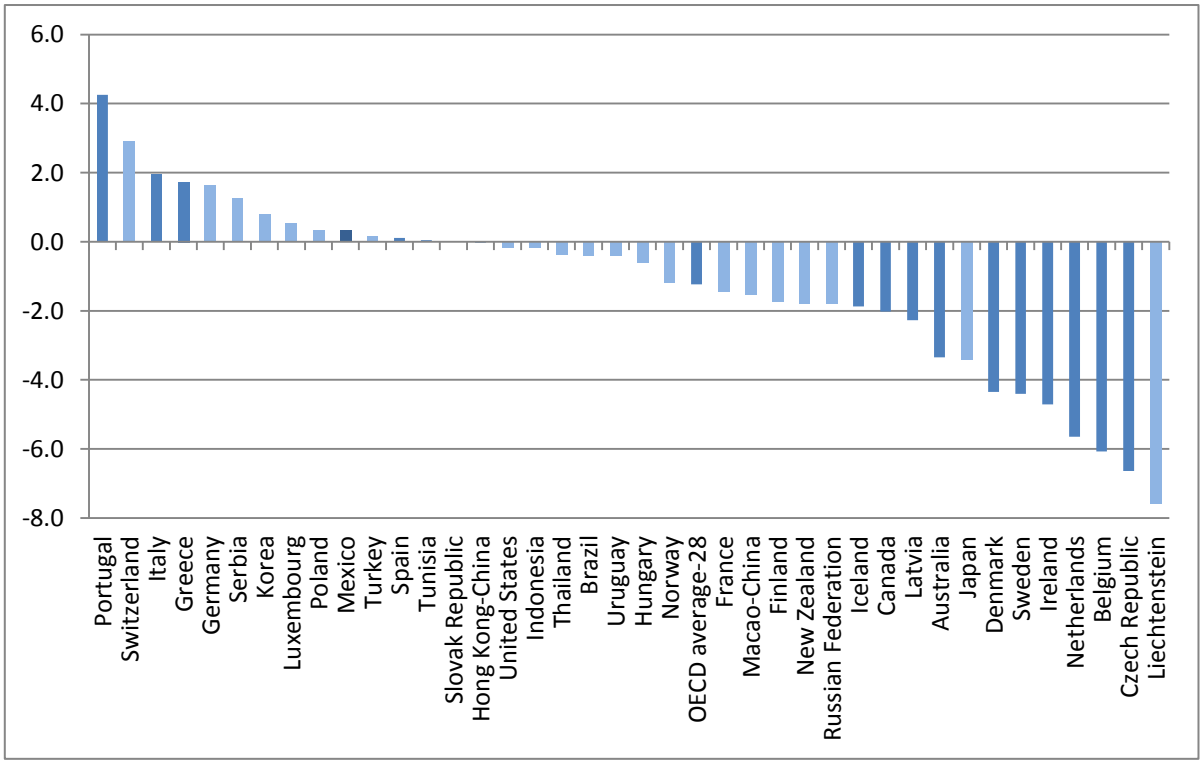
Changes in the percentages of students performing at or above Level 5 in mathematics between 2003 and 2009 are presented in Figure 5.3. There was a significant decrease in the percentage of high-achieving students in Ireland, from 11.4% in 2003 to 6.7% in 2009. The percentage of students in Ireland achieving at or above Level 5 was below the OECD average in 2003 (14.7%) and in 2009 (13.4%). Significant drops in percentages of high achievers occurred in 10 other countries, including the Czech Republic (6.6%), Denmark (4.4%), Iceland (1.9%) and the Netherlands (5.6%), while significant increases in percentages of high achievers occurred in Greece (1.7%), Italy (1.9%), Mexico (0.3%), and Portugal (4.3%).

Figure 5.2: Changes in the percentage of students below proficiency Level 2 in mathematics between 2003 and 2009 – countries participating in both years, and OECD average



Source: OECD, 2010e, Figure V.3.3. Significant differences are marked in a darker shade.

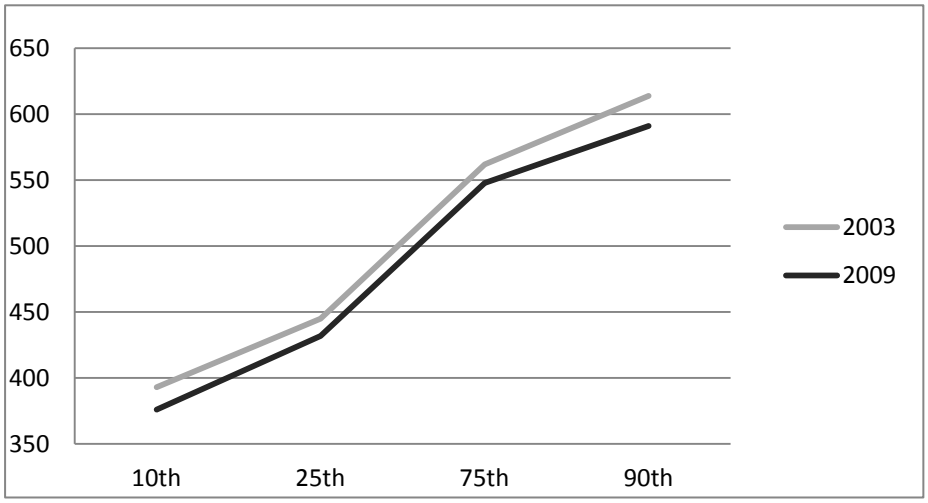
Figure 5.3: Changes in the percentage of students at or above proficiency Level 5 in mathematics between 2003 and 2009 – countries participating in both years, and OECD average



Source: OECD, 2010e, Figure V.3.4. Significant differences are marked in a darker shade.

A comparison of the mathematics performance of students in Ireland at key benchmarks (10th, 25th, 75th, and 90th percentiles) in 2003 and 2009 shows that, in contrast to the uniform decline across the range of achievement in reading (see Chapter 3), the decline in mathematics performance is slightly greater at the top end of the achievement distribution (Figure 5.4).

Figure 5.4: Performance at key percentiles on the mathematics scale – Ireland, 2003 and 2009



Changes in the Mathematics Performance of Male and Female Students

In 2003 in Ireland, male students obtained a significantly higher mean mathematics score (510) than female students (495). The mean scores of both genders dropped significantly between 2003 and 2009. The decline was greater for males (19 points) than for females (12 points), which narrowed the gender gap to a level that was no longer statistically significant in 2009 (491 for males; 483 for females). On average across OECD countries, the gender gap changed very little, with male students significantly outscoring females by 11.1 points in 2003 and by 11.5 points in 2009.

Between 2003 and 2009 in Ireland, there was an increase in the percentages of both males (from 15.0% to 20.6%) and females (from 18.7% to 21.0%) scoring below proficiency Level 2. The increase was greater for males (5.6%) than for females (2.3%). The decline in performance was more marked for males at the upper levels of proficiency. The percentage of males in Ireland performing at or above proficiency Level 5 dropped by 5.6 point (from 13.7% in 2003 to 8.1% in 2009), while the percentage of females at this level dropped by 3.9 points (from 9.0% to 5.1%).

Overall Performance on Science

Ireland achieved a mean score of 508.0 on the science scale, which is significantly higher than the OECD average of 500.8, albeit by just 7 points (Table 5.7). This score places Ireland 14th out of 34 OECD countries and 20th out of 65 participating countries/economies. The application of a 95% confidence interval indicates that Ireland's true rank lies between 11th and 17th among OECD countries and between 16th and 23rd among all participating countries/economies.

Ten OECD countries (including Finland, Korea, New Zealand, and Germany) achieved mean scores on the science scale that are significantly higher than Ireland's, while fifteen OECD countries (including France, Iceland, and Sweden) performed at a

significantly lower level than Ireland. The eight OECD countries that do not differ significantly from Ireland in their mean scores on the science scale include the United Kingdom, Poland, and the United States. The mean score for Northern Ireland (511.4) does not differ significantly from that achieved by Ireland.

As in the case of reading and mathematics, Shanghai-China achieved the highest mean score in science (574.6), followed by Finland (554.1), Hong Kong-China (549.0), Singapore (541.7), and Japan (539.4).

Table 5.7: Mean country scores and standard errors (SE) for the science scale and positions relative to the OECD and Irish means – all participating countries

	Mean	SE	SD	SE	IRL		Mean	SE	SD	SE	IRL
Shanghai-China	574.6	(2.30)	81.7	(1.68)	▲	Italy	488.8	(1.77)	96.6	(1.48)	▼
Finland	554.1	(2.34)	89.2	(1.11)	▲	Spain	488.3	(2.05)	87.5	(1.05)	▼
Hong Kong-China	549.0	(2.75)	87.4	(1.97)	▲	*Croatia*	486.4	(2.83)	84.8	(1.78)	▼
Singapore	541.7	(1.36)	104.0	(1.12)	▲	Luxembourg	483.9	(1.23)	104.5	(1.07)	▼
Japan	539.4	(3.41)	99.7	(2.50)	▲	*Russian Federation*	478.3	(3.30)	90.2	(1.99)	▼
Korea	538.0	(3.44)	82.2	(2.32)	▲	Greece	470.1	(4.04)	91.6	(2.15)	▼
New Zealand	532.0	(2.58)	107.3	(1.96)	▲	*Dubai (UAE)*	466.5	(1.22)	105.6	(1.07)	▼
Canada	528.7	(1.62)	89.8	(0.94)	▲	Israel	454.9	(3.11)	106.7	(2.43)	▼
Estonia	527.8	(2.67)	84.2	(1.62)	▲	Turkey	453.9	(3.60)	80.7	(2.00)	▼
Australia	527.3	(2.53)	101.5	(1.61)	▲	Chile	447.5	(2.92)	81.4	(1.48)	▼
Netherlands	522.2	(5.42)	96.1	(2.13)	▲	*Serbia*	442.8	(2.37)	84.1	(1.64)	▼
Chinese Taipei	520.4	(2.63)	86.6	(1.64)	▲	*Bulgaria*	439.3	(5.86)	105.6	(2.54)	▼
Germany	520.4	(2.80)	100.6	(1.90)	▲	*Romania*	428.2	(3.36)	78.8	(1.89)	▼
Liechtenstein	519.9	(3.42)	87.3	(3.36)	▲	*Uruguay*	427.2	(2.57)	96.5	(1.70)	▼
Switzerland	516.6	(2.82)	95.9	(1.40)	▲	*Thailand*	425.3	(2.98)	79.6	(1.99)	▼
United Kingdom	513.7	(2.52)	98.8	(1.36)	O	Mexico	415.9	(1.79)	77.2	(0.94)	▼
Slovenia	511.8	(1.15)	94.2	(0.96)	O	*Jordan*	415.4	(3.54)	89.3	(2.09)	▼
Macao-China	511.1	(1.03)	76.3	(0.85)	O	*Trinidad and Tobago*	410.2	(1.24)	108.2	(1.03)	▼
Poland	508.1	(2.41)	86.9	(1.21)	O	*Brazil*	405.4	(2.43)	84.0	(1.35)	▼
Ireland	508.0	(3.27)	97.1	(2.10)		*Colombia*	401.8	(3.63)	81.3	(1.84)	▼
Belgium	506.6	(2.52)	105.0	(2.28)	O	*Montenegro*	401.3	(2.03)	87.3	(1.36)	▼
Hungary	502.6	(3.14)	86.5	(2.88)	O	*Argentina*	400.8	(4.58)	102.0	(3.68)	▼
United States	502.0	(3.64)	97.6	(1.69)	O	*Tunisia*	400.7	(2.69)	81.4	(1.88)	▼
Czech Republic	500.5	(2.97)	97.3	(1.95)	O	*Kazakhstan*	400.4	(3.13)	86.6	(1.73)	▼
Norway	499.9	(2.60)	89.6	(1.02)	O	*Albania*	390.7	(3.94)	88.8	(1.67)	▼
Denmark	499.3	(2.48)	91.9	(1.30)	▼	*Indonesia*	382.6	(3.78)	68.8	(2.08)	▼
France	498.2	(3.60)	102.6	(2.84)	▼	*Qatar*	379.4	(0.89)	103.7	(0.77)	▼
Iceland	495.6	(1.41)	95.4	(1.18)	▼	*Panama*	375.9	(5.74)	90.0	(2.88)	▼
Sweden	495.1	(2.72)	99.8	(1.53)	▼	*Azerbaijan*	373.2	(3.05)	73.9	(1.64)	▼
Austria	494.3	(3.24)	101.8	(2.19)	▼	*Peru*	369.4	(3.49)	89.2	(2.08)	▼
Latvia	493.9	(3.07)	78.0	(1.73)	▼	*Kyrgyzstan*	329.5	(2.92)	90.6	(2.02)	▼
Portugal	492.9	(2.90)	83.4	(1.42)	▼	OECD average	500.8	(0.5)	94.0	(0.3)	
Lithuania	491.4	(2.93)	85.1	(2.13)	▼						
Slovak Republic	490.3	(2.99)	95.4	(2.55)	▼						

	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

Note: OECD countries are in regular font, partner countries are in italics.

Variation in Performance on Science

Table 5.7 also displays the standard deviations of average country performance in the science assessment. The standard deviation in Ireland (97.1) is marginally larger than the OECD average (94.0), implying a slightly wider distribution of science scores than on average across OECD countries. Note that there is considerable variation in the size of the standard deviation across countries, even among those in which average

achievement does not differ significantly from that in Ireland. For example, the standard deviation for Poland (86.9) is considerably smaller than that for Belgium (105.0).

Table 5.8 presents mean science scores achieved by students at key percentile markers ranging from the 5th to the 95th percentile, for Ireland, the OECD and the comparison countries/economies. On average across the OECD, the range of achievement in science (308) is slightly larger than that for reading (305) or mathematics (300). The distribution of science achievement in Ireland (315) is wider than that in reading (309; see Chapter 3) and mathematics (279). Science is the only domain in which Ireland exceeds the OECD average difference. Among comparison countries/economies, the narrowest achievement differences are found in Shanghai-China (270), Poland (286) and Finland (294), while New Zealand (349) and France (339) have the largest differences. There is less variation in science achievement in Ireland than in Northern Ireland (335).

Comparing scores at the 5th and 95th percentiles in Ireland with the OECD averages, we can see that Ireland's low-performing students scoring at the 5th percentile) have a score that is similar to their OECD counterparts (around 341) (Table 5.8), while the score of high-performing students (at the 95th percentile) in Ireland (656.3) exceeds the corresponding OECD estimate (648.9). While the mean science score of students in both Northern Ireland and Poland are similar to the Irish mean, these countries exhibit very different patterns of performance variation. Northern Ireland is almost identical to Ireland (and to the OECD average) in respect of the score at the 5th percentile (340.7), but the score at the 95th percentile exceeds that of students in the rest of Ireland by 20 points (676.1). On the other hand, low-scoring students in Poland exhibit a comparatively high score (364.5), but the score of Poland's high-achieving students (650.0) is somewhat lower than that of high-achieving students in Ireland.

Table 5.8: Scores of students at key percentile markers on the science scale in Ireland, the OECD, and selected comparison countries

	5th		10th		25th		75th		90th		95th	
	Score	SE	Score	SE	Score	SE	Score	SE	Score	SE	Score	SE
Korea	399.1	(6.49)	430.6	(5.20)	484.7	(4.25)	595.2	(3.74)	639.7	(3.69)	664.7	(4.82)
Finland	400.4	(4.22)	436.6	(4.22)	496.1	(3.27)	616.5	(2.85)	664.7	(2.95)	694.3	(3.58)
New Zealand	347.5	(5.62)	389.8	(4.26)	460.9	(4.07)	607.7	(3.04)	666.6	(3.33)	697.0	(3.56)
Poland	364.5	(3.93)	395.5	(3.30)	448.4	(2.71)	568.7	(2.66)	620.6	(2.95)	650.0	(3.80)
United States	341.3	(4.77)	374.4	(4.48)	433.5	(3.89)	571.6	(4.71)	629.3	(5.07)	662.4	(6.72)
Germany	345.5	(7.03)	382.6	(6.16)	452.2	(4.10)	594.1	(3.35)	645.3	(3.51)	675.4	(3.82)
Ireland	341.3	(8.30)	382.3	(4.89)	445.4	(3.66)	575.6	(3.32)	627.3	(4.00)	656.3	(4.37)
France	313.7	(8.07)	357.8	(7.13)	432.8	(5.62)	572.0	(3.83)	623.7	(4.24)	652.8	(4.64)
United Kingdom	348.4	(4.26)	384.7	(3.62)	446.7	(3.70)	582.8	(3.13)	640.4	(3.34)	672.2	(3.90)
OECD	341.2	(0.99)	377.3	(0.82)	438.1	(0.66)	567.1	(0.56)	619.5	(0.62)	648.9	(0.72)
Shanghai-China	430.2	(4.86)	466.9	(4.35)	523.0	(2.95)	631.7	(2.77)	673.7	(3.42)	700.0	(3.30)
Northern Ireland	340.7	(12.13)	378.2	(9.04)	440.5	(7.33)	583.6	(5.01)	641.7	(5.82)	676.1	(5.71)

Performance on Science Proficiency Levels

As in the case of reading and mathematics, performance on the science scale can be defined in terms of proficiency levels, which divide student performance into descriptive categories. Proficiency is reported in terms of six levels, from Level 1, the most basic level, to Level 6, the most advanced level. There is also a below Level 1 category to take account of students who do not reach the most basic level of proficiency measured by PISA. These proficiency levels were established in PISA 2006, when science was the major assessment domain. Performance at proficiency Level 2 is considered a baseline level at which students 'begin to demonstrate the science competencies that will enable them to participate effectively in life situations related to science and technology' (OECD, 2010a, p.148). Table 5.9 displays percentages of students at each proficiency level, for Ireland and the OECD, along with descriptions of the skills displayed by students at each level, and the cut-points on the science scale that delimit the categories.

Table 5.9: Descriptions of the six levels of proficiency on the science scale and percentages of students achieving each level (OECD and Ireland)

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 708)*	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, Figure I.3.19.

There is a lower percentage of students in Ireland who scored at or below Level 1 (15.2%)[14] compared with the OECD average (18.0%), while the percentage of students in Ireland who scored at or above Level 5 (8.7%) is very similar to the average across OECD countries (8.5%). Shanghai-China and Finland, the countries/economies with the highest mean scores on the combined science scale, both have low percentages of

[14] Multiple decimal places were used to calculate the percentages of students across different proficiency levels.

students at or below Level 1 (3.2% in Shanghai-China and 6.0% in Finland) and high percentages at or above Level 5 (24.3% in Shanghai-China and 18.7% in Finland) (Table 5.10). Northern Ireland is quite similar to Ireland in its percentage of low-achieving students (16.7% compared to 15.2%), but has a higher percentage of high-achieving students than Ireland (11.8% versus 8.7%).

Table 5.10: Percentage of students at each proficiency level on the science scale in Ireland, the OECD, and selected comparison countries

	Below Level 1		Level 1		Level 2		Level 3		Level 4		Level 5		Level 6	
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Korea	1.1	(0.32)	5.2	(0.68)	18.5	(1.15)	33.1	(1.13)	30.4	(1.14)	10.5	(0.90)	1.1	(0.31)
Finland	1.1	(0.19)	4.9	(0.41)	15.3	(0.73)	28.8	(0.95)	31.2	(1.08)	15.4	(0.74)	3.3	(0.34)
New Zealand	4.0	(0.53)	9.4	(0.52)	18.1	(1.01)	25.8	(0.88)	25.1	(0.74)	14.0	(0.72)	3.6	(0.36)
Poland	2.3	(0.33)	10.9	(0.69)	26.1	(0.80)	32.1	(0.81)	21.2	(0.97)	6.8	(0.49)	0.8	(0.19)
United States	4.2	(0.54)	13.9	(0.93)	25.0	(0.87)	27.5	(0.80)	20.1	(0.94)	7.9	(0.78)	1.3	(0.28)
Germany	4.1	(0.51)	10.7	(0.81)	20.1	(0.86)	27.3	(1.08)	25.0	(1.18)	10.9	(0.68)	1.9	(0.29)
Ireland	4.4	(0.69)	10.7	(1.01)	23.3	(1.17)	29.9	(0.99)	22.9	(0.95)	7.5	(0.68)	1.2	(0.23)
France	7.1	(0.82)	12.2	(0.83)	22.1	(1.25)	28.8	(1.32)	21.7	(1.02)	7.3	(0.70)	0.8	(0.22)
United Kingdom	3.8	(0.34)	11.2	(0.68)	22.7	(0.73)	28.8	(0.97)	22.2	(0.83)	9.5	(0.61)	1.9	(0.25)
OECD	5.0	(0.10)	13.0	(0.14)	24.4	(0.16)	28.6	(0.17)	20.6	(0.16)	7.4	(0.10)	1.1	(0.04)
Shanghai-China	0.4	(0.11)	2.8	(0.36)	10.5	(0.66)	26.0	(0.99)	36.1	(1.12)	20.4	(0.96)	3.9	(0.45)
Northern Ireland	4.4	(1.17)	12.3	(0.94)	21.8	(1.32)	28.2	(1.53)	21.6	(1.14)	9.7	(1.09)	2.1	(0.40)

Gender Differences on Science

The majority of OECD countries do not display significant differences in the mean scores of male and female students, and the gender gaps that do exist tend to be small compared to those in reading and mathematics. In Ireland, female students obtained a marginally higher mean science score (509.4) than males (506.6), but the difference is not statistically significant. On average across OECD countries, the mean science scores of males (500.9) and females (500.8) are almost identical. Of the comparison countries/economies listed in Table 5.11, Finland is the only country that has a significant gender difference (of 15.5 points) in favour of females[15], while the United States[16] and the United Kingdom have significant differences of 13.7 and 9.4 points, respectively, in favour of male students. The mean scores of female students in Northern Ireland (509.1) is almost identical to that of female students in Ireland (509.4), but male students in Northern Ireland obtained a higher mean score (513.8) than males in Ireland (506.6).

Slightly more males than females perform below Level 2, both in Ireland (16.0% of males and 14.3% of females) and on average across OECD countries (18.8% of males and 17.1% of females). At the upper end of the scale (Level 5 or above), the percentages of males (9.0%) and females (8.3%) in Ireland are similar. On average across OECD countries, there is a slightly larger gender gap in favour of males at the upper levels of achievement (9.4% of males compared to 7.7% of females score at Level 5 or above).

[15] Slovenia and Japan are the only other OECD countries in which females achieved significantly higher mean science scores than males.
[16] Among OECD countries, the United States displays the largest gender gap in favour of males on the science scale.

Table 5.11: Gender differences on the science scale in Ireland, the OECD, and selected comparison countries

	Males		Females		Difference (males-females)	
	Mean	SE	Mean	SE	Score diff	SE
Korea	536.8	5.01	539.3	4.21	-2.4	6.26
Finland	546.4	2.73	561.8	2.58	**-15.5**	2.57
New Zealand	529.0	3.95	535.2	2.90	-6.2	4.64
Poland	505.1	2.70	511.0	2.81	-5.9	2.68
United States	508.7	4.24	495.0	3.71	**13.7**	3.28
Germany	523.1	3.70	517.6	3.28	5.5	4.22
Ireland	506.6	4.26	509.4	3.81	-2.7	4.78
France	499.9	4.65	496.6	3.49	3.3	3.90
United Kingdom	518.5	3.60	509.1	3.15	**9.4**	4.51
OECD	500.9	0.62	500.8	0.56	0.1	0.65
Shanghai-China	574.3	3.10	574.9	2.32	-0.6	2.94
Northern Ireland	513.8	8.69	509.1	4.46	4.7	10.41

Note. Significant gender differences are marked in bold.

Table 5.12: Percentages of male and female students achieving each proficiency level on the science scale – Ireland and the OECD

	Ireland				OECD			
	Males		Females		Males		Females	
	%	SE	%	SE	%	SE	%	SE
Level 6	1.4	(0.3)	0.9	(0.3)	1.4	(0.1)	0.9	(0.0)
Level 5	7.6	(0.9)	7.4	(0.9)	8.0	(0.1)	6.8	(0.1)
Level 4	22.8	(1.2)	23.0	(1.3)	20.5	(0.2)	20.6	(0.2)
Level 3	29.2	(1.2)	30.7	(1.3)	27.5	(0.2)	29.7	(0.2)
Level 2	22.9	(1.4)	23.7	(1.5)	23.8	(0.2)	24.9	(0.2)
Level 1	10.5	(1.0)	11.0	(1.6)	13.3	(0.2)	12.6	(0.2)
Below Level 1	5.5	(1.0)	3.3	(0.6)	5.5	(0.1)	4.5	(0.1)

Changes in Science Achievement Since PISA 2006

Changes in science performance are based on comparisons between PISA 2009 and PISA 2006, when science was the major domain. Fifty-six countries/economies, including 33 OECD countries, have valid data for both cycles[17].

Changes in Overall Science Performance

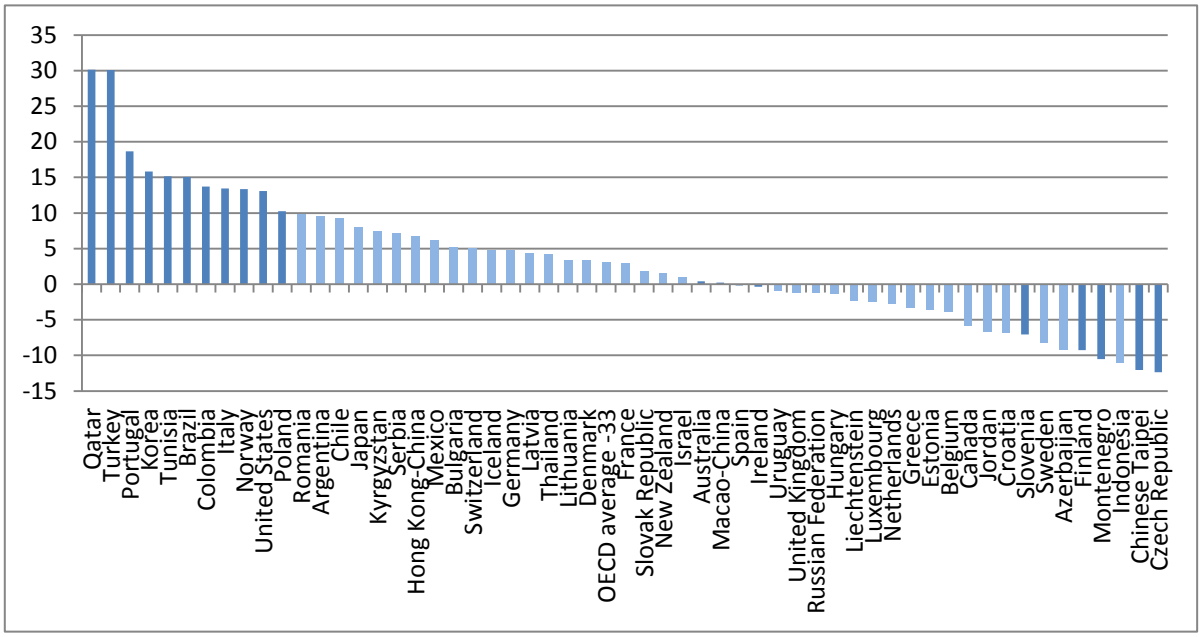
Score point changes in science performance between 2006 and 2009 are displayed in Figure 5.5. The majority of countries, including Ireland, exhibited no significant change. Ireland's mean science score was significantly above the OECD average in both 2006 (508.3 compared to 498.1) and 2009 (508.0 compared to 501.0).

Eleven countries show significant increases in mean science scores, including Portugal (by 19 points), Korea (16), Italy (13), Norway (13), the United States (13), and Poland (10). These improvements mean that Norway and the United States have moved from being below the OECD average in 2006 (487 and 489, respectively) to being very

[17] In addition to the countries listed in footnote 13, Argentina, Azerbaijan, Bulgaria, Chile, Chinese Taipei, Colombia, Croatia, Estonia, Israel, Jordan, Kyrgyzstan, Lituania, Montenegro, Qatar, Romania and Slovenia also have valid data for PISA 2006 and 2009.

close to the OECD average in 2009 (500 and 502, respectively). Mean science performance in Poland in 2009 (508) moved above the OECD average (501), having been at the OECD average in 2006 (498). Five countries exhibited a significant decline in science performance. These include the Czech Republic, which is now not significantly different from the OECD average, having been significantly above it in 2006. There was also a significant decline in Finland, although Finland still ranks second among all participating countries in PISA 2009. There was a slight though statistically insignificant increase in science performance in Northern Ireland (from 508.1 in 2006 to 511.4 in 2009).

Figure 5.5: Changes in average science scores between 2006 and 2009 – countries participating in both years, and OECD average



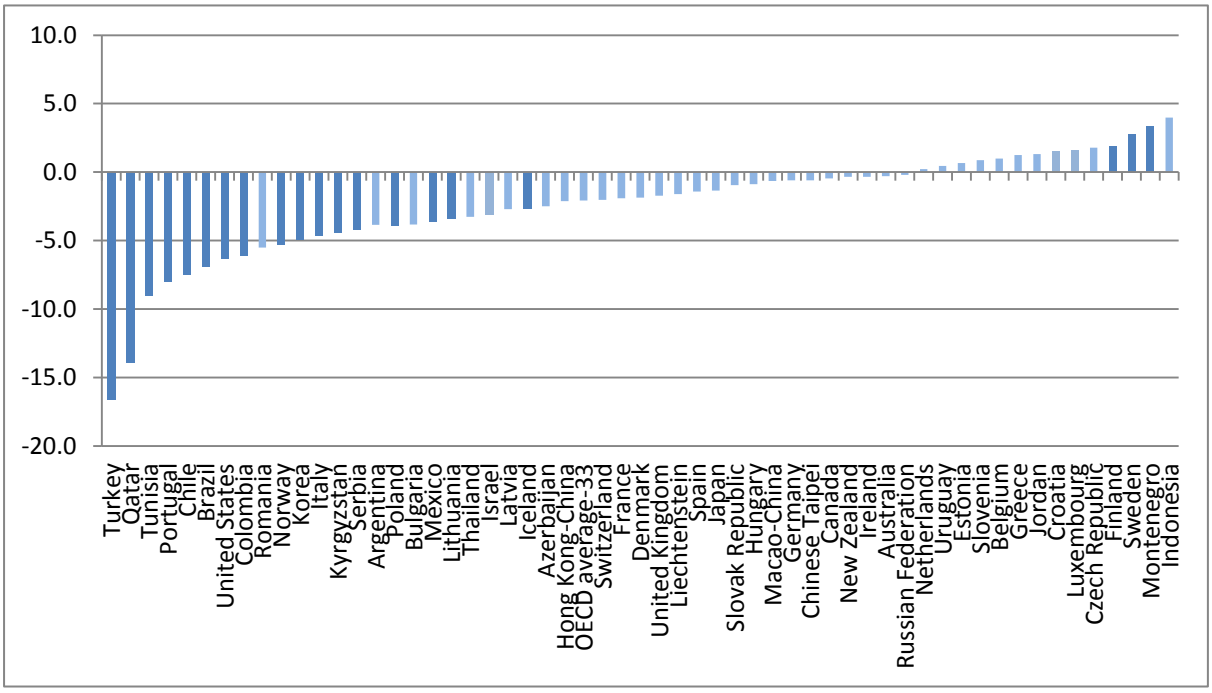
Source: OECD, 2010e, Figure V.3.5. Significant differences are marked in a darker shade.

Changes in Science Performance Among Low and High Achieving Students

Figure 5.6 shows changes between 2006 and 2009 in the percentages of low achieving students (at or below proficiency Level 2). On average across OECD countries, there was a significant decrease in the percentage of students performing below Level 2 (from 19.9% in 2006 to 17.9% in 2009). The percentage of students achieving at this level in Ireland is almost identical across cycles (15.5% in 2006 and 15.2% in 2009). Significant decreases in the percentage of low achieving students were recorded in 10 countries, including Iceland (2.6%), Korea (4.9%), Norway (5.3%), Poland (3.8%), Portugal (3.8%), Turkey (16.6%) and the United States (6.3%).

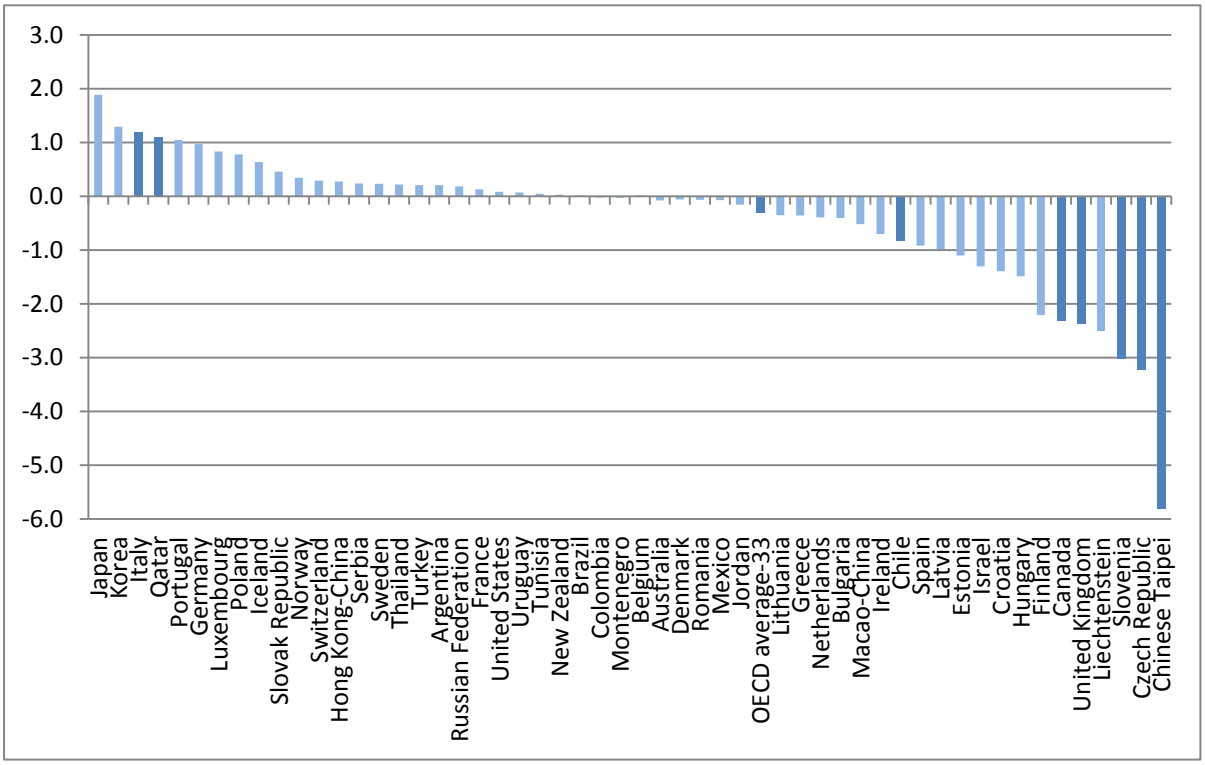
Poland and Korea are the only countries that had below average percentages of low achieving students in 2006 (17.0% and 11.2%, respectively) and which exhibited further, significant, declines in proportions of low achievers in 2009 (to 13.1% and 6.3%, respectively). Norway and Portugal were above the OECD average in 2006 (21.1% and 24.5%, respectively), but in 2009 had below-average percentages of low achievers (15.8% and 16.5%, respectively).

Figure 5.6: Changes in the percentage of students below proficiency Level 2 in science between 2006 and 2009 – countries participating in both years, and OECD average



Source: OECD, 2010e, Figure V.3.7. Significant differences are marked in a darker shade.

Figure 5.7: Changes in the percentage of students at or above proficiency Level 5 in science between 2006 and 2009 – countries participating in both years, and OECD average



Source: OECD, 2010e, Figure V.3.8. Significant differences are marked in a darker shade.

Figure 5.7 displays changes in the percentages of high-performing students (those at or above proficiency Level 5) in science between 2006 and 2009. In the majority of countries/economies, there was no significant change, although on average across OECD countries there was a very slight but significant decrease from 8.8% to 8.5%. Ireland showed a small, non-significant decline in percentage of high achievers, from 9.4% to 8.7%. Italy is the only OECD country to show a significant increase in high achievers, though the percentage of high achievers remained below the OECD average in both cycles (4.6% in 2006; 5.8% in 2009).

The United Kingdom and Canada were still above the OECD average of high-performing students in 2009, despite a drop of 2.4% in the former (from 13.7% to 11.4%) and a drop of 2.3% in the latter (from 14.4% to 12.1%). A significant decline in the percentage of students performing at or above Level 5 in the Czech Republic resulted in a change in the position of that country with respect to the OECD average. It was above average in 2006 (11.6% compared to 8.8%); in 2009, it was marginally below average (8.4% compared to 8.5%).

Changes in the Science Performance of Male and Female Students

On average across OECD countries, the gender gap in science performance in favour of males narrowed since 2006, from 2.2 points, to one-tenth of a point. In contrast, the gender gap in Ireland increased slightly, from 0.4 to 2.8 points in favour of female students, though it is still small and not significant. This change can be attributed to a slight increase in the mean score of females (from 508.5 to 509.4) along with a small decrease in the mean score of males (from 508.1 to 506.6), neither of which, however, is significant. In Northern Ireland, the mean scores of both males and females increased (from 509.2 to 513.8 for males and from 507.0 to 509.1 for females), but again, the changes are not significant.

Chapter Summary and Conclusions

Ireland's overall performance on mathematics ranked it 26th out of 34 OECD countries, with a mean score (487) that is significantly below the OECD average (496). However, the distribution of achievement, as indicated by the standard deviation (86), was narrower than on average across the OECD (92).

In Ireland, the score of students at the 5th percentile (338) was just slightly lower than the OECD average (343), while its score at the 95th percentile (617) was some 26 points lower than the OECD average (643), implying that Ireland's lower-than-average performance was due in part to the relatively low performance of higher achievers. This is consistent with the finding that, across the OECD, close to 13% of students achieved Levels 5 and 6 on the mathematics proficiency scale, compared to just under 7% in Ireland. At the other end of the scale, 21% of students in Ireland scored below proficiency Level 2, compared to 22% on average across the OECD.

The gender difference in favour of boys in Ireland (7.5 score points) is not statistically significant, and is smaller than the OECD average gender difference of 11.5 points, which is statistically significant. Similar percentages of males and females in Ireland (about 21%) scored below proficiency Level 2 on mathematics, while slightly more males (8%) than females (5%) scored at Levels 5 and 6.

Since 2003, the performance of Irish students has declined by about 16 points, which is the second largest decline observed across 28 OECD countries with valid data

for both cycles. Most of this decline (14 points) occurred since 2006. In 2003, the Irish average score was at the OECD average, while in 2009, it was significantly below it. Furthermore, the percentage of low achievers in Ireland increased by 4% and the percentage of high achievers in 2009 decreased by close to 5%.

The decline in Ireland's mathematics performance is a cause for concern, particularly now that the Irish average mathematics score is significantly below the OECD average. Not only has overall achievement declined, but drops in achievement are more marked among higher achievers, and it must be of concern that 21% of students in Ireland are unlikely to be able to solve even basic mathematical tasks in PISA.

The results for science show some contrast with those for mathematics. The average science score for Ireland (508) was significantly above the OECD average score (501) in 2009, ranking Ireland 14th out of 34 OECD countries. The range of scores in Ireland was similar to that across the OECD. For example, Ireland's score at the 5th percentile (341) is the same as the OECD average, while its score at the 95th percentile (656) is marginally above the OECD average (649). Across the OECD, 8.5% of students scored at proficiency Levels 5 and 6, while in Ireland, 8.7% were similarly classified. In Ireland, there were slightly fewer students scoring at or below Level 2 (15%), compared with the OECD average (18%).

On average across the OECD, girls achieved the same mean score as boys on the science assessment. In Ireland, the small gender difference (3 points) was not statistically significant. Similar percentages of males (16%) and females (14%) in Ireland scored below Level 2, and the percentages of males (9%) and females (8%) scoring at Levels 5 and 6 were also similar.

The average science score of students in Ireland did not change since 2006. Similarly, the percentages of students scoring at Levels 5 and 6, and below Level 2, have not changed. Gender differences in science performance have also remained unchanged.

The stability in science performance of students in Ireland may be regarded as a positive finding, since Ireland's score remains above the OECD average. Furthermore, girls and boys are doing equally well. However, although the percentage of low achievers in Ireland (15%) is lower than the OECD average (18%), this still indicates that close to one in six PISA students in Ireland is struggling with the application of basic science concepts, knowledge and skills.

Chapter 6: Student- and School-Level Associations with Achievement

This chapter examines relationships between individual variables that describe aspects of student and school background and achievement in the four domains measured in PISA 2009. As reading is the main focus of PISA 2009, particular attention is paid to comparisons of print and digital reading. As priority is given to variables that show clear associations with achievement in Ireland[18] and ones that were judged to be relevant to policy-making in Ireland, some school and student variables reported by the OECD (2010b, c, e) are not reported here.

Results in the chapter are presented in four sections. The first examines student-level associations with achievement, the second describes school-level associations with achievement, the third examines variation in performance and socioeconomic status, and the final section examines changes in selected variables since PISA 2000. Where considered relevant[19], as well as examining relationships within Ireland, relationships across countries are considered, with particular reference to the OECD average and to the set of 10 comparison countries identified in the introduction to Chapter 3.

A Note on the Analyses

The analyses in this chapter are largely bivariate; that is, they describe the relationship between two variables; for the most part, an achievement variable and a student or school background variable. This type of analysis is useful for initial conceptualisation of relationships between pairs of variables, but is limited in that it cannot directly take account of inter-relationships between variables that are related to achievement. More complex multilevel analyses which take into account the inter-relationships of multiple predictors to derive models of print and digital reading achievement are presented in Chapter 8. The present chapter does, however, provide some commentary on relationships between student and school background variables, particularly with regard to socioeconomic status, as socioeconomic status is likely to mediate, at least in part, the associations between many student and school background variables and achievement.

Two types of analyses are presented, depending on whether the variables involved can be described as categorical or as continuous. A categorical variable refers to discrete groups, such as immigrant status or family structure. A continuous variable is one in which each score corresponds to a value within a range of real numbers. Some continuous variables (also referred to as scales or indices) are composites constructed from a series of related questions, e.g., attitude to reading. All indices are standardised to have an OECD average of 0 and a standard deviation of 1, unless otherwise stated in the text.

Relationships between two continuous variables (e.g., Economic, Social and Cultural Status, or ESCS, and print reading scores) are reported as correlations.

[18] ICT-related variables reported in the PISA 2009 summary report for Ireland (Perkins et al., 2010) are excluded from this report, as relationships with achievement tended to be weak or non-linear.
[19] Where variables are not directly comparable across countries (e.g., because they are unique to Ireland, or for technical reasons), this is noted in the text.

Relationships between a categorical and continuous variable (e.g., print reading achievement and immigrant background) require a comparison of the mean scores of students in each category. When group comparisons are presented in tables, 25 scale points on achievement scales or 0.25 scale points on other indices are used as benchmarks for effect size. These are equal to one-quarter of a standard deviation on average across OECD countries. It is important to note that while the analyses indicate whether an association between two variables is statistically significant or not, they cannot establish causation. Readers are referred to Chapter 1 (Inset 1.2) for further discussion of technical issues related to the analyses presented in this chapter, and to OECD (2011b) for a description of the method used to construct the questionnaire scales.

The purpose of the analyses presented in this Chapter is twofold. First, we aim to provide a detailed context in which to consider results of PISA 2009, including changes in some of the background characteristics since 2000. Second, the results serve to act as an introduction to the more complex analyses presented in Chapter 8 as well as the examination of changes in achievement since 2000 presented in Chapter 9. Both significant and non-significant results are reported, and reference is made to national analyses, as well as to comparative analyses from the international PISA reports (OECD, 2010b, 2010d, 2011a).

Student Characteristics

This section examines relationships between achievement and student background variables, which are mainly derived from responses to the student questionnaire. It is important to note the potential limitations of data based on the self-perceptions of individuals, particularly in the context of an international comparative study, where cultural differences between countries (e.g., social desirability bias) may influence the pattern of responses.

The student characteristics considered here fall into four categories: student demographics, student social and home background, student educational background, and student engagement with education. Inset 6.1 lists the student variables examined.

Inset 6.1: Student characteristics examined in Chapter 6

Student Demographics
Family structure
Immigrant and language status
Membership of Traveller community*
Number of siblings in the home*

Student Social and Home Background
Time spent in paid work during term time*
Parental Interaction*
Economic, Social and Cultural Status (ESCS)
Parental occupation
Home educational resources
Cultural possessions
Material possessions
Parental education
Number of books in the home

Subscales that contribute to ESCS

Student Educational Background
Current grade (year) level
Attendance of preschool

Student Engagement with Education
Early school-leaving risk*
Absence from school*

* = Variable is nationally-derived.

Student Demographics

In this section, the results of analyses involving four variables relating to student demographics are described: family structure, number of siblings, immigrant/language status, and membership of the Traveller community.

Family Structure

Information on the household composition of students obtained in the student questionnaire was used to form a family structure variable which categorised students according to whether they usually lived with one or two parents. In Ireland, students in lone parent families had significantly lower scores in all four achievement domains than students belonging to dual parent families, with the largest score-point difference on the mathematics scale (Table 6.1). Ireland does not differ significantly from the OECD average in terms of the percentage of students in lone parent families (15.7% of students in Ireland compared to 16.9% on average across OECD countries) nor in the size of the achievement gap on the print reading scale between students from lone and dual parent families (25 scale points in Ireland compared to 18 across the OECD).

Belonging to a lone parent family is associated with significantly lower socioeconomic status (as measured by the PISA index of ESCS[20]) than belonging to a dual parent family, both within Ireland and across the OECD (Table 6.1). For Ireland, the achievement difference associated with lone parent households is reduced by holding ESCS constant, but a significant achievement gap remains (13 points on the print reading scale[21]), indicating that inequalities between students belonging to lone and dual parent families cannot be wholly explained by differences in socioeconomic background. The difference in reading performance after accounting for ESCS in Ireland is exceeded among OECD countries only by the United States, in which the gap is very large (23 points, reduced from 44 points before accounting for ESCS). In contrast, in the United Kingdom, the gap in performance is entirely attributable to differences in ESCS: as average print reading scores for students of lone and dual parent families are identical when ESCS is held constant (compared to an initial performance gap of 19 points).

Number of Siblings

In response to a question in which students were asked to indicate the number of siblings who currently lived at home, 8.2% reported that they had none, 31.4% that they had one, 31.6% that they had two, 17.0% that they had 3, and 11.8% that they had four or more. Correlations between number of siblings and all four achievement domains and ESCS are weak but significant for Ireland (Table 6.1). The correlations are negative, indicating that students in larger families tended to have slightly lower levels of achievement as well as lower socioeconomic status. Achievement and ESCS scores are lowest for students with four or more siblings. For example, mean print reading achievement ranged from 491 to 506 points in students with three or fewer students, while it was 472 points for students with higher numbers of siblings. The mean ESCS score of students with four or more siblings was -0.23.

[20] The composition of the index of ESCS is described in detail later in this chapter. Here, we use the terms 'socioeconomic status' and 'ESCS' interchangeably.
[21] Compared to 5 points on average across OECD countries, which is also significant.

Table 6.1: Comparisons of mean scores on achievement scales and ESCS by family structure, immigrant and language background, and Traveller status, and correlations with number of siblings in the home (Ireland)

	Comparisons					Corr.
	Family structure	Immigrant and language			Traveller Status*	
Scale	Lone parent family – Other family type	Native – Immigrant, speaks English / Irish	Native – Immigrant, other language	Immigrant, English / Irish – Immigrant, other language	Settled - Traveller	No. of siblings in the home (r)
Print Reading	⇓	=	⇑	⇑	⇑	**-.118**
Digital Reading	↓	=	⇑	⇑	⇑	**-.166**
Mathematics	⇓	=	⇑	↑	⇑	**-.098**
Science	⇓	=	⇑	↑	⇑	**-.117**
ESCS	⇓	↓	=	↑	↑	**-.056**

Note: * The percentage in the Traveller category is very small (2.0%), so findings should be interpreted cautiously.
Significantly higher ($p \leq .05$) ↑ Significantly lower ($p \leq .05$) ↓
Significantly higher ($p \leq .01$) ⇑ Significantly lower ($p \leq .01$) ⇓
No statistically significant difference ($p > .05$) =
Values of r in bold indicate that correlation is significant ($p < .05$).
Shading indicates that the difference between the two groups being compared is statistically significant and at least 25 on the achievement scales or 0.25 on the index of ESCS (i.e., one-quarter of an average standard deviation across OECD countries).

Immigrant and Language Background

PISA categorises students as 'native' if they were born in the country or had at least one parent born in the country, and as 'immigrant' if the student and both parents were born in another country, or if both parents were born in another country but the student was born in the country in which the PISA test was taken. Of the 8.0% of students in Ireland identified as having an immigrant background, 4.5% spoke the language of the host country at home (i.e., English or Irish) and 3.5% spoke a language other than English or Irish at home[22]. As the vast majority of students categorised as having a native background spoke English or Irish at home (99.8%), they were treated as a single group in analyses.

Immigrant students who spoke English or Irish at home do not differ significantly in their mean achievement scores from native students on any of the four domains (Table 6.1). However, immigrant students who spoke a language other than English or Irish at home have significantly and substantially (more than one-quarter of a standard deviation in all cases) lower mean scores in each of the domains than either native students or immigrant students who spoke English or Irish.

[22] When calculated as a percentage of all students, 3.6% of students spoke a language other than English or Irish in the home.

A comparison of the average ESCS scores of the three groups suggests that achievement differences between groups cannot be entirely explained by socioeconomic factors. Despite the marked underperformance of immigrant students who spoke a language other than English or Irish at home compared to native students on every domain, the two groups have statistically equivalent socioeconomic compositions (Table 6.1). Furthermore, immigrant students who spoke English or Irish at home have a significantly higher mean ESCS score than native students, but have similar average achievement levels.

Membership of the Traveller Community

Just 2.0% of PISA students in Ireland identified themselves as members of the Traveller community. These students have a significantly lower mean score than other students in each domain, as well as a significantly lower average ESCS score (Table 6.1). The differences in achievement exceed a half of a standard deviation in each domain, and the gap in socioeconomic status is one-third of a standard deviation.

Student Social and Home Background

This section examines the following variables relating to students' social and home background: time spent in paid work during term time; the index of parental interaction, the overall index of ESCS; and the six variables that contribute to the index (parental occupation, parental education, home educational resources, cultural possessions, material possessions, and number of books in the home).

Time Spent in Paid Work During Term Time

When students in Ireland were asked how many hours a week they spent in paid work during term time, three-quarters (74.8%) of students did not engage in paid work, 11.2% worked for up to four hours a week, 7.6% worked for four to eight hours, and 6.4% worked for more than eight hours. Significantly more males (7.9%) than females (4.8%) worked for more than eight hours a week.

Time spent in paid work is significantly and negatively (though weakly) associated with all four achievement domains (ranging from r = -.089 for mathematics to r = -.143 for print reading) and with ESCS (r = -.076), indicating that students that spend more time working have both slightly lower average achievement levels and lower socioeconomic status. The relationships between amount of time spent in paid work and achievement in both print reading and science are significantly stronger for males than for females (r = -.185 compared to r = -.074 for print reading and r = -.154 compared to r = -.068 for science). Correlations between time spent in paid work and achievement in digital reading and mathematics did not differ for males and females.

Interaction with Parents

Another addition to the student questionnaire in Ireland was a series of items (listed in Table 6.2) asking students to indicate the frequency with which they engaged in various activities with their parents. Responses to the items were used to construct a scale measuring level of parental interaction, with higher values on the scale associated with

higher levels of interaction. The scale was set to have a national mean of 0 and a standard deviation of 1[23].

Higher levels of parental interaction were found to be weakly but significantly associated with higher levels of socioeconomic status (r = .128) and also with higher levels of achievement in all four domains (ranging from r = .073 for science to r = .093 for print reading). Significantly lower mean levels of parental interaction were reported by male students (-.05 compared to .05 for female students) and by students who belonged to lone parent families (-.16 compared to .03 for students belonging to dual parent families). The strength of the relationship between level of parental interaction and print reading achievement is practically identical across genders (r = .085 for females and r = .084 for males). It is weaker, though not significantly so, for students in lone parent families (r = .024) than for those in other family types (r = .103).

Table 6.2 presents the frequencies with which students in Ireland reported engaging in the five activities that make up the parental interaction scale. For the purposes of reporting, the five response categories with which students were presented (never or hardly ever, a few times a year, about once a month, several times a month, and several times a week) were collapsed into three. There was considerable variation in the overall frequency of engagement in the different activities. For example, 38.8% of students reported that they discussed political or social issues with their parents several times a month or more often, while over 80% said that they ate dinner around the table and spent time just chatting with their parents several times a month or more often (84.3% and 82.6%, respectively). Significantly more females than males reported engaging in the following activities several times a month or more often: discussing political or social issues (41.8% compared to 35.9%), discussing books, films or television programmes (65.1% compared to 55.9%), discussing how well they were doing at school (75.4% compared to 69.7%) and spending time just chatting (88.2% compared to 77.1%).

Table 6.2: Frequency of students' engagement in various activities with their parents, overall and by gender (Ireland)

	Never or hardly ever			At most once a month			At least several times a month		
Activity	Overall	Females	Males	Overall	Females	Males	Overall	Females	Males
Discuss political or social issues	25.4	24.1	26.8	35.7	34.1	37.3	38.8	41.8	**35.9**
Discuss books, films or television programmes	10.8	9.2	**12.4**	28.8	25.8	**31.7**	60.4	65.1	**55.9**
Discuss how well doing at school	3.5	3.2	3.9	24.0	21.5	**26.4**	72.5	75.4	**69.7**
Eat dinner around the table	6.8	6.8	6.9	8.8	7.4	**10.3**	84.3	85.8	82.8
Spend time just chatting	5.5	4.1	**6.9**	11.8	7.6	**16.0**	82.6	88.2	**77.1**

Note: This is a national set of questions unique to Ireland. Significant differences between males and females are in bold in the columns headed 'males'.

Economic, Social and Cultural Status (ESCS)

The average score of students in Ireland on the index of ESCS[24] is not significantly different from the average across OECD countries (0.05 compared to 0.00). Across OECD and partner countries, the general trend is for countries with a higher average student

[23] The scale was constructed using principal components analysis in SPSS® and is unique to Ireland.
[24] Estimates related to the PISA index of ESCS may differ slightly from those in the PISA 2009 summary report for Ireland (Perkins et al., 2010) as the index was re-standardised by the OECD (2010b) following publication.

ESCS to perform better on reading, but there are many exceptions. For example, France does not have a significantly different achievement score to Ireland despite having an ESCS that is below the OECD average (-0.13). Similarly, Shanghai-China (-0.49) and Korea (-0.15), the top-performing countries/regions, have below average ESCS scores.

As well as mean ESCS scores, the OECD (2010b) provides two statistics which describe different aspects of the relationship between socioeconomic background and print reading performance: the *strength* and the *slope* of the socioeconomic gradient[25]. The strength of the socioeconomic gradient indicates the percentage of variance in achievement that can be attributed to socioeconomic background, while the slope indicates the steepness of the relationship and is reported as the average score point difference on the achievement scale associated with a one unit increase on the index of ESCS.

Ireland does not differ significantly from the OECD average on either of these measures: 12.6% of the variance in print reading performance in Ireland is due to differences in ESCS (compared to 14.0% on average across OECD countries) and there is a 39 score-point difference on the print reading scale associated with a one unit increase on the ESCS scale in Ireland (compared to 38 score points on average across the OECD). Comparing these measures for Ireland with those for Poland helps to clarify their meaning. While the slope of the gradient is identical in both countries (39 points), the strength of the gradient is higher in Poland (14.8% compared to 12.6% in Ireland). This indicates that, although the average achievement gap between students of high and low socioeconomic status is identical in Ireland and Poland, socioeconomically disadvantaged students in Poland are more likely to have lower levels of achievement than socioeconomically disadvantaged students in Ireland (OECD, 2010b).

A final point of note concerning the relationship between socioeconomic background and achievement concerns the linearity of the gradient line, or the extent to which the performance difference associated with level of socioeconomic status is constant at different levels of socioeconomic status. In many countries, and on average across the OECD, the gradient line is roughly linear; however, Ireland is in a group of countries (including Poland) that display a levelling off of the gradient at higher levels of socioeconomic status; that is, as student ESCS increases, the associated performance advantage progressively lessens. This is in contrast to another group of countries, including the United States, that display the opposite effect; that is, progressively higher levels of performance advantage at higher levels of socioeconomic status.

For digital reading, the slope of the gradient line on average across participating OECD countries (38 score points) is very similar to that for print reading (40) [26], while in Ireland, the slope is less steep for digital than for print reading (34 compared to 39), suggesting somewhat greater equity in outcomes in digital reading on the basis of socioeconomic status for students in Ireland. The strength of the socioeconomic gradient on average across OECD countries is also very similar for digital and print reading, with ESCS explaining 14.1% of the variance in digital reading and 14.4% of that in print reading on average across the OECD. Again, in Ireland, the relationship with

[25] The term 'socioeconomic gradient' refers to the relationship between socioeconomic background and performance.

[26] As noted earlier, OECD averages for print reading may differ from OECD averages for print reading when it is being compared to digital reading, as comparisons between these domains are based on countries that have valid data in both assessments.

socioeconomic status is somewhat weaker for digital (10.7%) than for print reading (12.6%). In fact, of all four domains, digital reading displays the weakest correlation with ESCS in Ireland (r = .331), while mathematics displays the strongest (r = .369), with print reading (r = .359) and science (r = .347) occupying an intermediate position (Table 6.3).

ESCS Subscales

The relationship between achievement measures and each of the six variables that contribute to the indicator of socioeconomic status (ESCS) is examined separately in this section, since previous cycles of PISA indicate that the relationships are likely to vary.

Students were asked to estimate how many books were in their home, excluding magazines, newspapers and school books[27]. For students in Ireland, there is a strong positive relationship between number of books and achievement in all four domains (ranging from r = .418 for print reading to r = .377 for digital reading). All correlations are stronger than those observed for the overall index of ESCS.

An index of parental occupation was derived from students' descriptions of the main occupations of their mothers and fathers and descriptions of the type of work they did. Responses were coded using the International Standard Classification of Occupation Index (ISCO[28]) and transformed into an International Socioeconomic Index (ISEI) (see Ganzeboom et al., 1992), with each student being assigned the ISEI score of their highest scoring parent when more than one score was available. After number of books in the home, parental occupation displays the highest associations with achievement in Ireland (ranging from r = .317 for print reading to r = .285 for digital reading).

The index of parental education was based on students' reports of the highest level of education completed by each of their parents, with the higher of the two used as the PISA measure of parental education [29]. It is not as strongly correlated with achievement as parental occupation, with correlations ranging from r = .238 for print reading to r = .202 for digital reading.

Items on the scale of home educational resources include whether students had a desk to study at, a quiet place to study, a computer to use for schoolwork, educational software, books to help with schoolwork, technical reference books and a dictionary. The index of cultural possessions is based on whether students had classic literature, books of poetry and works of art in the home. The indices were also significantly and positively correlated with achievement in all four domains. The index of educational resources is most strongly associated with mathematics (r = .271), whereas the index of cultural possessions is most strongly related to achievement in print (r = .272) and digital reading (r = .270).

The index of material possessions was formed from student reports of whether they had the following in their home: a room of their own, a link to the Internet, a

[27] Response categories were: 0-10 books (13.6% of students), 11-25 books (14.9%), 26-100 books (29.8%), 101-200 books (18.9%), 201-500 books (15.3%) and more than 500 books (7.5%).
[28] http://www.ilo.org/public/english/bureau/stat/isco/
[29] The modal level of parental education in Ireland was Leaving Certificate (37.8% of students). Similar numbers of students had at least one parent who had completed a third level degree (34.3%) and 17.2% had at least one parent who had completed a third level certificate or diploma. The parents of 8.2% of students had completed their education at Junior Certificate and just 2.4% of students had parents who had completed primary level education at most.

dishwasher, a DVD player; number of mobile phones, televisions, computers, cars, and bathrooms; and three nationally-specific items, which in Ireland's case were a flat-screen television, a bedroom with an en-suite bathroom and a premium cable TV package. Although this index displays significant positive correlations with achievement in all domains, the correlations are much weaker than those involving the other ESCS subscales (ranging from .065 for print reading to .134 for mathematics). Further, the OECD (2010b) reported that when a range of other student background variables[30] were held constant, increases on all the ESCS subscales were associated with increases in achievement (although the increase on the index of home educational resources is not significant for Ireland), with the exception of the index of material possessions. An increase of one unit on this scale was actually associated with a significant decrease of 11.2 points on the print reading scale in Ireland.

Table 6.3: Comparisons of mean scores on ESCS and subscales of ESCS by immigrant and language status, correlations with achievement, and change in print reading achievement per unit change on indices (Ireland)

	Comparisons			Correlations				
	Immigrant & language							
Scale	Native – Immigrant with English / Irish	Native – Immigrant with other language	Immigrant with English / Irish – Immigrant with other language	Print reading (r)	Digital reading (r)	Mathematics (r)	Science (r)	Slope of the socioeconomic gradient*
ESCS	↓	=	↑	**.359**	**.331**	**.369**	**.347**	**39.0**
Parental occupation	↓	=	⇑	**.317**	**.285**	**.314**	**.305**	**0.9**
Home educational resources	=	=	=	**.227**	**.226**	**.271**	**.221**	3.5
Cultural possessions	=	=	=	**.272**	**.270**	**.221**	**.214**	**7.2**
Material possessions	=	⇑	⇑	**.065**	**.092**	**.134**	**.084**	**-11.2**
Books in the home	-	-	-	**.418**	**.377**	**.410**	**.409**	**19.2**
Parental education in years	-	-	-	**.238**	**.202**	**.224**	**.226**	**2.2**

Note: * For each of the indices listed, except for the overall index of ESCS, the slope of the socioeconomic gradient reported is estimated after accounting for a range of student background variables, i.e., the other five indices that contribute to the index of ESCS, immigrant background and whether language spoken at home is different from the language of assessment.
The slope of the socioeconomic gradient is the change in print reading achievement per unit change on the index.
Comparisons by immigrant and language status are not given for books in the home or parental education in years, as these scales are derived from categorical data.
Significantly higher ($p \leq .05$) ↑ Significantly lower ($p \leq .05$) ↓
Significantly higher ($p \leq .01$) ⇑ Significantly lower ($p \leq .01$) ⇓
No statistically significant difference ($p > .05$) =
Values of r in bold indicate that correlation is significant ($p < .05$)
Shading indicates that the difference between the two groups being compared is statistically significant and at least 25 on the achievement scales or 0.25 on the index of ESCS (i.e., one-quarter of a standard deviation across OECD countries).

[30] For each ESCS subscale, the variables held constant consist of the other five indices that contribute to the index of ESCS, along with immigrant background and whether the language spoken at home differs from the language of the assessment.

The mean scores of the four continuous scales that contribute to ESCS do not vary by the immigrant or language status of students, with the exception of material possessions. Immigrant students who did not speak English or Irish at home had a significantly lower score on this scale than both native students and immigrant students who spoke English or Irish at home. Differences between groups on level of parental occupation mirror those on the overall index of ESCS: immigrant students who spoke the host language(s) had significantly higher scores than the other two groups, while the difference between native students and immigrant students who did not speak the host language(s) is not statistically significant.

Student Educational Background

Data were collected on two variables related to student educational background: student grade or year level, and preschool attendance.

Student Grade (Year) Level

As the sampling for PISA uses an age-based criterion, participating students were spread across grade or year levels. Almost six in 10 students (59.1%) were in Third Year, 24.0% in Transition Year, 14.4% in Fifth Year, 2.4% in Second Year and 0.1% in First Year. In the analyses, the very small numbers of students in First Year were combined with the Second Year category.[31]

In all four domains, Third Year students scored significantly below students in Transition Year, and significantly above students in Second Year (Table 6.4). The relative achievement levels of Third and Fifth Year students differ by domain. Fifth Year students had significantly higher mean scores in digital reading and mathematics, while differences between year levels in print reading and science were not significant. Transition Year students displayed significantly higher average achievement levels than students in all other year groups across all domains, with the exception of mathematics; their mean mathematics score did not differ significantly from that of Fifth Year students. Although the average ESCS score of Transition Year students (0.13) was higher than that of Third Years (0.00), it was not significantly different. In contrast, Fifth Year students had a mean ESCS score (-0.21) that was significantly lower than that of Third and Transition Year students. Students in Second Year had a mean ESCS score (-0.47) that was lower than in the other year levels, significantly so in comparison with Third and Transition Year students, but not Fifth Years.

Preschool Attendance

Students were asked whether or not they attended preschool. In Ireland, 17.4% of students reported that they had not, which is more than double the average across OECD countries (8.3%). It was also less common for students in Ireland to have attended more than one year of preschool (41.2% compared to 72.2% on average across OECD countries).[32]

[31] The international equivalents are as follows: Grade 8 = Second Year, Grade 9 = Third Year, Grade 10 = Transition Year, Grade 11 = Fifth Year.

[32] Note, however, that the OECD does not classify Junior and Senior Infants as preschool. In January 2010, the Irish Government introduced an Early Childhood Care and Education Scheme, aimed at providing one year's free education and care to all children between the ages of 3 years, 2 months and 4 years, 7 months (Office of the Minister for Children and Youth Affairs, 2010).

Students in Ireland who had not attended preschool had significantly lower print reading, digital reading, and science mean scores, but not mathematics scores, than students who had attended one year or less and students who had attended more than one year of preschool (Table 6.4). Non-attendance at preschool is also associated with lower levels of socioeconomic status among students in Ireland. Socioeconomic status does not account for all of the achievement gap, however, as Irish students who did not attend preschool still had a mean print reading score that is 21 points lower than that of students who attended one year or less of preschool when ESCS is held constant (reduced from 31 points before accounting for ESCS)[33], suggesting an independent relationship between preschool attendance and print reading achievement (Table 6.4).

In Ireland, the mean reading scores of students who had attended one year or less and students who had attended more than one year of preschool did not differ significantly. In fact, on the digital reading scale, students who had attended more than one year of preschool had significantly lower scores on average than students who had attended one year or less. This is in contrast to the situation on average across OECD countries, in which students who had attended preschool for more than one year had significantly higher mean print reading scores than students who had attended for one year or less (OECD, 2010b).

Table 6.4: Comparisons of mean scores on achievement scales and student ESCS by current grade (year) level and duration of preschool attendance (Ireland)

	Grade/year level				Preschool Attendance		
Scale	Third Year – Second Year	Third Year – Transition Year	Third Year – Fifth Year	Transition Year – Fifth Year	No preschool – One year or less	No preschool – More than one year	One year or less – More than one year
Print Reading	⇑	⇓	=	⇑	⇓	⇓	=
Digital Reading	⇑	⇓	⇓	⇑	⇓	⇓	↗
Mathematics	⇑	⇓	↓	=	=	=	=
Science	⇑	⇓	=	⇑	⇓	↓	=
ESCS	⇑	=	⇑	⇑	⇓	⇓	=

Note: Significantly higher ($p \leq .05$) ↗ Significantly lower ($p \leq .05$) ↓
Significantly higher ($p \leq .01$) ⇑ Significantly lower ($p \leq .01$) ⇓
No statistically significant difference ($p > .05$) =
Shading indicates that the difference between the two groups being compared is statistically significant and at least 25 on the achievement scales or 0.25 on the index of ESCS (i.e., one-quarter of an average standard deviation across OECD countries).

Student Engagement with Education

Data were obtained on two national variables related to student engagement with education: early school-leaving risk, and absence from school.

[33] These estimates are very similar on average across OECD countries, where accounting for socioeconomic status reduces the reading achievement gap between groups from 30 to 19 points.

Early School-Leaving Risk

As a national addition to the student questionnaire in Ireland, students were asked whether they intended to stay in school until they had completed the Leaving Certificate Examination, with the options 'Yes, definitely', 'I'm not sure', and 'No'. Just 1.2% said they did not intend to stay, and a further 8.0% said they weren't sure. These two groups were combined in analyses and defined as the at-risk group. Students defined as at risk had significantly and substantially lower mean scores in all four achievement domains than students who intended to remain in school (with scale score differences ranging from about 64 to 81 points). Students at risk of early school leaving also had a significantly lower mean score on the ESCS scale than students not at risk (-0.44 compared to 0.05) (Table 6.5).

Table 6.5: Comparisons of mean scores on achievement scales and student ESCS by early school leaving risk and number of days absent from school in last two weeks (Ireland)

	Early school-leaving risk	Absence from school		
Scale	At risk – Not at risk	None – 1 or 2 days	None – 3 or more days	1 or 2 days – 3 or more days
Print Reading	⇓	⇑	⇑	⇑
Digital Reading	⇓	→	⇑	⇑
Mathematics	⇓	⇑	⇑	⇑
Science	⇓	⇑	⇑	⇑
ESCS	⇓	⇑	⇑	=

Note: Significantly higher ($p \leq .05$) ↑ Significantly lower ($p \leq .05$) ↓
Significantly higher ($p \leq .01$) ⇑ Significantly lower ($p \leq .01$) ⇓
No statistically significant difference ($p > .05$) =
Shading indicates that the difference between the two groups being compared is statistically significant and at least 25 on the achievement scales or 0.25 on the index of ESCS (i.e., one-quarter of an average standard deviation across OECD countries).

Absence from School

In a further addition to the student questionnaire in Ireland, students were asked how many days they had been absent from school during the last ten school days, with four response options: 'none' (selected by 60.4% of respondents), 'one or two' (31.1%), 'three or four' (5.5%) and 'five or more' (3.1%). The reasons for absence from school were not asked. The latter two categories were collapsed in analyses. In all four domains, students who had not been absent in the preceding two weeks had significantly higher mean scores than students who had been absent for one or two days; students in the latter group, in turn, had significantly higher mean scores than those who had missed three or more days (Table 6.5). The largest achievement differences lay between students who had missed three or more days and the other groups: the former scored more than one-quarter of a standard deviation below other students in all domains.

While students who reported no absences had a significantly higher mean score on the ESCS scale than students who had missed one or more days, students who had missed one or two days and students who had missed three or more days did not differ in their mean ESCS scores, suggesting that achievement differences between these groups are not associated with differences in socioeconomic status.

School Characteristics

This section examines relationships between school characteristics and achievement. School background variables were derived from three sources: the student questionnaire, the Department of Education and Skills database of post-primary schools, and the school questionnaire which was completed by school principals. All analyses were carried out at the individual student level, including analyses of school-level variables, which were disaggregated to student level by assigning each student the school value on the variable.

A number of limitations of the data may be noted. Only 127 of 144 school questionnaires were returned. This is a return rate of 88.2% at school level, which results in missing rates of at least 12.2% at the student level for all variables derived from the school questionnaire. Furthermore, the OECD (2010d) has pointed to difficulties in the use and interpretation of data based on principals' responses, especially when these data are linked to student performance or attitudes, since these outcomes represent the cumulative result of previous educational experience and experiences outside school, rather than solely of the current educational environment. A further problem with the analyses arises from assigning school values to students. This approach, though common, runs the risk of incorrectly inferring statistical significance. For all of these reasons, results in this section should be interpreted with caution.

Inset 6.2 lists the school variables discussed in this section, grouped into four categories: school structure, school social composition, school selectivity, and school climate.

Inset 6.2: School characteristics examined in Chapter 6

School Structure
School Sector and Gender Composition*
Fee-paying Status*
School Location
Availability of other schools locally

School Social Composition
School Average Economic, Social and Cultural Status (ESCS)
Disadvantaged Status*
Outlier Status*†

School Selectivity
Ability grouping
Academic selectivity on intake

School Climate
Teacher behaviour
Student behaviour
Teacher-student relations
Disciplinary Climate
Teacher Stimulation of Student Reading
Engagement
Leadership
Sense of belonging*

* = Variable is nationally-derived.
† = Being a performance outlier is not wholly related to school social composition, but it is nonetheless associated with differences in social composition.

School Structure

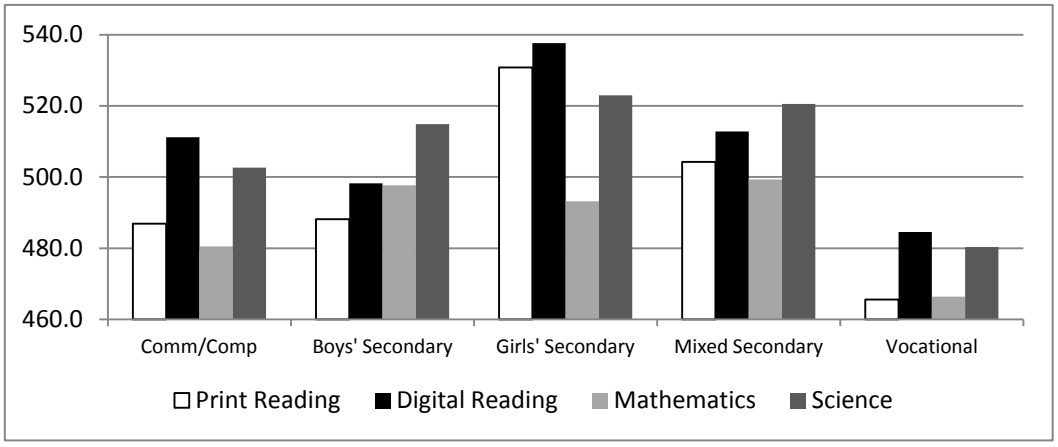
Four variables related to school structure are considered: school sector and gender composition, fee-paying status, school location, and availability of other schools locally.

School Sector and Gender Composition

Post-primary schools in Ireland can be categorised into five groups based on sector and gender composition: community/comprehensive (15.4% of students participating in PISA 2009 were attending a school of this type); vocational (23.1%); boys' secondary (18.5%); girls' secondary (22.5%); and mixed secondary (20.5%). Information on the sector and gender composition of schools was drawn from the Department of Education and Skills database of post-primary schools.

Achievement in print reading varies considerably by school sector. It is lowest for students in vocational schools (465.6) and highest for students in girls' secondary schools (530.8). Average achievement is very similar for students in community/comprehensive schools (486.9) and boys' secondary schools (488.2), with somewhat higher average scores achieved by students in mixed secondary schools (504.3). Applying confidence intervals around these means, students in girls' secondary schools had significantly higher levels of print and digital reading achievement than students in all other school types (Table 6.6). The average reading achievements of students in community/comprehensive schools, boys' schools, and mixed secondary schools do not differ significantly. The mean reading score of students in vocational schools was significantly lower than those of students in girls' secondary and mixed secondary schools. The mean achievement scores in mathematics and science of students in girls' secondary schools do not differ significantly from those of students in boys' secondary, mixed secondary or community/comprehensive schools. They are, however, significantly higher than the mean scores of students in vocational schools. Students in community/comprehensive and vocational schools performed considerably better on digital than on print reading (Figure 6.1).

Figure 6.1. Achievement scores of students by school sector/gender composition (Ireland)



Some of these achievement differences are likely to be related to socioeconomic status (as well as gender) (Table 6.6). For example, the average ESCS of students in vocational schools (-0.29) is significantly lower than that of students in the four other school types. Students in mixed, all boys', and all girls' secondary schools have average ESCS scores that do not differ significantly from one another (0.15, 0.12, and 0.06, respectively). Students in community/comprehensive schools have a mean ESCS score (-0.09) that is lower than that of students in the three secondary school types, but this is significant only in the case of mixed secondary schools.

Fee-Paying Status

Data on the fee-paying status of schools were taken from the Department of Education and Skills database of post-primary schools. The vast majority of students in PISA 2009 were enrolled in non-fee-paying schools (91.0%). Students in fee-paying schools have significantly higher mean scores in all achievement domains and on the ESCS scale than students in non-fee-paying schools. Differences between fee-paying and non-fee-paying schools in achievement and socioeconomic status are large (40 points or more in the case of achievement, and 0.84 points in the case of ESCS) (Table 6.6).

School Location

School principals were asked to describe where their school was located[34]. More than half of students in Ireland (55.1%) attended a school located in a town, about a quarter (25.8%) attended a school in a city, and the remaining 19.1% attended a school located in a rural area. Students attending city schools had significantly higher mean ESCS and print reading scores than students attending schools in rural areas, and students attending schools in rural areas had a significantly lower mean mathematics score than students attending schools located in towns (Table 6.6). There were no other significant achievement or socioeconomic differences between groups based on school location.

Table 6.6: Comparisons of mean scores on achievement scales and student ESCS by school sector and gender composition, fee-paying status, school location and availability of other schools locally (Ireland)

	School sector/gender composition				Fee-paying Status	School Location			Availability of other schools locally		
Scale	Girls' Secondary – Comm./Comp.	Girls' Secondary – Boys' Secondary	Girls' Secondary – Mixed Secondary	Girls' Secondary – Vocational	Yes - No	Town - Rural	Town - City	City - Rural	No others – One other	No others – Two or more	One other – Two or more
Print Reading	⇑	⇑	⇑	⇑	⇑	=	=	↑	=	=	=
Digital Reading	⇑	⇑	⇑	⇑	⇑	=	=	=	=	=	=
Mathematics	=	=	=	⇑	⇑	↑	=	=	=	=	=
Science	=	=	=	⇑	⇑	=	=	=	=	=	=
ESCS	=	=	=	⇑	⇑	=	=	↑	=	=	=

Note: Significantly higher ($p \leq .05$) ↑ Significantly lower ($p \leq .05$) ↓
Significantly higher ($p \leq .01$) ⇑ Significantly lower ($p \leq .01$) ⇓
No statistically significant difference ($p > .05$) =
Shading indicates that the difference between the two groups being compared is statistically significant and at least 25 on the achievement scales or 0.25 on the index of ESCS (i.e., one-quarter of an average standard deviation across OECD countries).

[34] School location data for the 17 schools that did not return a school questionnaire was drawn from the Department of Education and Skills database of post-primary schools.

Availability of Other Schools Locally

Principals were asked how many other schools competed for their students in their school's catchment area. The majority of students in Ireland (70.3%) were in schools where principals reported that there were two or more other schools available to their students, 11.5% had one other school that was available locally, and for 18.1% of students, no other schools were available in their catchment area. Students in Ireland tended to have greater school choice than their OECD counterparts (OECD, 2010d). Across OECD countries, on average, 24.1% of students had no other schools available to them locally, and 61.2% had two or more available. There are no significant differences in achievement scores or in the socioeconomic background of students in Ireland based on the amount of school choice available to them (Table 6.6).

School Social Composition

Measures of school social composition considered in this section are school average ESCS, participation in the School Support Programme (SSP), and school outlier status (i.e., whether or not the school has a very low average print reading score).

School Average Socioeconomic Status (ESCS)

The relationship between the average socioeconomic status of schools and student achievement may be contrasted with the relationship between the socioeconomic status of individual students and achievement. In analyses, each student was assigned the average of the ESCS scores of all students in the school[35]. As was the case for student ESCS, school average ESCS was found to be significantly correlated with achievement scores all four domains, ranging from r = .279 for digital reading to r = .337 for print reading (Table 6.7). Not surprisingly, student ESCS and school average ESCS are strongly correlated (r = .501).

In the vast majority of participating countries, including Ireland, the association between school average ESCS and student achievement was stronger than the relationship between individual student socioeconomic background and achievement, even when both are considered simultaneously. In Ireland, half a unit (standard deviation)[36] increase on the index of ESCS at the school level is associated with an increase of 26.5 points on the print reading scale. In contrast, half a unit increase on the index of ESCS at the student level is associated with an increase of only 13.5 points on print reading. This finding is indicative of a 'social context effect'. However, the effect is weaker in Ireland than on average across the OECD (where a half-unit change on the index is associated with an expected score change of 31.5 points on the print reading scale). Countries with very strong social context effects include Belgium (55.5 points), the Czech Republic (61.5 points), Germany (61 points) and Japan (68.5 points). Weaker social context effects are evident in others, including Canada (16 points), Finland (9.5 points), Iceland (5.5 points), and Poland (14.5 points) (OECD, 2010b, Chapter 5).

[35] As noted earlier, the ESCS index is comprised of parental occupation, parental education, books in the home, home educational resources, cultural possessions, and material possessions.
[36] Half a unit on the ESCS index is used as a benchmark because, according to the OECD (2010b), this gap corresponds to realistic socioeconomic differences between schools.

School Support Programme (SSP) Status

Schools were classified according to whether or not they were in receipt of the School Support Programme (SSP) under DEIS (Department of Education and Science, 2005), recorded in the Department of Education and Skills database of post-primary schools. Students in schools in the SSP (23.0% of participants) had significantly lower average achievement levels in all four domains and significantly lower socioeconomic status than schools not in the programme. Achievement differences ranged from about 40 points (on digital reading) to 70 points (on print reading). Students in SSP schools had a mean ESCS score that was 0.61 points lower than students in non-SSP schools (Table 6.7).

Table 6.7: Comparisons of mean scores on achievement scales and student ESCS by disadvantaged status and outlier status, and correlations between achievement and student ESCS and school ESCS (Ireland)

	Comparisons		Corr.
	In SSP under DEIS	Outlier Status	
Scale	Yes - No	Yes - No	School Average ESCS (r)
Print Reading	⇓	⇓	**.337**
Digital Reading	⇓	⇓	**.279**
Mathematics	⇓	⇓	**.313**
Science	⇓	⇓	**.299**
Student ESCS	⇓	⇓	**.501**

Note: Significantly higher ($p \leq .05$) ↑ Significantly lower ($p \leq .05$) ↓
Significantly higher ($p \leq .01$) ⇑ Significantly lower ($p \leq .01$) ⇓
No statistically significant difference ($p > .05$) =
Shading indicates that the difference between the two groups being compared is statistically significant and at least 25 on the achievement scales or 0.25 on the index of ESCS (i.e., one-quarter of an average standard deviation across OECD countries).

Outlier Schools on PISA Print Reading

Eight schools (in which there were 4.3% of students) in PISA 2009 in Ireland each achieved mean print reading scores that were more than 100 points (one international standard deviation) below the national average. There were no comparable outlier schools in PISA 2000, when every school had a mean reading score within 100 points of the national average[37]. As well as displaying a mean reading score (367.3) that is significantly below that of the other schools in the sample (501.4), students in the outlier schools also had mean mathematics and science scores that were more than a standard

[37] The possible significance of the inclusion of these outlier schools in the PISA 2009 sample for explaining changes in achievement is explored further in Chapters 8 and 9.

deviation below those of students in non-outlier schools (Table 6.7). The difference in mean scores on the digital reading test (59 points) is also substantial. Students attending the outlier schools also had a mean score on the ESCS scale that is more than half of an international standard deviation lower than that of students in non-outlier schools. The percentage of students in outlier schools who spoke a language other than English or Irish (11.7%)[38] was much greater than that in non-outlier schools (3.4%).

School Selectivity

Data were obtained from two variables related to school selectivity: ability grouping, and academic selectivity on intake. Both variables are based on school questionnaire data disaggregated to the student level.

Ability Grouping

School principals were asked to indicate whether students in the modal grade for participation in PISA in their school (in Ireland's case, Third Year) were grouped by 'ability' into different classes (subject areas were not specified in the question). The majority of students (87.3%) were in schools that grouped students by ability for some subjects. A further 9.0% were in schools in which students were grouped by ability for all subjects, and 3.6% were in schools which did not group students by ability. Practices for grouping students were not related to students' achievements or to their ESCS scores (Table 6.8). It should be noted, however, that ability grouping in Ireland was more prevalent than on average across the OECD, where 31.9% of students were in schools that did not practise ability grouping. Countries in which ability grouping for some subjects was common include Korea (86.2%), New Zealand (93.6%), the United States (83.8%), and the United Kingdom (91.5%) (OECD, 2010d).

Academic Selectivity of Intake

An index of school academic selectivity of intake was constructed from information provided by principals about the frequency with which consideration was given to students' records of academic performance (including placement tests), and recommendations from feeder schools, when students were admitted to the school. An index was constructed to categorise schools in terms of their selectivity: schools in which these two factors were 'never' considered for student admittance (low), schools considering at least one of these factors 'sometimes' but neither of them 'always' (medium), and schools where at least one of these factors was 'always' considered (high).

Students' records of academic performance were considered less frequently in Ireland than on average across OECD countries (76.5% of students in Ireland were in schools in which principals report that this was 'never' considered, compared to 47.4% at OECD level), whereas recommendations of feeder schools tended to be considered somewhat more frequently in Ireland (20.7% of students in Ireland were in schools where this factor was 'always' considered, compared to 16.1% of their OECD counterparts). When these two factors are considered together in the index of academic selectivity, Ireland displays lower selectivity than OECD countries on average. Almost half (49.7%) of students in Ireland attended schools categorised as having low academic

[38] This differs from the value reported in the PISA 2009 summary report for Ireland (Perkins et al., 2010) as it was calculated at the student rather than the school level.

selectivity, compared to just over a third (35.1%) of students on average across the OECD, and a smaller percentage of students in Ireland attend schools categorised as having high academic selectivity (23.8% compared to 35.6%).

Students in Ireland attending schools characterised by a high level of academic selectivity on intake had a significantly lower mean digital reading score than students attending schools characterised by low levels of academic selectivity (Table 6.8). School selectivity was not related to students' achievement except in the case of digital reading; nor was it related to their ESCS scores.

Table 6.8: Comparisons of mean scores on achievement scales and student ESCS by ability grouping and school academic selectivity on intake (Ireland)

	Ability Grouping			Academic Selectivity		
Scale	All classes – Some classes	All classes – No classes	Some classes – No classes	High selectivity – Medium selectivity	High selectivity – Low selectivity	Medium selectivity – Low selectivity
Print Reading	=	=	=	=	=	=
Digital Reading	=	=	=	=	⇓	=
Mathematics	=	=	=	=	=	=
Science	=	=	=	=	=	=
ESCS	=	=	=	=	=	=

Note: Significantly higher ($p \leq .05$) ↑ Significantly lower ($p \leq .05$) ↓
Significantly higher ($p \leq .01$) ⇑ Significantly lower ($p \leq .01$) ⇓
No statistically significant difference ($p > .05$) =
Shading indicates that the difference between the two groups being compared is statistically significant and at least 25 on the achievement scales or 0.25 on the index of ESCS (i.e., one-quarter of an average standard deviation across OECD countries).

School Climate

In this section, we describe findings relating to various aspects of school climate represented in seven scales describing teacher behaviour, student behaviour, school principal's leadership, teacher-student relations, disciplinary climate, teachers' stimulation of student reading engagement, and sense of belonging[39]. The teacher behaviour, student behaviour, and school principal's leadership indices are based on principals' responses to the school questionnaire. The remaining four indices were constructed from responses to the student questionnaire. All international indices were standardised to have a mean of 0 and a standard deviation of 1 across OECD countries.

Intercorrelations between many of these indices are significant, both in Ireland and on average across OECD countries For example, in Ireland, the index of teacher-student relations is significantly and positively correlated with disciplinary climate

[39] Sense of belonging is a national variable unique to Ireland. The index was created using principal components analysis in SPSS®.

(r = .217, p<.001), teacher stimulation of student reading engagement (r = .296, p<.001), and weakly, though significantly, with student behaviour (r = .068, p<.05).

Teacher Behaviour

The index of teacher behaviour was constructed from principals' ratings of the extent to which they considered that various teacher-related behaviours (listed in Table 6.9) influenced students' learning in their school. In both Ireland and across the OECD on average, the three factors among the list of those shown in Table 6.9 rated as least problematic in hindering learning were teachers being too strict, teacher absenteeism, and poor student-teacher relations. Factors perceived to be more prevalent in hindering learning included teachers not meeting individual student needs, and low expectations of students. Ratings in Ireland are broadly similar to those on average across the OECD; however, principals in Ireland rated staff resisting change as a hindrance to learning less frequently than on average across the OECD.

Table 6.9: Percentage of students in schools whose principals reported that the various teacher behaviours hindered learning 'not at all' or 'very little' (Ireland and OECD)

In your school, to what extent is the learning of students hindered by…	% Ireland	% OECD
Teachers' low expectations of students	78.2	77.6
Poor student-teacher relations	92.5	87.6
Teachers not meeting individual students' needs	75.6	71.7
Teacher absenteeism	87.6	83.4
Staff resisting change	82.3	72.0
Teachers being too strict with students	89.5	89.7
Students not being encouraged to achieve their full potential	84.1	76.6

Higher scores on the overall index indicate that principals assign a low value to the impact of teacher behaviour on student learning[40]. Ireland's overall mean score on the index (0.10) is significantly higher than the mean across OECD countries (-0.09)[41] suggesting that, on average, teachers' behaviours are more positive in Ireland (Table 6.10). The United Kingdom has a mean score similar to that in Ireland (0.07), while Poland displays the second highest mean score among OECD countries (0.47). In Shanghai-China, by contrast, principals perceived the behaviours listed as having high levels of adverse effects on student learning (score = -0.60).

In Ireland, more positive teacher behaviour is significantly and positively associated with achievement in all four domains and with ESCS, though the associations are weak (Table 6.10). On average across OECD countries, a significant increase of 9.6 points on the print reading scale is associated with an increase of one point on the index of teacher behaviour. However, the relationship between reading performance and teacher behaviour varies widely across countries. In Ireland, an increase of one unit (standard deviation) on this index is associated with a significant increase of 14.1 points on the reading scale, whereas in Poland (which displays a very high level of positive

[40] The OECD (2010d) note that principals' reports may not be the most objective or reliable source of information on teacher behaviour.

[41] Some of the scales reported on in this section do not have an OECD average of 0.0, due to the fact that responses to the individual items underlying the scales was linked (anchored) to 2000 values.

teacher behaviour, as noted above), there is no significant relationship between print reading achievement and scores on this index.

Table 6.10: Mean scale scores for school climate variables, comparisons with international means and by school sector/gender, and correlations with achievement domains and ESCS (Ireland)

		Ireland							
					Correlations				
Scale	International Mean	Mean	SE	SD	Print Reading (r)	Digital Reading (r)	Mathematics (r)	Science (r)	ESCS (r)
Teacher behaviour*	↑	0.10	0.08	0.9	**.128**	**.122**	**.100**	**.084**	**.136**
Student behaviour*	↓	-0.25	0.08	0.8	**.207**	**.160**	**.209**	**.176**	**.212**
School principal's leadership	=	-0.20	0.08	0.9	-.011	.050	-.029	-.045	.000
Teacher-student relations	⇓	-0.08	0.02	1.0	**.185**	**.217**	**.223**	**.216**	**.113**
Disciplinary climate	=	-0.03	0.03	1.1	**.174**	**.123**	**.110**	**.108**	**.050**
Teacher stimulation of student reading engagement	⇑	0.06	0.02	1.0	.035	.018	.020	.029	**.059**
Sense of belonging**	NA	0.00	0.02	1.0	**.075**	**.093**	**.092**	**.073**	**.128**

Note: * = These are school-level variables derived from principals' responses.
** = This is a national variable unique to Ireland.
Significantly higher ($p \leq .05$) ↑ Significantly lower ($p \leq .05$) ↓
Significantly higher ($p \leq .01$) ⇑ Significantly lower ($p \leq .01$) ⇓
No statistically significant difference ($p > .05$) =
Values of r in bold indicate that correlation is significant ($p < .05$).

Student Behaviour

Principals were asked to indicate the extent to which they considered certain student behaviours affected learning in their school. Their responses to six items (listed in Table 6.11) were combined to form a composite variable representing the perceived effect of negative student behaviour on learning. Higher scores on this index indicate less adverse effects (a more positive outcome). The responses to individual items suggest that in both Ireland and across the OECD on average, behaviours that were less commonly perceived as problematic were students skipping classes, intimidating or bullying other students, and using alcohol or drugs. Student absenteeism and disruption of classes by students were perceived to be more frequently problematic. In Ireland, student absenteeism was perceived to be more of a problem than across the OECD on average, while skipping classes was perceived to be less of a problem in Ireland than across the OECD.

Ireland had a relatively low score on this index (-0.25) which is indicative of student behaviour being more of a hindrance to learning in Ireland than on average across the OECD (Table 6.10). Finland's mean score on the index (-0.43) indicates even greater levels of perceived negative student behaviour, while Korea (0.40) and the United Kingdom (0.19) have comparatively high mean scores. The index of student behaviour correlates positively and significantly with achievement in all four domains and with student socioeconomic status in Ireland, and although the associations are

weak, they are stronger than those for the index of teacher behaviour (Table 6.10). The relative positions of different countries on the index of teacher behaviour tend to match their positions on the index of student behaviour[42].

Table 6.11: Percentage of students in schools whose principals reported that various student behaviours hindered learning 'not at all' or 'very little' (Ireland and OECD)

In your school, to what extent is the learning of students hindered by…	% Ireland	% OECD
Student absenteeism	39.2	52.0
Disruption of classes by students	56.2	60.2
Students skipping classes	78.7	66.7
Students lacking respect for teachers	70.7	76.2
Student use of alcohol or drugs	88.9	91.1
Students intimidating or bullying other students	79.8	86.3

In almost all OECD and partner countries, an increase of one unit on the index of student behaviour is associated with a significant increase on the print reading scale[43], though the size of the effect varies in magnitude. The effect in Ireland (23.6 points) is very close to the average across OECD countries (22.5), as is the case in New Zealand (24.4), the United Kingdom (24.8), and the United States (25.3), while it is much larger in Germany (44.8 points) and much smaller in Poland (7.6 points).

School Principal's Leadership

The index of school principal's leadership was constructed from principals' reports of how often they were involved in school matters described in 14 statements such as 'I observe instruction in classrooms', 'I use student performance results to develop the school's educational goals', and 'I give teachers suggestions as to how they can improve their teaching'. In Ireland, the index was not related to performance in any of the achievement domains or to ESCS (Table 6.10). Ireland's mean score on the index did not differ significantly from the OECD average.

Teacher-Student Relations

An index measuring the quality of teacher-student relations was constructed from students' levels of agreement with five statements about their relationships with teachers in their school (Table 6.12). Higher values on the scale are indicative of better teacher-student relations, as perceived by students. Ireland's score on the overall index of student-teacher relations (-0.08) was significantly below the OECD average (0.00), suggesting that students in Ireland perceived that they have comparatively less positive relationships with their teachers (Table 6.10). However, responses to the individual questions comprising the index in Ireland are similar to the OECD averages. Although the percentages of students agreeing with the various statements were quite high on average across the OECD, there is a lot of variation between countries. For example, while high percentages of students in the United States agreed with these statements (e.g., 90% agreed that they get along well with their teachers), rates of agreement were

[42] There is a strong positive association ($r = .600$, $p<.001$) between the indices in Ireland.
[43] Although in one of our comparison countries, Finland, there is no significant change in reading score associated with a change of one unit on the index.

much lower in Poland (e.g., just 35% of students agreed that their teachers were interested in their well-being).

Table 6.12: Percentage of students agreeing or strongly agreeing with statements about their relationships with teachers in their school (Ireland and OECD)

How much do you disagree or agree with the following statements about teachers at your school?	% Ireland	% OECD
I get along well with most of my teachers.	81.8	84.7
Most of my teachers are interested in my well-being.	75.6	66.5
Most of my teachers really listen to what I have to say.	62.8	67.1
If I need extra help, I will receive it from my teachers.	77.4	78.9
Most of my teachers treat me fairly.	81.1	78.8

Correlations between the index of student-teacher relations and achievement in all four domains and ESCS are positive and significant in Ireland, implying that more positive student-teacher relations are associated with both higher achievement and higher socioeconomic status. The change in the reading score associated with a one unit change on the student-teacher relations scale is almost double the average across OECD countries (21.1 compared to 12.2 points; both significant). In contrast, in Germany, there is no significant change in the reading score per unit of the index. In Ireland, female students reported significantly ($p<.01$) more positive relations with their teachers than male students.

Disciplinary Climate

Student ratings of how often lessons in their language of instruction were disrupted by various disciplinary problems were used to construct an index of disciplinary climate, on which higher scores denote a better disciplinary climate (i.e., fewer interruptions of class). The majority of students in Ireland and of their counterparts across the OECD reported infrequent occurrences of each of five disciplinary problems. For example, 81% reported that it happens never or hardly ever, or only in some lessons, that students cannot work well (Table 6.13).

Ireland's mean score on the disciplinary climate index (-0.03) does not differ significantly from the OECD average (Table 6.10). Shanghai-China, Korea, and Germany have very high mean scores on the index (0.45, 0.38 and 0.25, respectively), which suggests that these countries have very few interruptions during classes due to disciplinary problems. Finland (-0.29) and France (-0.20), on the other hand, have low mean scores suggesting a relatively poor perceived disciplinary climate.

In Ireland, scores on the disciplinary climate index are significantly and positively associated with all four achievement domains, the strongest correlation being with print reading achievement ($r = .174$) (Table 6.10). An increase of one unit on the disciplinary climate index is associated with an increase of 14.7 points on the print reading scale, which is very similar to the average across OECD countries (14.3 points). Disciplinary climate is only weakly, though significantly, associated with ESCS in Ireland ($r = .050$). An examination of differences on the disciplinary climate index by school sector and gender composition within Ireland reveals that the only significant differences relate to students in girls' secondary schools, who reported significantly fewer disciplinary problems than students in all other school types.

Table 6.13: Percentage of students reporting that various disciplinary issues during lessons in their language of instruction occurred 'never or hardly ever' or 'in some lessons' (Ireland and OECD)

How often do these things happen in your English lessons?	% Ireland	% OECD
Students don't listen to what the teacher says.	63.7	71.4
There is noise and disorder.	64.6	68.5
The teacher has to wait a long time for the students to settle down.	69.9	72.0
Students cannot work well.	80.8	80.6
Students don't start working for a long time after the lesson begins.	75.1	74.6

Teacher Stimulation of Student Reading Engagement

Students were asked how often, during lessons in their language of instruction, teachers encouraged them to engage with reading in various ways (e.g., by asking them to explain the meaning of a text, by recommending a book or author to read, and by encouraging students to express their opinions about a text). Their responses were used to construct an index measuring teacher stimulation of student reading engagement, with higher scores on the index associated with greater encouragement by teachers. Ireland's mean score on the index (0.06) is slightly, though significantly higher than the OECD average (0.00), suggesting that teachers of English in Ireland engage in attempts to stimulate students' engagement with reading with a relatively high frequency. This scale, however, is not significantly associated with any of the achievement domains in Ireland (Table 6.10).

Sense of Belonging in School

In Ireland, students were asked to rate their agreement with a series of statements (listed in Table 6.14) concerning their sense of belonging in school. The majority (over 75%) either agreed or strongly agreed with each of the statements, indicating a high sense of belonging, though only 69% agreed that they felt calm and relaxed.

Table 6.14: Percentages of students agreeing and disagreeing with statements about their sense of belonging in school (Ireland)

My school is a place where …	Strongly Disagree		Disagree		Agree		Strongly Agree	
	%	SE	%	SE	%	SE	%	SE
I feel included in things	3.4	(0.31)	9.7	(0.55)	62.3	(0.90)	21.2	(0.70)
I make friends easily	2.0	(0.25)	8.0	(0.39)	52.5	(0.94)	33.8	(0.85)
I feel like I belong	4.2	(0.32)	13.7	(0.52)	56.6	(0.93)	21.8	(0.77)
I feel safe	3.4	(0.31)	12.0	(0.57)	59.3	(0.96)	21.8	(0.83)
Other students seem to like me	2.0	(0.24)	6.5	(0.41)	66.5	(0.94)	21.3	(0.74)
I feel happy	5.0	(0.38)	12.9	(0.54)	57.1	(0.92)	21.1	(0.80)
I feel calm and relaxed	5.6	(0.35)	21.4	(0.65)	51.7	(0.89)	17.6	(0.65)

Note: This is a national indicator unique to Ireland.

An index of sense of belonging in school was constructed from responses to the seven items (standardised to have a national mean of 0 and a standard deviation of 1), with higher values on the scale indicating a greater sense of belonging[44]. Sense of belonging was positively associated with higher achievement in all four domains, though correlations are weak (ranging from r = .073 for science to r = .093 for digital

[44] The scale was constructed using principal components analysis in SPSS® and is unique to Ireland.

reading) (Table 6.10). Sense of belonging is also significantly and positively, though weakly, associated with socioeconomic status (r = .128).

Male and female students did not differ in their sense of belonging in school (Table 6.15). However, immigrant students with a language other than English or Irish had a mean score on the index that was almost half a standard deviation (0.47 scale points) lower than native students. Immigrant students who spoke English or Irish also had a significantly lower mean score on this scale (by 0.24 index points) than native students. There were also differences in mean sense of belonging by school sector/gender composition, with students in girls' and mixed secondary schools reporting a higher average sense of belonging than students in boys' secondary, community/comprehensive and vocational schools. Students in SSP schools had a mean score on the index that was significantly lower (by 0.22 index points) than students in non-SSP schools.

Table 6.15: Mean scores on the sense of belonging in school scale, by gender, immigrant status, school type and school SSP status (Ireland)

Student Gender	Mean	SE
Female (Ref)	0.05	0.025
Male	-0.05	0.028
Student Immigrant Status		
Native (Ref)	0.03	0.018
Immigrant with English/Irish	**-0.21**	0.089
Immigrant with another language	**-0.44**	0.125
School Type		
Community/Comprehensive	**-0.07**	0.037
Boys' Secondary	**-0.06**	0.056
Girls' Secondary (Ref)	0.08	0.021
Mixed Secondary	0.09	0.042
Vocational	**-0.08**	0.045
School SSP Status		
In SSP (Ref)	-0.19	0.045
Not in SSP	**0.03**	0.023

Note: Significant differences are in bold.

Total and Between-School Variance in Print and Digital Reading Achievement

In this section, we compare the variance in achievement on print and digital reading scores for Ireland and on average across the OECD. The smaller the total variance, the narrower the distribution of achievement. In print reading, the total variance in Ireland (9053) exceeds the OECD average (8793), whereas, for digital reading, there is less variation in achievement in Ireland (7830 compared to 8807 on average across the OECD) (OECD, 2010e, 2011a).

Between-school variance, expressed here as a percentage, is an indication of the extent to which schools differ with respect to average achievement. The lower the between-school variance, the more equitable a school system is with respect to student achievement. The percentage of total variance in print reading achievement that can be attributed to schools is smaller in Ireland (28.7%) than on average across the OECD

(38.6%), indicating, according to the OECD, greater academic equity between schools in this domain in Ireland (OECD, 2010e). The percentage of variance in digital reading achievement is also smaller in Ireland than on average across OECD countries (21.8% compared to 36.6%) (OECD, 2011a). That Ireland has lower between-school variance on digital reading than on print reading indicates that the former is less dependent on school factors than the latter.

Total and Between-School Variance in ESCS

The OECD (2010b) regards the percentage of variance on the ESCS scale that is between schools as indicative of 'social inclusion'. The higher this percentage, the more schools differ with respect to socioeconomic intake. In Ireland, 23.3% of variance in ESCS was between schools, compared to 25.2% on average across the OECD, indicating marginally less differentiation in Ireland. Socioeconomic differentiation was similar to Ireland in some of the comparison countries: 24.0% in Germany, 25.9% in Korea, 21.1% in New Zealand, and 26.7% in Poland. It was somewhat lower than Ireland in Finland (10.8%) and the United Kingdom (18.4%), and higher than Ireland in the United States (29.3%) and Shanghai-China (33.7%).

The relationship between performance and ESCS can be further examined by considering the extent to which performance differences between and within schools are related to socioeconomic differences. In Ireland, the percentage of between-school differences in print reading performance accounted for by between-school differences in ESCS (58.5%) is close to the OECD average (55.1%), but this varies a lot across countries. In Finland, differences in the socioeconomic background of schools account for just 23.2% of performance differences between schools, whereas more than 70% of performance differences in print reading between schools are related to ESCS differences between schools in the United Kingdom, the United States, and New Zealand (OECD, 2010b).

The percentage of variance in digital reading performance explained by between-school differences in ESCS is smaller, both on average across OECD countries (48.4% compared to 56.8% for print reading) and in Ireland (48.0% compared to 58.5%) (OECD, 2010b).

Changes in Student- and School-Level Characteristics Since 2000

This section examines changes between PISA 2000 and PISA 2009 in student- and school-level characteristics and in their relationships to performance. For the most part, changes in associations with achievement are restricted to print reading[45]. Inset 6.3 lists the variables that were examined for change. These particular variables were selected for trend analysis on the basis of two considerations: first, their potential ability to explain changes in achievement in Ireland since 2000; and second, in the case of indices, their technical comparability with PISA 2000[46].

The OECD averages described in this section are based on the 26 countries that have valid data for PISA 2000 and PISA 2009. International and country estimates

[45] However, associations between current grade (year) level and achievement are presented for print reading, mathematics and science, as different patterns of change are evident in the different domains.
[46] In order to make valid comparisons over time, indices were re-estimated to have an OECD mean of 0 and a standard deviation of 1 for 2009. This equating was performed by the OECD (2010e) for certain variables only.

reported here may differ slightly from those reported in previous national and international reports, due to re-estimation of some indices. Some of the values reported here also differ from those reported in the PISA 2009 summary report for Ireland (Perkins et al., 2010), as Austria was removed from comparative analyses by the OECD from some of the comparisons following publication of the national summary report. As discussed in greater detail in Chapter 9, caution should be exercised in interpreting trend data, as many factors can influence change.

Inset 6.3: School and student variables examined for changes, 2000 - 2009

Variation in Performance
Economic, Social and Cultural Status (ESCS)
Immigrant background
Language
Student Grade (Year) Level
School Sector and Gender composition*
Disciplinary Climate
Teacher-Student Relations

* = Variable is nationally-derived.

Variation in Reading, Mathematics and Science Performance

Table 6.16 shows the standard deviations for reading, mathematics and science in Ireland for each year in which PISA was administered, as well as the standard deviation in achievement in Ireland expressed as a percentage of the respective OECD averages[47]. The top portion of the table facilitates a comparison of variation in achievement within Ireland over time, while the bottom portion compares variation in achievement in Ireland to the OECD over time.

Table 6.16: Variation in achievement, all domains, all cycles – standard deviations for Ireland, and standard deviations expressed as percentages of the respective OECD averages

SD - Ireland	2000	2003	2006	2009
Print Reading	93.4	86.5	92.0	95.1
Mathematics	83.6	85.3	82.0	86.0
Science	91.7	93.0	94.0	97.0
Digital Reading				87.1
SD - % of OECD average				
Print Reading	93.4	86.3	92.9	102.1
Mathematics	83.6	85.3	89.1	93.8
Science	91.7	88.2	98.9	103.2
Digital Reading				96.6

In general, overall variation in achievement in Ireland has tended to increase over time, though the pattern is not smooth. A comparison of 2000 and 2009 reveals increases in the variation in achievement in print reading and science, but less so in mathematics.

Table 6.17 shows the percentages of total variation in achievement between schools for all domains and all cycles. Figures are missing for OECD averages for

[47] The standard deviation in Ireland was divided by the OECD average standard deviation and expressed as a percentage.

mathematics and science for PISA 2009 as these have not yet been published. In Ireland, there is a general trend across all domains for the percentage of between-school variance to increase over time between 2000 and 2009: from 17.8% to 28.7% in reading, from 11.4% to 23.5% in mathematics, and from 14.1% to 25.0% in science. It should be noted that there is also a general tendency for between-school variance to increase on average across the OECD, though it is not as marked as in Ireland.

Ireland was one of only four OECD countries that displayed a significant increase in the percentage of between-school variance in print reading achievement in 2009 relative to 2000. The other three countries were Italy, Japan, and Switzerland (OECD, 2010e).

Although between-school variance in all achievement domains tends to be smaller in Ireland than the respective OECD averages, that it is increasing indicates that schools in Ireland are now more different to one another in terms of average reading achievement than they were in 2000. This would also seem to be the case for mathematics and science, though OECD averages would be required to verify this.

Table 6.17: Between-school variance in achievement (expressed as a percentage of total variance), all domains, all cycles (Ireland and OECD)

	Ireland				OECD			
Domain	2000	2003	2006	2009	2000	2003	2006	2009
Print Reading	17.8	22.5	23.4	28.7	34.7	31.4	36.0	39.3
Mathematics	11.4	16.7	19.4	23.5*	31.4	32.7	34.7	
Science	14.1	16.2	17.2	25.0*	30.6	29.9	32.7	
Digital Reading				21.8				38.7

Note: *Estimates for mathematics and science for 2009 were computed in HLM 6.0®. Estimates for mathematics and science are not available for the OECD average for 2009.

Economic, Social and Cultural Status (ESCS)

Student average socioeconomic background, as measured by the index of ESCS, increased in Ireland and on average across OECD countries between 2000 and 2009, although the change was significant at OECD level only (Table 6.18).

Table 6.18: Comparisons of mean ESCS and overall, between- and within-school effects of ESCS on print reading achievement (Ireland and OECD, 2000 – 2009)

	2000		2009		Diff (2009 – 2000)	
	Ireland	OECD	Ireland	OECD	Ireland	OECD
Mean ESCS	-0.03	-0.02	0.05	0.01	0.08	**0.03**
Overall effect of ESCS	33.7	39.1	39.4	38.3	5.8	-0.9
Between-school effect of ESCS	53.8	65.6	53.1	61.4	-0.7	**-7.3**
Within-school effect of ESCS	22.9	17.9	26.9	19.1	4.0	**1.8**

Note: 'Overall effect of ESCS' = Student-level score point difference associated with one unit increase in the ESCS. 'Between-school effect of ESCS' = School-level score point difference associated with one unit increase in the school mean ESCS. 'Within-school effect of ESCS' = Student-level score point difference associated with one unit increase in the school mean ESCS. Significant differences between 2000 and 2009 are in bold. OECD averages are based on 26 countries. 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 due to problems with the measurement of parental occupation in 2000, but is included in the OECD averages for 2009.

The average ESCS of students in Ireland did not differ significantly from that of their counterparts on average across OECD countries in either cycle. The overall association between ESCS and print reading achievement[48] did not change significantly in Ireland or on average across OECD countries, while the overall association between ESCS and print reading performance in Ireland did not differ from the average association across OECD countries in either cycle. This relationship generally remained quite stable across countries, with some exceptions. For example the relationship between ESCS and achievement was significantly weaker in the United States and Germany in 2009 than in 2000, bringing these countries closer to the OECD average on this indicator.

Across OECD countries on average, between-school effects of ESCS on print reading achievement decreased significantly, while within-school effects increased significantly (Table 6.18). There was, however, no significant change in the effects of ESCS on print reading achievement in Ireland, either between or within schools. Ireland did not differ significantly from the OECD average in the strength of between-school effects of ESCS on reading achievement in either cycle, but did have a significantly stronger within-school association between ESCS and reading achievement than OECD countries on average in 2009, having not significantly differed from the OECD average on this estimate in 2000. This indicates that in Ireland, the social context effect associated with ESCS was the same in 2000 and 2009, but that there was a greater socioeconomic differentiation at the individual student level in 2009 than in 2000, relative to the OECD averages.

Immigrant Background

To facilitate international comparisons, immigrant background and language status are treated as separate variables in this section, rather than as a combined immigrant and language background variable as reported in Table 6.1. While the percentage of immigrant students in Ireland in 2000 (2.3%) was significantly below the OECD average (8.2%), in 2009 Ireland did not differ significantly from the OECD average (8.3% compared to 9.9%) (Table 6.19). Although there was a significant increase of 2.1 points in the percentage of immigrant students on average across OECD countries, Ireland experienced the second largest increase of all OECD countries[49] in percentage of immigrant students between 2000 and 2009 (5.9 percentage points; Table 6.19)[50].

In PISA 2000, immigrant students achieved a significantly higher mean print reading score than native students in Ireland, while on average across OECD countries, the opposite was the case. Between 2000 and 2009, both native and immigrant students in Ireland recorded significant decreases in mean achievement scores. However, the decrease among immigrant students was much larger than that among native students, so that by 2009 native students were significantly outscoring immigrant students. In contrast, OECD average achievement scores of native and immigrant students remained very stable across cycles (Table 6.19).

[48] That is, the slope of the socioeconomic gradient.
[49] The largest increase was in Spain.
[50] The difference (2009 - 2000) in the percentage of immigrant students across the OECD on average does not equal the 2009 OECD value minus the 2000 OECD value as differences between 2000 and 2009 are based on those countries which had sufficient numbers in *both* cycles.

Table 6.19: Percentages of immigrant students and comparisons of mean print reading scores of native and immigrant students (Ireland and OECD, 2000 – 2009)

	2000		2009		Diff (2009 – 2000)	
	Ireland	OECD	Ireland	OECD	Ireland	OECD
% Immigrant	2.3	8.2	8.3	9.9	**5.9**	**2.1**
Native Mean	527.5	500.4	501.9	501.5	**-25.6**	
Immigrant Mean	551.8	460.1	473.1	458.0	**-78.7**	
Diff (Native – Immigrant)	**-24.3**	**43.9**	**28.8**	**43.1**	**53.1**	-3

Note: Figures are based on 26 countries. Significant differences are in bold. The Diff. (2009 - 2000) at OECD level does not equal the 2009 OECD value minus the 2000 OECD value as averages are calculated for countries that have sufficient numbers of observations to report performance gaps across students in each cycle (in this case, at least 30 students with an immigrant background spread across at least 5 different schools), while trends are based on those countries which had sufficient numbers in both cycles. Therefore, OECD trend estimates related to this variable that have not been published by the OECD are not reported, as they cannot be accurately calculated from the available data.

Language Spoken in the Home

In line with the increase in the number of students with an immigrant background, the percentage of students in Ireland who spoke a language other than English or Irish at home increased four-fold between 2000 and 2009 (0.9% compared to 3.6%) (Table 6.20). Comparisons of mean scores on the print reading scale between cycles reveal a reversal of relative achievement levels similar to those for immigrant status. While differences in mean reading scores based on language status were not significant in 2000, in 2009, students who did not speak English or Irish at home scored more than half a standard deviation lower, on average, than English/Irish-speaking students. This was due to a very large drop of 88.9 score points in the mean reading achievement of other language students (Table 6.20).

Table 6.20: Percentages and comparisons of mean print reading scores of students who spoke English/Irish and those who spoke another language (Ireland, 2000 – 2009)

	2000		2009		Diff (2009 - 2000)	
	%	Mean	%	Mean	%	Mean
Other Language	0.9	532.8	3.6	443.9	**2.7**	**-88.9**
English/Irish	99.1	527.4	96.4	500.4	-2.7	**-27**
Diff (English/Irish – Other Lang.)		-5.4		**56.6**		**62**

Note: Significant differences are in bold. Estimates reported in this table differ from those reported for Ireland in the OECD report for PISA 2009 (OECD, 2010b, 2010e) as the OECD recoded 'Other Language' students to include, along with students who spoke neither English nor Irish at home (3.6% of students in 2009), students who spoke Irish at home but did the mathematics and science tests through English (0.5% of students in 2009), and those who spoke English at home but did the tests through Irish (1.5% of students in 2009). The OECD also included in this category students for whom the language of the test was unspecified but who spoke English at home (0.2% of students in 2009). The variable reported here includes just those students who spoke neither English nor Irish at home.

These findings prompt us to consider the possibility of changes since 2000 in other characteristics of students who speak a language other than English or Irish. A comparison of these students with students who spoke English or Irish indicates that changes in the socioeconomic composition of the groups may underlie some of the changes in achievement. While in 2000, the mean ESCS score of other language students was significantly higher than English/Irish speakers, by 2009 the mean ESCS scores of

the two groups were more similar. The mean ESCS score of other language speakers decreased from 0.14 to -0.08 while that of English/Irish speakers remained stable (-0.01 in 2000; -0.02 in 2009).

Student Grade (Year) Level

In each of the four PISA cycles to date, there has been a successive decrease in the percentage of students in Fifth Year (from 18.6% in 2000 to 14.4% in 2009), while the percentage in Transition Year has increased (from 16.0% in 2000 to 24.0% in 2009). Table 6.21 presents data on the achievement levels of students in print reading, mathematics, and science. The baseline for making comparisons is 2000 for reading, 2003 for mathematics, and 2006 for science.

Table 6.21: Comparisons of mean scores in print reading, mathematics and science across grade (year) levels (Ireland, all PISA cycles), and differences in average achievement across cycles

	2000		2003		2006		2009		
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	
Print Reading									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									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									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: Significant differences are in bold.

While mean scores in print reading declined significantly between 2000 and 2009 for students at all grade levels, the decline was uneven across grades. The largest decline was at Fifth Year (49.7 points), followed by Transition Year (43.1 points), Second Year (34.7 points) and Third Year (29.0 points). In mathematics, in contrast, students in Transition Year showed the greatest drop in achievement between 2003 and 2009 (33.4 points), followed by Fifth Year (19.0 points), and then Third Year (12.2 points). Science achievement levels remained stable between 2006 and 2009, with no significant changes in mean scores at any grade level. There were no significant changes in mean ESCS scores between 2000 and 2009 for students at any grade level that might help to explain the differential changes in achievement levels (Table 6.22).

Table 6.22: Mean ESCS scores by student grade/year level (Ireland, 2000 and 2009)

Year Level	2000		2009	
	Mean	SE	Mean	SE
Second Year	-0.35	0.091	-0.47	0.124
Third Year	-0.03	0.032	0.00	0.031
Transition Year	0.15	0.059	0.13	0.049
Fifth Year	-0.15	0.044	-0.21	0.051

School Sector and Gender Composition

Achievement trends related to school sector and school gender composition are examined separately here as data for school sector and gender composition combined are not available for 2000 (Table 6.23). Between 2000 and 2009, the mean print reading scores of students in community/comprehensive schools and secondary schools dropped in significant, and approximately equal, amounts (35.0 and 34.1 points), while the much smaller drop in the scores of students in vocational schools (18.1 points) was not significant. Although the achievement gap between vocational and secondary schools narrowed, the mean scores of secondary school students remained significantly higher. However, while the average achievement level of students in community/comprehensive schools was at a significantly higher level than students in vocational schools in 2000, these two sectors did not differ significantly in 2009.

Mean reading scores of students in all girls', all boys' and mixed schools all dropped significantly between 2000 and 2009, with the largest drop occurring in all boys' schools (47.0 points) and the smallest in all girls' schools (17.4 points). In 2000, the mean achievement levels of students in all girls' and all boys' schools did not differ significantly; however, by 2009, students in all boys' schools were scoring significantly lower on average than students in all girls' schools.

Table 6.23: Comparisons of mean print reading scores by school sector and school gender composition (Ireland, 2000 and 2009), and differences 2009-2000

	2000			2009			Diff (2009 - 2000)	
	%	Mean	SE	%	Mean	SE	Mean	SE
School Sector								
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
School Gender								
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: These variables are unique to Ireland. Significant differences are in bold.

Disciplinary Climate

Trends in country mean scores on the indices of disciplinary climate and teacher-student relations have not been published by the OECD and so cannot be reported here. However, it can be noted that Ireland's mean score on the disciplinary climate index was significantly higher than the average of the OECD countries that had valid data for PISA 2000, and did not differ significantly from the OECD average in 2009.

An examination of changes in the individual items that make up the index, in Ireland and on average across OECD countries that had valid data for both cycles, also suggests a general perceived disimprovement in disciplinary climate in Ireland compared to the OECD average. Significantly smaller percentages of students in Ireland in 2009, compared to 2000, reported that three of the five disciplinary problems (students not listening to what the teacher says, noise and disorder, and students not being able to work well) never or hardly ever occurred, or occurred only in some lessons (Table 6.24).

Table 6.24: Change in percentages of students reporting that various disciplinary issues during English lessons in their language of instruction occurred 'never or hardly ever' or 'in some lessons' (Ireland and OECD, 2009 – 2000)

	% Diff (2009 - 2000)	
How often do these things happen in your English lessons?	IRL	OECD
Students don't listen to what the teacher says.	**-11.2**	**-3.2**
There is noise and disorder.	**-9.1**	0.3
The teacher has to wait a long time for the students to settle down.	-1.0	**5.9**
Students cannot work well.	**-2.5**	**1.6**
Students don't start working for a long time after the lesson begins.	0.3	**2.0**

Note: Negative figures indicate a disimprovement in disciplinary climate and positive figures indicate an improvement. Significant differences are in bold.

In contrast, on average across OECD countries, there was a significant improvement on three of the five indicators, with greater percentages of students reporting that the following never or hardly ever happened, or happened only in some lessons: the teacher has to wait a long time for the students to quieten down, students cannot work well, and students don't start working for a long time after the lesson begins. There was a disimprovement in just one indicator at OECD level, with a significantly smaller percentage of students reporting that it happened never or hardly ever, or only in some lessons, that students don't listen to what the teacher says, although the decrease was smaller across the OECD on average than in Ireland (-3.2 compared to -11.2) (Table 6.24).

Teacher-Student Relations

Table 6.25 presents data on changes in the percentages of students agreeing or strongly agreeing with selected items from the index of teacher-student relations, from 2000 to 2009. Positive changes indicate an improvement in teacher-student relations. Both in Ireland, and on average across OECD countries, there was a significant increase in the percentages of students agreeing or strongly agreeing with each of the three items: most of my teachers really listen to what I have to say; if I need extra help, I will receive it from my teachers; and most of my teachers treat me fairly. This suggests an improvement since 2000 in teacher-student relations, both in Ireland and on average across OECD countries.

Table 6.25: Change in percentages of students agreeing or strongly agreeing with three items from the teacher-student relations index (Ireland and OECD, 2009 – 2000)

How much do you disagree or agree with each of the following statements about the teachers at your school?	% Diff (2009 - 2000)	
	IRL	OECD
Most of my teachers really listen to what I have to say.	**5.5**	**2.9**
If I need extra help, I will receive it from my teachers.	**4.2**	**4.6**
Most of my teachers treat me fairly.	**3.1**	**5.3**

Note: Positive figures indicate an improvement in teacher-student relations. Significant differences are in bold.

Chapter Summary and Conclusions

This chapter described a range of student and school characteristics and their associations with achievement in the four PISA achievement domains[51]. Since many of these characteristics are associated with socioeconomic background, we also examined their relationships with ESCS. To provide a comparative context, we referred to some of the international results (OECD, 2010b, 2010d, 2011a). Even where background characteristics did not show a significant association with achievement, we reported results, since it can be useful to be aware of characteristics that are not associated with achievement as well as those that are.

Information on background characteristics is based on students' and principals' responses to the PISA questionnaires. Most of this information is internationally comparable, while a small number of national additions were made to the questionnaires in Ireland to address areas of national policy interest. Since only 88% of schools in Ireland returned a questionnaire in 2009, missing data issues should be borne in mind when considering the results. A further source of information used for analyses in this chapter is the Department of Education and Skills database of post-primary schools. All data were analysed at the student level.

Student Demographics and Social and Home Background

The mean ESCS (Economic, Social and Cultural Status) score of Irish students did not differ from the OECD average. ESCS is consistently and positively associated with achievement both in Ireland and across the OECD. A one-point increase in ESCS is associated with a 39-point increase on the print reading scale in Ireland, which is about the same as the OECD average. The association between ESCS and digital reading is weaker than that between ESCS and print reading in Ireland, while these associations are about the same as one another on average across the OECD.

Large differences in mean achievement and ESCS scores were found between students of differing immigrant and language backgrounds. In Ireland, immigrant students with English or Irish as their home language (about 4%) had mean achievement scores that did not differ from native Irish students, and a mean ESCS score that was slightly but significantly lower. Immigrant students with another first language, on the other hand (again, about 4%), had a mean achievement score in all four achievement domains that was significantly lower (by half of a standard deviation or more) than that of native Irish students, even though their mean ESCS score was significantly higher.

[51] We already considered gender as a background characteristic in Chapters 3, 4 and 5, where it was found that gender differences in achievement varied depending on the PISA domain considered, as has generally been the case in previous cycles. Readers are referred to Tables 3.25, 3.26, 3.27, 4.4, 4.5, 5.5, 5.6, 5.11 and 5.12 for comparisons of the achievements of males and females.

About 16% of students in Ireland belonged to lone parent families, which is similar to the OECD average of 17%. Students in these families in Ireland had significantly lower scores on all four achievement domains, even when differences in ESCS were taken into account. The number of siblings was also negatively related to achievement and ESCS, albeit weakly, and the lowest achievement and ESCS scores were associated with the 12% or so of students who had four or more siblings.

About three-quarters of students in Ireland reported that they did not engage in paid work during term time, while on the other hand, 6% worked for more than eight hours a week. More males than females engaged in paid work, and the negative association between participating in paid work and achievement was stronger for males than for females in the case of print reading and science. Time spent in paid work was also negatively, though weakly, associated with ESCS.

Other findings relating to demographic and home background characteristics indicate that students from the Traveller community – about 2% of PISA participants in Ireland – scored significantly lower on all four domains (by 25 points or more), and also had a significantly lower mean ESCS score, than students who were not from the Traveller community. The frequency with which students interacted with their parents was positively, though weakly, associated with achievement and with ESCS.

Student Educational Background and Engagement with Education

Students in Second Year had significantly lower achievement scores in all domains as well as a significantly lower mean ESCS score than students in Third Year. Students in Transition Year significantly outperformed students in Third Year. Third Years and Fifth Years achieved print reading and science scores that did not differ from one another, while Fifth Years significantly outperformed Third Years on digital reading and mathematics. Transition Year students significantly outperformed Fifth Years in all achievement domains except mathematics, and also had a significantly higher mean ESCS score.

One in seven students in Ireland (17%) reported that they had not attended preschool, which is well above the OECD average (8%). Students in Ireland who had attended preschool had a significantly higher score on the ESCS scale than students who had not. Their achievement scores were significantly higher than non-preschool attenders, even after accounting for ESCS differences.

In Ireland, students were asked if they intended to complete the Leaving Certificate. About 9% indicated that they were not sure or that they definitely wanted to leave prior to completion. There were large achievement differences between students who wanted to leave school early and those who did not – over 60 score points in all domains. There were also marked differences in the socioeconomic characteristics of the two groups: potential early school leavers had a mean ESCS score that was half a standard deviation below potential completers. Higher rates of absence from school were also associated with lower achievement and ESCS.

School Structure and School Social Composition

Students in girls' secondary schools significantly outperformed students in all other school types in print and digital reading. Students in vocational schools had the lowest scores in all four domains. These achievement differences are related to differences in

ESCS: students in vocational schools had a significantly lower mean ESCS score than student in the other school types.

About 23% of students in Ireland attended schools in the SSP (School Support Programme). Large and significant achievement differences were observed between students in SSP and non-SSP schools, ranging from about 40 to 70 score points. Students in SSP schools had a mean ESCS score that was three-fifths of a standard deviation below that of students in non-SSP schools.

Students enrolled in secondary schools that charged fees (9%) had significantly higher scores in all domains, with differences varying from about 40 to 50 score points. The mean ESCS score of students in fee-paying schools was four-fifths of a standard deviation higher than that of students attending non-fee-paying schools.

In Ireland, eight schools, containing 4% of PISA participants, achieved very low average scores on the print assessment in 2009 (over 100 points lower than other schools in the sample). No schools in PISA 2000 had such low scores. The mean digital reading score of students in these so-called 'outlier' schools was about 60 points below that of students in non-outlier schools. Students in outlier schools also had a mean ESCS score that was about 0.6 points lower than students in other schools as well as a higher concentration of other language speakers. The reasons for the appearance of these schools in the PISA 2009 sample were not clear (whether they represented increasing socioeconomic and demographic diversity in the system as a whole, or were due to chance sampling fluctuations). The characteristics of these schools are considered further in Chapters 8 and 9 of this report.

In addition to individual student ESCS, school average ESCS was found to be significantly associated with achievement, suggesting a social context effect. In Ireland, half a standard deviation increase on the index of ESCS at the school level was associated with an increase of 27 points on the print reading scale, while half a unit increase on the index of ESCS at the student level was associated with an increase of only 14 points. The social context effect is somewhat weaker in Ireland than on average across the OECD.

The achievement scores of students attending schools in differing locations (in terms of population density) and in terms of the number of other schools available locally were also examined. Generally, these did not vary significantly; nor did ESCS scores. Two indicators of school selectivity (ability grouping and academic selectivity on intake) generally did not show any associations with achievement or with ESCS, though it should be borne in mind that the PISA design may not be optimal for measuring these features of schools.

School Climate

Five aspects of school climate were positively associated with both achievement and ESCS, though the strength of the associations was weak. These were indices of teacher behaviour, student behaviour, teacher-student relations, disciplinary climate, and students' sense of belonging in school. Average scores on these indices tended to differ from the OECD averages. While the index of teacher behaviour was significantly higher than the OECD average, scores on the student behaviour and teacher-student relations scales were significantly lower than their respective OECD averages.

Variation in Achievement and ESCS

In Ireland, the between-school variance on print reading was lower than on average across the OECD (29% compared with 39%), indicating higher academic equity. Between-school variance in achievement on digital reading is lower than for print reading in Ireland (22%, compared to an OECD average of 37%).

The OECD also reported data on an indicator of 'social equity', which is the percentage of total variation in ESCS that is associated with schools. Lower percentages can be interpreted as indicative of higher social equity. In Ireland, 23% of variation in ESCS was between schools, compared with an OECD average of 25%, indicating that social equity or differentiation on the basis of school intake in Ireland was similar to the OECD average.

Changes in Background Characteristics

In considering changes in school and student characteristics since PISA 2000, it was found first, that schools in 2009 in Ireland differed more from one another with respect to achievement than in 2000. For example, the between-school variance in achievement on print reading increased from 18% to 29%. Second, while the social context effect remained about the same, there is evidence of greater socioeconomic differentiation at the individual student level in Ireland in 2009 compared to 2000. Third, across all OECD countries but one, Ireland experienced the highest increase in the number of immigrant students participating in PISA, from 2% in 2000 to 8% in 2009. While immigrant students outperformed their Irish-born counterparts in 2000, the opposite was found to be the case in 2009, while at the same time, the socioeconomic advantage of immigrant students in 2000 was no longer apparent in 2009. Therefore, trends in the performance of immigrant students in Ireland need to be interpreted with respect to both the relative size of this group and changes in its socioeconomic composition. Fourth, students in 2009 were distributed somewhat differently across year levels compared with 2000, with an increase in the percentage of students enrolled in Transition Year. Trends in achievement vary depending on the year level considered. In the case of reading, drops in performance were more marked among senior cycle students compared with students in junior cycle, while in mathematics, the most marked decrease in achievement occurred in Transition Year. Mean achievement has remained stable in science across all year levels. These variations cannot be explained by changes in the socioeconomic characteristics of students.

Chapter 7: Student Reading Engagement and Strategies

Detailed information about students' engagement in and attitudes towards reading, and their awareness and use of reading and learning strategies, was obtained in PISA 2009. In this chapter, we relate these characteristics in a systematic way to student achievement in both print and digital reading. The chapter is divided into four main sections: engagement in reading, reading and learning strategies, comparisons of subgroups of students, and changes in engagement in reading in 2009 since 2000. In describing engagement in reading and strategy usage, we first provide a descriptive overview, and then describe differences in these outcomes by gender and Economic, Social and Cultural Status (ESCS), as well as their associations with both print and digital reading. Some of the measures examined here were new in 2009 and so comparisons with 2000 are not possible (see Inset 7.1 for a list of variables examined and those for which comparisons with 2000 are made). Where relevant, reference is made to the comparison countries identified in Chapter 3.

Inset 7.1: Variables measuring reading engagement and reading and learning strategies

Students' Engagement in Reading

*Frequency of reading for enjoyment
*Enjoyment of reading as a leisure activity
*Diversity of print reading
Frequency and overall index of online reading
Library usage

Students' Reading and Learning Strategies

Awareness of understanding and remembering strategies
Awareness of summarisation strategies
Use of memorisation strategies
Use of control strategies
Use of elaboration strategies

*Comparisons between PISA 2000 and 2009.

Attitudes towards reading and learning, motivation, engagement in reading and reading proficiency are considered to be mutually reinforcing, with positive reinforcement occurring at two levels:

1. *Past engagement* impacts on current and future performance: a student's success in applying learning strategies in the past can influence whether such strategies are drawn on in the future.
2. *Circular associations* among engagement, learning strategies, and performance: engaging in reading activities, adopting effective learning strategies, and being a proficient reader are mutually dependent. As students read more, their reading proficiency increases, and when this occurs, they tend to read more and enjoy reading (OECD, 2010c).

Even if strong associations are revealed between engagement in reading and reading performance, causal inferences are not warranted. Relationships may be reciprocal, and frequently mediated by other variables such as socioeconomic status[52]. The models of reading performance presented in Chapter 8 allow for further consideration of some of the variables examined in this chapter in terms of their association with print and digital reading when other relevant variables, such as gender and indicators of home background, are held constant.

Engagement in Reading

In this section, five indicators of reading engagement are described: frequency of reading, enjoyment of reading, diversity of print reading, frequency of online reading, and library usage. The first, frequency of reading, is a categorical measure, while the other four are indices, made up of responses to a number of related questions, with an OECD mean of 0 and standard deviation of 1.

Frequency of Reading for Enjoyment

Students were asked to indicate how much time they usually spend reading for enjoyment each day[53]. In Ireland, 41.9% reported that they don't read at all for enjoyment, while 15.8% read for at least one hour a day (Table 7.1). Students who did not read at all had a mean print reading score (457.6) that is significantly lower than that of students who read for up to 30 minutes day (505.4), while students who read for between 30 minutes and an hour (540.1) and for more than one hour (550.1) have significantly higher scores than students who read for up to 30 minutes (Table 7.1). 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, which suggests that there is a ceiling effect associated with the amount of time spent reading in its relationship with achievement.

Significantly more males (47.5%) than females (36.2%) in Ireland reported that they did not read for enjoyment (Table 7.1). The mean print reading score of females who did not read for enjoyment (474.8) is significantly higher than the mean of non-reading males (444.7), and this mirrors the overall gender difference on print reading (see Chapter 3).

As well as significant gender differences, frequency of reading for enjoyment varies significantly by socioeconomic status (ESCS). In Ireland, 56.3% of students in the bottom quartile of the ESCS scale did not read for enjoyment, compared to just 26.0% in the top quartile. The OECD averages are 44.4% and 28.1%, respectively, indicating comparatively low rates of leisure reading among socioeconomically disadvantaged students in Ireland. Among students who did not engage in any reading for enjoyment, those in the bottom quartile of the ESCS scale had a mean reading score of 431.4, while non-readers in the top ESCS quartile had a mean score of 498.0. Students in the bottom ESCS quartile who did read for enjoyment had a mean reading score of 487.0, while those in the top ESCS quartile who did read had a mean reading score of 555.5. For non-readers, the performance differences between the top and bottom quartiles of the ESCS scale (67 points) is about the same as that between students who did read (68 points) (OECD, 2010c).

[52] As noted in Chapter 6, the term 'socioeconomic status' is used interchangeably with ESCS.
[53] The question did not define reading or specify particular text formats (e.g., print, digital).

Table 7.1: Percentages of students indicating various frequencies of reading for enjoyment and mean print reading scores, all students, males and females (Ireland)

	All Students				Males		Females	
Frequency	%	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 a 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: Reading scores of students that differ significantly from the reference group (30 minutes or less a day) are in bold in the 'mean' column. Statistically significant gender differences (percentages) are in bold in the 'females' column.

The percentage of students in Ireland reporting that they did not read for enjoyment (41.9%) is significantly higher than the OECD country average of 37.4%. In Northern Ireland, 43.3% did not read for enjoyment, which is about the same as in the rest of Ireland. In Finland, the highest-scoring European country in print reading literacy in 2009, one-third (33%; 19.4% of females and 46.7% of males) did not read for enjoyment. In almost all countries in PISA 2009, students who did not read for enjoyment had significantly lower mean print reading scores than students who engaged in at least some reading (OECD, 2010c).

Enjoyment of Reading

Students were asked to indicate their levels of agreement with ten statements relating to enjoyment of reading. In Ireland, 31.7% agreed or strongly agreed that 'Reading is one my favourite hobbies', while a similar percentage agreed that they liked to exchange books with friends (Table 7.2). On all but one of the statements, females had significantly higher rates of agreement than males for positively-worded statements and significantly lower rates for negatively-worded statements. The exception was the negatively-worded statement, 'I find it hard to finish books', with which similar percentages of males and females agreed.

Table 7.2: Percentages of students 'agreeing' or 'strongly agreeing' with various statements about their enjoyment of reading, all students, males and females (Ireland)

	All		Male		Female	
Statement	%	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 are in bold in the 'females' column.

A composite index of enjoyment of reading was constructed, based on the statements in Table 7.2. The mean score for Ireland on the index was -0.08, indicating below-average enjoyment of reading. The mean score for Finland (0.05) was higher than for Ireland, while the mean score for Northern Ireland (-0.19) was lower (OECD, 2010c).

Diversity of Reading Print-Based Texts

Students were asked to indicate the frequency with which they read various print-based texts – fiction (novels, narratives, and stories), non-fiction, magazines, comic books and newspapers – because they wanted to. Three in 10 students in Ireland (30.3%) said that they read fiction at least several times a month, while just 16.0% reported reading non-fiction books with this frequency (Table 7.3). On the other hand, about two-thirds (67.5%) said that they read newspapers, while over half (57.1%) read magazines. Only 1 in 12 reported reading comics (the least frequently read of the text types in Table 7.3). Females in Ireland read magazines and fiction books significantly more frequently than males, while males read comic books and newspapers significantly more frequently than females.

Table 7.3: 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)

	All Students		Males (Ref)		Females	
Type of material	%	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: Significant gender differences are in bold in the 'females' column.

Reading fiction and non-fiction texts on a regular basis were both associated with higher print reading achievement (Table 7.4). In contrast, achievement differences between students who read and did not read newspapers and comics were small, with students who read newspapers and comics having significantly lower mean scores than students who did not. However, on average across OECD countries, students who read comics, newspapers and magazines had significantly higher mean print reading scores than those who did not (OECD, 2010c).

Table 7.4: Mean print reading scores of students reporting that they read/no not read various texts because they want to at least several times a month (Ireland and OECD)

	Ireland				OECD			
	Reads		Does Not Read		Reads		Does Not Read	
Type of material	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Comic Books	**475.9**	(6.74)	500.4	(2.98)	**492.5**	(0.75)	495.1	(0.51)
Fiction	**542.1**	(3.53)	480.3	(3.07)	**532.8**	(0.60)	480.0	(0.50)
Magazines	498.5	(3.14)	497.4	(4.04)	**500.9**	(0.49)	486.1	(0.63)
Newspapers	**494.7**	(3.00)	505.0	(4.18)	**500.7**	(0.51)	484.4	(0.64)
Non-fiction	**525.8**	(5.12)	494.0	(3.03)	**513.3**	(0.73)	491.7	(0.49)

Source: OECD (2010c, Table III.1.6). Significant differences between readers and non-readers of each material are in bold in the 'reads' column.

An index of diversity of reading was constructed based on the five types of material shown in Table 7.4. The mean score for students in Ireland on this scale (-0.13) indicates below-average diversity of reading relative to the OECD average.

Online Reading

Students were asked to indicate the frequency with which they engaged in various online reading activities, either in or outside school. The activities in which students in Ireland engaged most frequently (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 7.5). Female students engaged in reading emails and chatting online more frequently than males. On the other hand, males spent more time than females on reading online news, using an online encyclopaedia or dictionary, taking part in online group discussions or forums, and searching online for practical information. However, participation in these activities by both males and females was low.

Table 7.5: Percentages of students indicating that they engage in various online reading activities at least several times a week, all students, males and females (Ireland)

	All Students		Males (Ref)		Females	
Reading activity	%	SE	%	SE	%	SE
Reading emails	46.0	(1.02)	42.4	(1.12)	**49.7**	(1.52)
Chatting on line	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 online for practical information	24.1	(0.74)	27.1	(1.13)	**21.0**	(0.95)

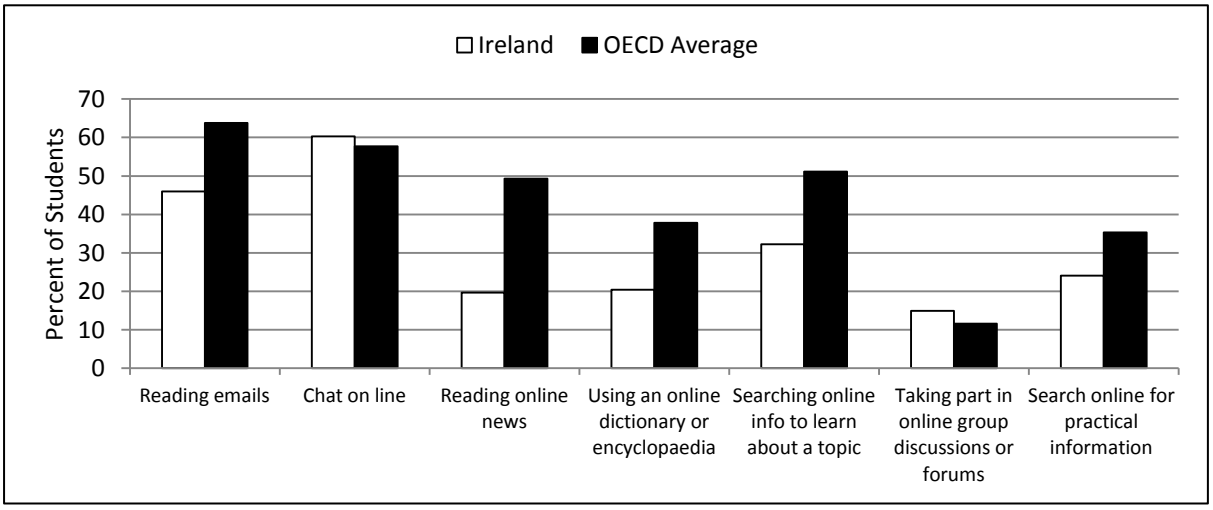
Note: Significant gender differences are in bold in the 'females' column.

The percentage of students in Ireland who chatted online at least several times a week was about the same as the OECD average (57.7%) (Figure 7.1). However, significantly more students on average across OECD countries than in Ireland reported weekly engagement on five of the remaining six online reading activities. The exception was taking part in online group discussions or forums, in which significantly more students in Ireland (14.9%) than on average across OECD countries (11.6%) reported taking part (OECD, 2010c).

In Northern Ireland, more students than in the rest of Ireland reported reading online (79.1% vs. 60.3%) and reading e-mails (66.8% vs. 46.0%), while the percentage that reported searching for information about a topic (31.0%) was about the same as in the rest of Ireland (32.2%).

Drawing on the seven measures of online reading in Table 7.5, a diversity of online reading materials index was constructed. In Ireland, the mean score was -0.50, indicating very limited diversity in online reading. Comparison countries with higher scores on this scale include the United Kingdom (0.11) and Poland (0.44), while New Zealand (-0.29) and Shanghai-China (-0.35) had relatively low mean scores. The mean score for diversity of online reading materials in Northern Ireland was 0.01, which is about half a standard deviation higher than in the rest of Ireland.

Figure 7.1: Percentages of students indicating that they engage in various online reading activities at least several times a week (Ireland and OECD)



Library Usage

Students were asked how often they used libraries (whether public or school-based) for various purposes. In Ireland, students did not use a library very often except to use the Internet (Table 7.6). For example, fewer than 7% of students visited a library to borrow books to read for pleasure, while less than 3% visited to borrow books to read for schoolwork. More girls than boys visited libraries to borrow books to read for pleasure, and to read books for fun. On the other hand, boys visited more often than girls to learn about things that were not course-related. Internet usage in libraries by boys and girls occurred at about the same frequency. The data in Figure 7.2 indicates that, for all of seven purposes considered, higher percentages of students on average across OECD countries than in Ireland reported using the library. For example, 11.1% of students in Ireland compared to 24.0% on average across the OECD visited a library to work on homework, course assignments or research papers.

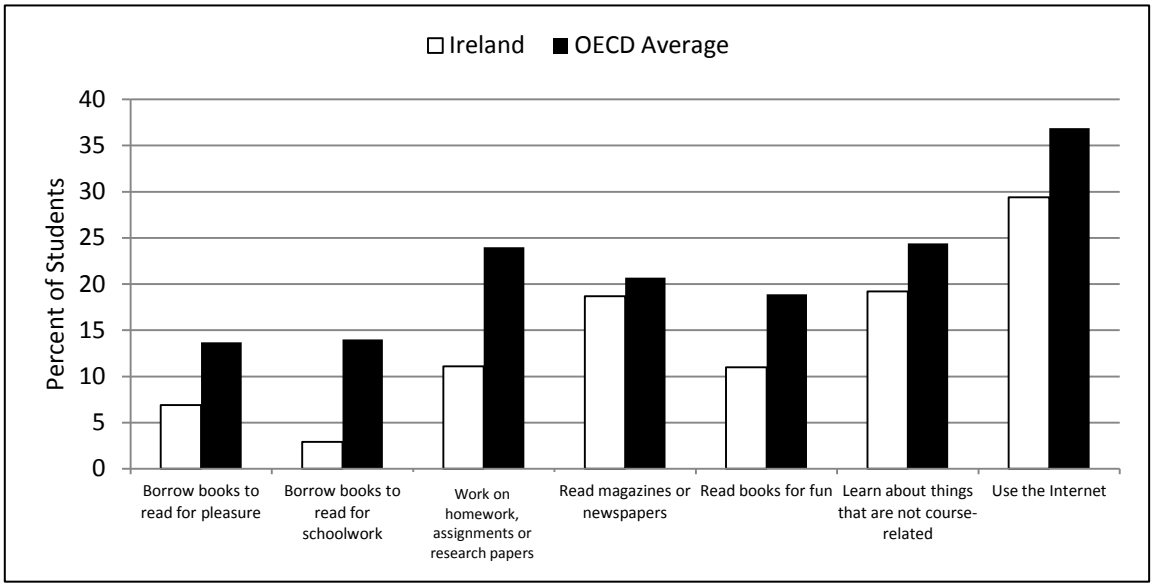
On a scale of library use, comprising the variables in Table 7.6, students in Ireland had a score of -0.32, or one third of a standard deviation below the OECD average.

Table 7.6: Percentages of students indicating that they use libraries for various activities at least several times a month, all students, males and females (Ireland)

	All Students		Males (Ref)		Females	
Library activity	%	SE	%	SE	%	SE
Borrow books to read for pleasure	6.9	(0.42)	4.5	(0.46)	**9.3**	(0.64)
Borrow books to read for schoolwork	2.9	(0.32)	2.2	(0.33)	3.5	(0.47)
Work on homework, course assignments or research papers	11.1	(0.64)	11.8	(0.92)	10.3	(0.72)
Read magazines or newspapers	18.7	(0.68)	19.0	(0.95)	18.4	(0.93)
Read books for fun	11.0	(0.52)	8.6	(0.70)	**13.4**	(0.72)
Learn about things that are not course-related	19.2	(0.73)	21.7	(1.05)	**16.8**	(0.94)
Use the Internet	30.4	(0.84)	31.6	(1.18)	29.3	(1.02)

Note: Significant gender differences are in bold in the 'females' column.

Figure 7.2: Percentages of students indicating that they use libraries for various activities at least several times a month (Ireland and OECD)



Gender, Achievement and ESCS Differences on Engagement in Reading

Table 7.7 shows the overall means for the four indices of reading engagement, together with gender differences and associations between them and both print and digital reading achievement and ESCS. As noted previously, average scores for Ireland were significantly below the respective OECD averages on the four indices, and substantially so in the case of online reading and library usage.

The size of the gender differences in the mean scores on the indices varies considerably, though girls had higher scores than boys on all scales. It is largest for enjoyment of reading (0.45 points), followed by library usage (0.19 points), and diversity of reading (0.14 points). The gender difference on the online reading scale (0.04 points) is not significant (Table 7.7).

Table 7.7: Mean index scores, gender differences, associations with print and digital reading, and with ESCS for aspects of engagement in reading (Ireland)

	Enjoyment of Reading	Diversity of Print Reading	Online Reading	Library Usage
Mean Score	-0.08	-0.13	-0.50	-0.32
Gender Difference (Males-Females)	**-0.45**	**-0.14**	-0.04	**-0.19**
Change in Print Reading per Unit on Index	45.1	19.3	18.9	-8.8
Change in Digital reading per Unit on Index	41.8	12.4	24.5	-9.4
Correlation with Print Reading	.448	.179	.190	-.101
Correlation with Digital Reading	.327	.166	.166	-.116
Correlation with ESCS	.258	.121	.191	-.011

Note: Statistically significant gender differences are in bold. Statistically significant correlations are shaded in grey.

The index with the strongest association with achievement is the enjoyment of reading scale, which has a correlation of .448 with print reading and .327 with digital reading. Correlations between achievement and the other three scales are weaker, ranging from about -.10 to .19. The correlations between library usage and both print

and digital reading, though weak, are negative; however, a similar finding emerged in a majority of OECD countries (OECD, 2010c).

The correlation between ESCS and library usage is close to zero and not significant, while correlations between ESCS and the other three scales are weak and positive. The correlation between ESCS and enjoyment of reading (.258) is the strongest.

Relationships Between Indicators of Engagement in Reading

The frequency with which students reported reading in their leisure time is strongly and positively associated with their scores on the enjoyment of reading index (r=.732). This supports the contention that liking reading equates to more reading, and vice versa. Frequency of reading is also positively associated with the diversity of reading index (r=.427), and somewhat more weakly, though still significantly, with online reading (r=.207) and library usage (r=.235). Correlations between the four scales (enjoyment of reading, diversity of reading, online reading, and library use) are also significant and positive, ranging from .439 (between enjoyment of reading and diversity of reading) to .160 (between online reading and library usage).

Reading and Learning Strategies

In this section, students' awareness of two reading strategies (understanding and remembering, and summarising), and their use of three general learning strategies (memorisation, control, and elaboration) are described. Students' awareness of strategies is linked to metacognition in that students who are aware of the value of particular strategies are likely to use them in their learning. However, care is indicated in interpreting associations between awareness of strategies and reading performance, since scores on the awareness indices may reflect aspects of prior reading ability as well as awareness about the usefulness of the strategies.

Understanding and Remembering

Students were asked to evaluate the extent to which they found a range of strategies to be useful for understanding and remembering information in texts, using a 6-point scale ranging from 'not useful at all' to 'very useful'. Table 7.8 gives the percentages of students rating each strategy as 'very useful'.

Table 7.8: Percentages of students indicating that they find various understanding and remembering strategies for reading and understanding a text 'very useful', all students, males and females (Ireland)

	All Students		Males (Ref)		Females	
Strategy	%	SE	%	SE	%	SE
I concentrate on the parts of the text that are easy to understand	24.3	(0.78)	21.0	(0.95)	**27.6**	(1.15)
I quickly read through the text twice.	14.0	(0.63)	15.1	(0.98)	14.5	(0.78)
After reading the text, I discuss its content with other people	25.7	(0.79)	23.6	(0.93)	**27.9**	(1.12)
I underline important parts in the text	65.4	(0.97)	59.8	(1.38)	**71.0**	(1.09)
I summarise the text in my own words	62.6	(0.72)	56.4	(1.15)	**68.9**	(0.83)
I read the text aloud to another person	21.5	(0.75)	17.6	(1.0)	**25.4**	(1.10)

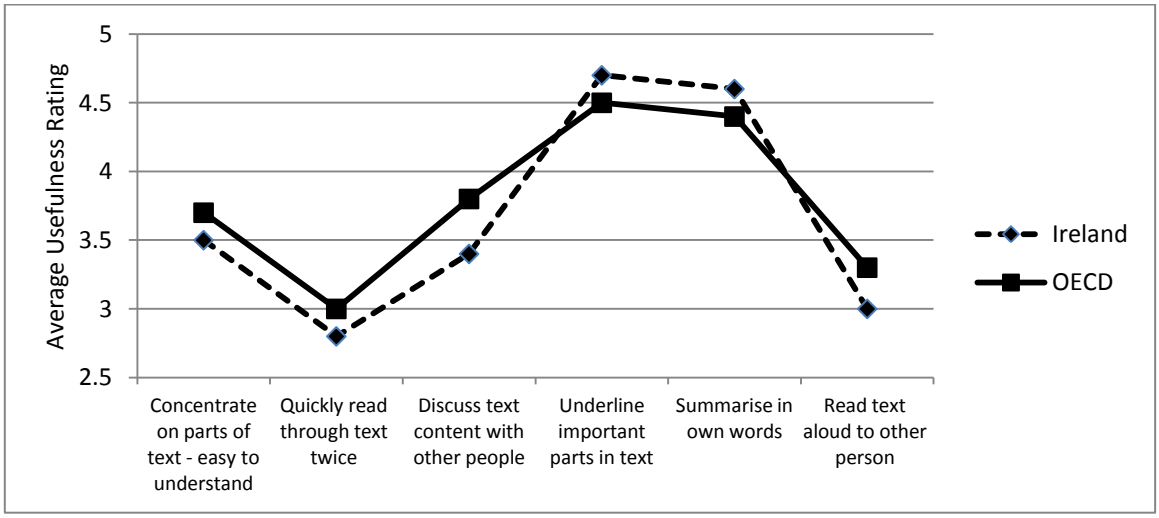
Note: 'Very useful' is defined here as 5 or 6 on a 6-point Likert-type scale, where 1 is not useful at all, and 6 is very useful. Significant gender differences are in bold in the 'females' column.

The most strongly endorsed strategies were 'underlining important parts in the text' (65.4%) and 'summarising the text in my own words' (62.6%). Not surprisingly, low-level strategies such as 'I read quickly through the text twice' were less strongly endorsed (14.0%). Female students assigned higher ratings than males to the two key strategies of 'underlining important parts in the text' and 'summarising the text in my own words'. Females were also significantly more likely than males to regard reading a text and discussing it with other people as a useful understanding and remembering strategy.

In Ireland, and on average across OECD countries, higher-level strategies such as 'underline important parts in the text' and 'summarise the text in own words' were endorsed to a greater extent than lower level strategies such as 'quickly read through the text twice' and 'read the text aloud to another person' (Figure 7.3).

Drawing on students' ratings of strategy usefulness, which were benchmarked against experts' ratings of the strategies, an index of understanding and remembering was constructed. The mean score for Ireland was 0.16, which is significantly above the OECD average, indicating somewhat stronger recognition of more effective strategies by students in Ireland. Countries with relatively high scores on this scale include France (0.17) and Germany (0.30). Students in Finland had a score of 0.03, indicating lower average awareness of effective strategies than students in Ireland. Students in Poland (-0.16) and the United States (-0.21) also had low scores relative to both Ireland and the OECD average. The mean score for students in Northern Ireland (0.13) was similar to that for students in the rest of Ireland (OECD, 2010c).

Figure 7.3: Perceived usefulness of six understanding and remembering strategies (Ireland and OECD)



Summarising Information

Students were asked to evaluate the extent to which they found various strategies useful for summarising a piece of expository text in a manner analogous to that for understanding and remembering strategies described in the previous section. Again, higher-order strategies such as 'I read through the text, underlining the most important sentences. Then I write them in my own words as a summary' and 'I carefully check whether the most important facts in the text are represented in the summary' were more strongly endorsed than lower-order strategies such as 'I try to copy out accurately as many sentences as possible' and 'Before writing the summary, I read the text as many

times as possible' (Table 7.9). Females were more likely than males to endorse higher-level summarisation processes (e.g., carefully checking whether the most important facts in a text are represented in the summary). However, more females than males also endorsed what may be considered to be a lower order strategy – reading the text as many times as possible before writing a summary.

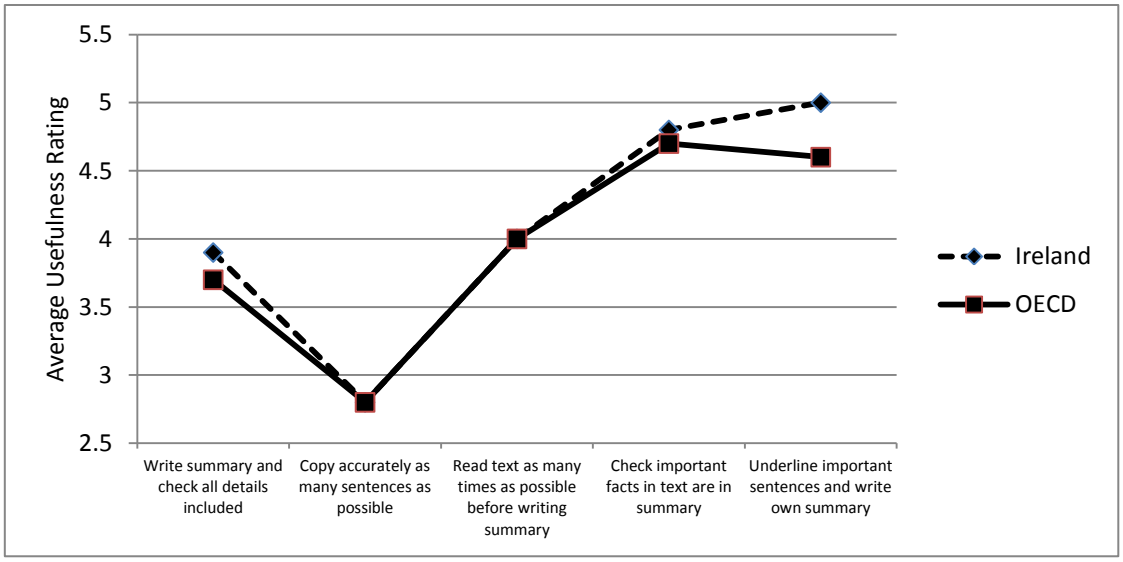
Table 7.9: Percentages of students indicating that they find various strategies for summarising a text 'very useful', all students, males and females (Ireland)

	All Students		Males (Ref)		Females	
Strategy	%	SE	%	SE	%	SE
I write a summary. Then I check that each paragraph is covered in the summary, because the content of each paragraph should be included	37.6	(0.82)	36.3	(1.09)	38.8	(1.19)
I try to copy out accurately as many sentences as possible	14.0	(0.63)	14.8	(0.92)	13.2	(0.81)
Before writing the summary, I read the text as many times as possible	40.0	(0.92)	34.7	(1.29)	**45.2**	(1.26)
I carefully check whether the most important facts in the text are represented in the summary	68.9	(0.98)	62.9	(1.30)	**74.9**	(1.20)
I read through the text, underlining the most important sentences. Then I write them in my own words as a summary	72.5	(0.97)	65.1	(1.34)	**80.0**	(0.96)

Note: 'Very useful' is defined here as 5 or 6 on a 6-point Likert-type scale, where 1 is not useful at all, and 6 is very useful. Significant gender differences are in bold in the 'females' column.

Ratings by students in Ireland and on average across OECD countries are broadly similar on all items relating to summarising information (Figure 7.4). However, students in Ireland engaged more often in underlining important sentences in their texts and then writing them in their own words as a summary.

Figure 7.4: Perceived usefulness of five summarising strategies (Ireland and OECD)



As with the understanding and remembering scale, the ratings of experts provided a benchmark against which to compare student responses, and a scale was created on this basis. The mean score for students in Ireland was 0.14, which is significantly above the OECD average. Other countries with relatively high scores on the index included France (0.24) and Germany (0.12) while in Northern Ireland, the mean score was significantly lower than that of the rest of Ireland, at -0.10.

Use of Control, Memorisation and Elaboration Strategies

This section describes students' responses to three groups of learning strategies: control strategies, memorisation strategies, and elaboration strategies. The first cluster, control strategies, is associated with metacognitive learning processes, i.e. strategies that learners use to evaluate their understanding of texts as they read or study. Memorisation strategies might be expected to be less useful to learners who need to engage in deep processing of text. On the other hand, use of elaboration strategies would be expected to enhance students' understanding of texts.

Control Strategies

Students' use of control strategies was assessed by asking them to indicate how often they engaged in a range of activities including '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'. In Ireland, 31.7% of students reported that when they studied, they 'almost always' started by figuring out exactly what they needed to learn, while 45.2% said that they 'almost always' looked for additional information to clarify something they didn't understand (Table 7.10). Just 18.4% reported that they tried to remember the most important points in the text. More females than males 'almost always' looked for additional information to clarify something that was not well understood, started studying by figuring out exactly what they need to learn, and checked if they understood what they had read.

Table 7.10: Percentages of students indicating that they used various control strategies 'almost always', all students, males and females (Ireland)

	All Students		Males (Ref)		Females	
Strategy	%	SE	%	SE	%	SE
When I study, I start by figuring out what exactly I need to learn	31.7	(0.89)	26.2	(1.13)	**37.3**	(1.25)
When I study, I check if I understand what I have read	28.5	(0.73)	24.3	(0.94)	**32.7**	(0.99)
When I study, I try to figure out which concepts I still haven't really understood	14.7	(0.56)	13.8	(0.74)	15.5	(0.81)
When I study I make sure I remember the most important points in the text.	18.4	(0.72)	13.8	(0.74)	15.5	(0.80)
When I study and I don't understand something, I look for additional information to clarify it	45.2	(0.83)	40.3	(1.26)	**50.1**	(1.03)

Note: Significant differences between males and females are indicated in bold in the 'females' column.

A composite index was constructed on the basis of responses to these items. In Ireland, the mean score on use of control strategies was 0.00, the same as the OECD average. Countries with relatively high scores on this measure included Germany (0.21) and the United Kingdom (0.08), while Finland (-0.34) was well below the OECD average. The mean score for Northern Ireland (0.12) was significantly above the OECD average.

Memorisation Strategies

Memorisation strategies were 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'. In Ireland, just 9.3% reported that they 'almost always'

read over the text again and again as they studied (a strategy that might be considered unhelpful if the goal is to process text content in depth) (Table 7.11). Just over 30% reported that they 'almost always' tried to memorise as many details in the text as possible, with significantly more females than males reporting use of this strategy.

An index of memorisation strategies was created using responses to the items in Table 7.10. The mean score for Ireland was -0.01, a value that is not significantly different from the OECD average. Countries with relatively high scores on this scale included Poland (0.42) and Germany (0.22), while the mean for Finland was lower (-0.25). In Northern Ireland, the mean score was 0.24.

Table 7.11: Percentages of students indicating that they used various memorisation strategies 'almost always', all students, males and females (Ireland)

	All Students		Males (Ref)		Females	
Strategy	%	SE	%	SE	%	SE
When I study, I try to memorise everything that is covered in the text	11.1	(0.51)	10.8	(0.70)	11.2	(0.73)
When I study, I try to memorise as many details as possible	30.3	(0.88)	26.6	(1.15)	**34.0**	(1.30)
When I study, I read the text so many times that I can recite it	9.3	(0.54)	7.14	(0.71)	**11.5**	(0.80)
When I study, I read the text over and over again	18.4	(0.72)	13.6	(0.92)	**23.3**	(1.03)

Note: Significant differences between males and females are indicated in bold in the 'females' column.

Elaboration Strategies

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'. In Ireland, 17.8% of students reported that they 'almost always' tried to relate new information to what they already know in other subjects, while 11% 'almost always' tried to understand material better by relating it to their own experiences (Table 7.12).

Ireland's mean score on use of elaboration strategies was -0.20, or one-fifth of a standard deviation below the OECD average, and similar to that in Northern Ireland (-0.16), Finland (-0.15), and France (-0.18). Students in Poland had a comparatively high mean score on this index (0.24).

Table 7.12: Percentages of students indicating that they used various elaboration strategies 'almost always', all students, males and females (Ireland)

	All Students		Males (Ref)		Females	
Strategy	%	SE	%	SE	%	SE
When I study, I try to relate new information to what I already know in other subjects	17.8	(0.71)	15.7	(0.91)	19.9	(0.91)
When I study, I figure out how the information might be useful outside school	5.7	(0.42)	7.1	(0.65)	**4.2**	(0.50)
When I study, I try to understand the material better by relating it to my own experiences	10.6	(0.50)	10.4	(0.64)	10.7	(0.73)
When I study and I don't understand something, I look for additional information to clarify it	8.7	(0.49)	9.1	(0.58)	8.3	(0.60)

Note: Significant differences between males and females are indicated in bold in the 'females' column.

Gender, Achievement and ESCS Differences on Reading and Learning Strategies

Table 7.13 shows the mean scores, gender differences, and associations with print and digital reading and ESCS for the five scales that measured students' use of reading and learning strategies. As noted above, students in Ireland had a higher mean score on the understanding and remembering and the summarising strategies scales than the respective OECD averages; Irish mean scores on the control and memorisation strategies did not differ from the OECD averages; and usage of elaboration strategies was significantly below the OECD average.

Gender differences in Ireland were significant on all five scales, with females scoring higher than males on four. Males had a significantly higher mean score than females on the elaboration strategies index. The largest gender difference was on the summarising strategies scale, on which females had a mean score that exceeded that of males by three-tenths of a standard deviation.

Associations between achievement on both print and digital reading are in the moderate range for three of these five scales (understanding and remembering, summarising, and use of control strategies), with correlations ranging from .28 to .42. Correlations between achievement and use of memorisation and elaboration strategies are much weaker, at less than .10. Relationships between the five scales and ESCS are positive, though weak, ranging from .08 (memorisation strategies) to .23 (control strategies).

Table 7.13: Mean index scores, gender differences, associations with print and digital reading, and with ESCS for indices of reading and learning strategies (Ireland)

	Understand and Remember	Summarise	Control Strategies	Memorisation Strategies	Elaboration Strategies
Mean Score	0.16	0.14	0.0	-0.01	-0.20
Gender Difference (Male-Female)	**-0.14**	**-0.30**	**-0.21**	**-0.26**	**0.17**
Change in Print Reading per Unit on Index	35.2	38.9	27.6	7.0	5.9
Change in Digital reading per Unit on Index	31.4	31.4	23.3	6.5	5.2
Correlation with Print Reading	.360	.415	.304	.073	.067
Correlation with Digital Reading	.341	.317	.282	.073	.063
Correlation with ESCS	.163	.140	.231	.077	.138

Note: Statistically significant gender differences in bold. Statistically significant correlations are shaded in grey.

Relationships Between Indicators of Reading and Learning Strategies

The correlation between the understanding and remembering and summarising strategies scales is significant and positive in Ireland (r=.413), suggesting that students who report awareness of understanding and remembering strategies also tend to be aware of summarising ones. However, the moderate strength of the relationship suggests that these are two distinct measures of reading strategies.

The three learning strategies also correlate significantly with each other. The correlation between control strategies and elaboration strategies is .513; between control strategies and memorisation strategies is .494; and it is .313 between memorisation and elaboration strategies.

Group Differences in Reading Engagement and Use of Strategies

In this section, we examine differences in reading engagement and strategy usage among a variety of subgroups (students with different immigrant and language backgrounds, members of the Traveller community, students in lone-parent families, and in different types of school).

Frequency of Reading for Enjoyment

Frequency of reading for enjoyment was similar for students living in single parent and other family structures, with 45.9% and 40.6% respectively indicating that they don't read at all for enjoyment, and about one-sixth in both groups reporting that they read for more than one hour a day (Table 7.14). Differences in the percentages of students who did not read between natives and immigrant speakers of English or Irish, and between natives and immigrant speakers of other languages, are not statistically significant. However, significantly more immigrant speakers of English/Irish (24.8%) than native students (14.9%) read for more than one hour per day. Significantly more members of the Traveller community (57.6%) than other students (41.3%) reported that they never read for enjoyment.

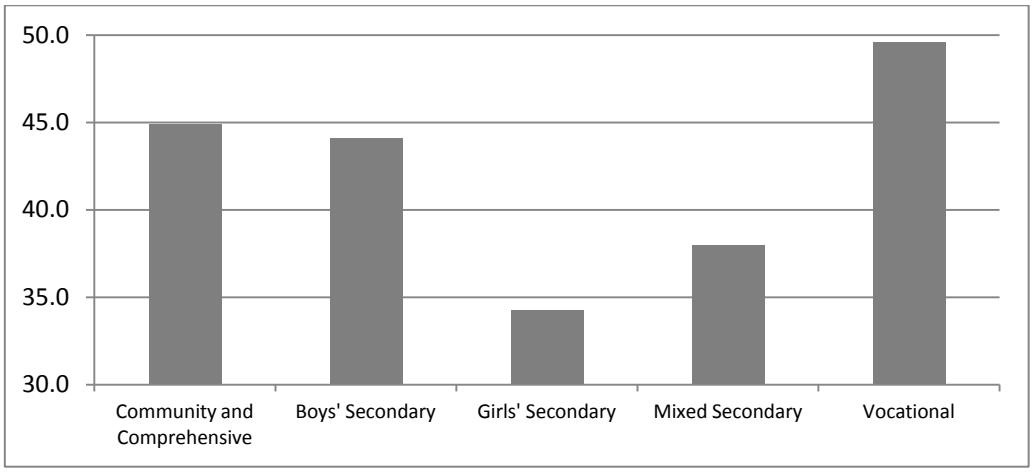
Table 7.14: Percentages of students indicating four levels of reading for enjoyment, by family structure, immigrant status and Traveller status (Ireland)

	Family Structure		Immigrant Status			Traveller Status	
Frequency	Single Parent (Ref)	Other	Native (Ref)	Immigrant Eng/Irish	Immigrant Other	Traveller (Ref)	Non-Traveller
Don't read for enjoyment	45.9	40.6	42.2	33.9	33.7	57.6	**41.3**
30 minutes or less a day	21.2	26.3	25.9	22.0	26.7	13.1	**25.9**
31-60 minutes a day	14.7	16.7	16.2	19.3	13.1	14.3	16.2
More than one hour a day	17.2	15.6	14.9	**24.8**	25.9	10.8	15.7

Significant differences within a row relative to the reference group are indicated in bold.

Figure 7.5 displays the percentages of students in schools classified by gender/school sector who reported not reading for enjoyment. The percentages of students not reading for enjoyment are similar in community and comprehensive (44.9%) and boys' secondary schools (44.1%), while the percentage in vocational schools (49.6%) is higher. Students reporting that they never read for enjoyment were less prevalent in mixed secondary (38.0%) and girls' secondary schools (34.2%).

Figure 7.5. Percentages of students reporting not reading for enjoyment, by school gender composition/sector, Ireland



Indices of Engagement in Reading and of Reading and Learning Strategies

Mean scores for students in single-parent families were significantly lower than scores for students in other family types on three indices – diversity of print reading; use of understanding and remembering strategies; and use of summarising strategies ($p < .05$) (Table 7.15).

Table 7.15: Mean scores of students on indices of engagement in reading, awareness of reading strategies, and use of learning strategies, by family structure, immigrant status and Traveller status (Ireland)

	Family structure	Immigrant and language			Traveller Status*
Scale	Lone parent family – Other family type	Native – Immigrant, speaks English / Irish	Native – Immigrant, other language	Immigrant, English / Irish – Immigrant, other language	Non-Traveller - Traveller
Enjoyment of reading	=	↑	=	=	⇓
Diversity of print reading	⇓	=	=	=	=
Index of online reading	=	=	⇑	⇑	⇓
Library usage	=	⇑	⇑	↑	=
Understand and remember strategies	⇓	=	↓	↓	⇓
Summarisation strategies	↓	=	⇓	↓	⇓
Control strategies	=	=	=	=	⇓
Memorisation strategies	=	=	↑	=	=
Elaboration strategies	=	=	⇑	=	=

Note: * The percentage in the Traveller category is very small (2.0%), so findings should be interpreted cautiously.
Significantly higher ($p \leq .05$) ↑ Significantly lower ($p \leq .05$) ↓
Significantly higher ($p \leq .01$) ⇑ Significantly lower ($p \leq .01$) ⇓
No statistically significant difference ($p > .05$) =
Shading indicates that the difference between the two groups being compared is statistically significant and at least 0.25 on the index (i.e., one-quarter of an average standard deviation across OECD countries).

Immigrant students who spoke a language other than English or Irish at home had significantly higher mean scores than native students on four measures: the index of online reading (indicating that the former group engaged more frequently in a range of online reading activities), library usage and use of both memorisation and elaboration strategies, and significantly lower scores on awareness of the value of using understanding and remembering and summarising strategies. Immigrant students who spoke English or Irish had a significantly higher mean score than native students on two indices – library usage and enjoyment of reading. Comparing between the immigrant groups on the basis of language spoken revealed four significant differences. Immigrant students who spoke English or Irish at home had a significantly higher score than immigrant students who spoke another language on two scales (library usage and online reading) and significantly lower scores on two scales (understanding and remembering, and summarisation strategies).

Traveller students had a significantly lower mean score than other students on the indices of reading for enjoyment, online reading, awareness of the value of using understanding and remembering and summarisation strategies, and use of control strategies.

Some differences on the indices of engagement in reading, awareness of reading strategies, and use of learning strategies were associated with school sector/gender composition, many of which may be related to students' gender (Table 7.16). The mean score on the index of enjoyment of reading was significantly higher in girls' secondary schools than in all of the other school types (first row). In contrast, mean scores on the diversity of print reading scale did not vary by school type/gender. The mean score for students in boys' secondary schools was significantly lower than those of girls' secondary schools on the index of library usage. Online reading was significantly lower in vocational schools than in girls' secondary schools.

Students' mean scores were significantly lower in both boys' secondary schools and vocational schools on the index of awareness of the value of using understanding and remembering strategies, while mean scores were lower in boys' secondary schools, mixed secondary schools, and vocational schools on the index of awareness of the value of using summarisation strategies.

Table 7.16: Mean scores of students on indices of engagement in reading, awareness of reading strategies, and use of learning strategies, by school sector/gender composition (Ireland)

	School Sector and Gender Composition			
Scale	Girls' Secondary – Comm./Comp.	Girls' Secondary – Boys' Secondary	Girls' Secondary – Mixed Secondary	Girls' Secondary – Vocational
Enjoyment of reading	↟	↟	↟	↟
Diversity of print reading	=	=	=	=
Index of online reading	=	=	=	↟
Library usage	=	↟	=	=
Understanding and remembering	=	↟	=	↟
Summarisation strategies	=	↟	↟	↟
Control strategies	↟	↟	=	↟
Memorisation strategies	↑	↟	↟	↟
Elaboration strategies	↡	=	=	↡

Significantly higher ($p \leq .05$) ↑ Significantly lower ($p \leq .05$) ↓
Significantly higher ($p \leq .01$) ↟ Significantly lower ($p \leq .01$) ↡
No statistically significant difference ($p > .05$) =

Shading indicates that the difference between the two groups being compared is statistically significant and at least 0.25 on the index (i.e., one-quarter of an average standard deviation across OECD countries).

Turning to learning strategies, students in girls' secondary schools reported greater use of control strategies than students in community/comprehensive schools, boys' secondary schools and vocational schools, and, perhaps surprisingly, greater use of memorisation strategies than students in the other four school types. Finally, students in girls' secondary schools had a significantly lower mean score on elaboration strategies than students in community/comprehensive and vocational schools. The findings in relation to use of learning strategies are consistent with the gender differences on strategy usage in Table 7.13.

Changes in Reading Engagement Since 2000

In this section, comparisons between 2000 and 2009 are made for frequency of reading for enjoyment, enjoyment of reading (called 'attitude to reading' in 2000), and diversity of reading (with the 2000 version of this scale rescaled to include print reading materials only).

Frequency of Reading for Enjoyment

There has been a substantial and significant increase in the percentage of students in Ireland who did not read for enjoyment, from 33.4% in 2000 to 41.9% in 2009 (Table 7.17). There was an increase in the OECD average of non-readers (from 31.6% to 36.7%), although to a somewhat lesser extent than in Ireland. In Ireland, the percentage of students 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, figures reduced to 63.8% of females and 52.5% of males in 2009. Hence, the decline was greater for females (11.7%) than for males (5.1%), though both differences are statistically significant.

In Ireland in 2000, 54.2% of boys in the bottom quarter of the ESCS scale reported that they engaged in at least some reading for enjoyment. By 2009, this figure had dropped to 40.7%. The corresponding figures for girls were 60.0% in 2000 and 47.9% in 2009. Thus, the decline was greater among low-ESCS girls than among low-ESCS boys. Declines were considerably smaller for both high-ESCS boys and girls (OECD, 2010e).

Table 7.17: Comparisons of percentages of students in Ireland indicating frequency of reading for enjoyment in PISA 2000 and PISA 2009 (Ireland)

	2000		2009		2009-2000	
Frequency	%	SE	%	SE	Diff	SE
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.

Enjoyment of Reading and Diversity of Print Reading

Somewhat lower levels of enjoyment of reading are evident in 2009 for four of the statements contributing to the engagement in reading scale (taking into account that some statements were negatively worded) (Table 7.18). For example, more students in 2009 agreed or strongly agreed that they read only when they have to, and that, for them, reading was a waste of time.

Table 7.18: 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	
Statement	%	SE	%	SE	Diff	SE
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)

Note: Differences that are significant across cycles are in bold.

There were no significant changes in the overall mean scores of students in Ireland on the enjoyment of reading and diversity of reading scales (Table 7.19). However, female students had significantly lower scores in 2009 than in 2000 on both scales, while for males differences between 2000 and 2009 were not statistically significant. In both years, though, mean scores for males lagged significantly behind those for females.

Table 7.19: Comparisons of mean scores of students in Ireland on student engagement indices common to PISA 2000 and PISA 2009 (Ireland)

	2000		2009		2009-2000	
Scale/Group	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.

On average, across 26 OECD countries in PISA 2000 and 2009, there was a small but significant drop of 0.04 points on the index of enjoyment of reading. The mean score for males also dropped significantly (from -0.23 to -0.29), while the mean score for girls dropped by a non-significant amount of 0.01 (OECD, 2010e). While mean scores on enjoyment of reading registered significant drops in some countries (e.g., Finland; -0.20), they increased to a significant extent in others, albeit to a smaller degree (e.g., Germany; 0.12, New Zealand; 0.08). On average across OECD countries, scores on the index of diversity of reading declined considerably between 2000 and 2009 (from 0.11 to -0.02). The decline for boys (-0.16) was slightly greater than that for girls (-0.10). No OECD country recorded a significant increase on this scale.

Chapter Summary and Conclusions

This chapter described patterns of students' engagement in reading and usage of reading and learning strategies in PISA 2009. Gender differences, associations with ESCS, and other group differences (by family structure, newcomer/language group, Traveller/non-Traveller group, and school sector/gender composition) were described. For some of these measures, comparisons were made with PISA 2000.

In 2009, 42% of students in Ireland reported that they spent no time reading for enjoyment. This is significantly higher than the OECD average of 37%. Not reading for enjoyment was more common among boys (48%) than girls (36%) in Ireland. Average print reading achievement scores were almost 100 points lower for students who did not read compared with students who did read. However, there was only a small increase in achievement associated with spending over one hour a day reading.

On a scale measuring enjoyment of reading, the mean score for Ireland was -0.08, indicating a below-average level of reading for enjoyment relative to the OECD average. The correlation between enjoyment and print reading performance in Ireland was .49, and it was .32 with digital reading. Females in most OECD countries, including Ireland, had a significantly higher average enjoyment of reading score than males.

The mean score of students in Ireland on a diversity of print reading scale was -0.13, which is also significantly below the OECD average. The mean score of Irish students on a scale measuring diversity of online reading activities was extremely low, at
-0.50 (half a standard deviation below the OECD average). In Ireland, correlational data indicated that diversity of materials which students read was less strongly associated with either print or digital reading achievement than students' enjoyment of reading. Aspects of online reading in which students in Ireland engaged significantly less often than students on average across OECD countries included reading online news, using an online dictionary or encyclopaedia, searching online for information about a topic, and searching online for practical information.

Students in Ireland had a mean score of -0.32 on the index of library usage, indicating below-average use for activities such as borrowing books to read for pleasure or for schoolwork, and learning about things that were not course-related. The most frequent library-based activity in which students in Ireland engaged was using the Internet. Females in Ireland, and on average across OECD countries, reported greater levels of library usage than males. In Ireland, the correlations between library usage and print reading (-.10) and digital reading (-.12) were weak and negative, similar to those found in a majority of OECD countries.

The high correlation between frequency of reading and enjoyment of reading (.73) confirms that students who read more also enjoy reading more, and vice versa. Although enjoyment of reading is significantly correlated with ESCS (.26), the strength of the relationship indicates that ESCS is not the only factor at play in determining which students enjoy reading. Gender differences in engagement in reading appear to be at least as important.

The mean scores for students in Ireland on two reading strategies scales, understanding and remembering (0.16), and summarising information (0.14), are both significantly above the corresponding OECD averages. Both scales are significantly correlated with print reading achievement (.36 in the case of understanding and remembering, and .42 in the case of summarising information). Of the general learning strategies scales, only use of control strategies had a moderate correlation with print reading performance (.30).

The relatively strong correlations between awareness of the value of strategy use (remembering and understanding, summarising, or use of control strategies) and reading achievement may have implications for the types of interventions designed to address low reading achievement (see OECD, 2010c, for a detailed discussion on this issue), notwithstanding the associations that usage of such strategies may have with prior reading skills. This may be particularly important when we consider that, as with engagement in reading, correlations between these strategies and ESCS are weak (ranging from about .15 to .25), while associated gender differences are significant.

Declines in the frequency with which students read for enjoyment 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 among females than among males, though males continued to have mean scores that were well below those of females. Frequency of reading for enjoyment exhibited a more marked decline among both males and females of lower socioeconomic status.

Chapter 8: Modelling Performance on Print and Digital Reading in 2009, and on Print Reading in 2000 and 2009

In previous chapters, it was noted that relationships between student achievement and single background characteristics should be interpreted with caution, since many such characteristics are themselves inter-related. This chapter addresses this concern by describing how performance on the print and digital reading assessments varies when relationships with a range of school and student background characteristics are considered simultaneously. For example, performance that varies by school sector could be due to differences in the socioeconomic intake of schools. Similarly, gender differences in reading achievement might be accounted for by differences in the extent to which students engage in leisure reading. This chapter presents the results of *multilevel models* of achievement in three main parts as follows:

- Achievement on print reading in PISA 2009
- Achievement on digital reading in PISA 2009
- A comparison of achievement on print reading in PISA 2000 and PISA 2009.[54]

Simply put, multilevel modelling allows us to examine the simultaneous contributions of a range of background characteristics at both school and student levels. It also allows us to describe the extent to which various characteristics account for differences in achievement singly and in combination. Thus, for example, after accounting for differences in socioeconomic backgrounds of schools and students, we can determine the extent to which students' reading practices explain variation in achievement.

The results presented in this chapter attempt to (i) shed some light on the nature of performance differences on the 2009 print and digital reading assessments, and (ii) to see whether demographic and other changes between 2000 and 2009 impact differently on print reading achievement in the two years.

Analytic Approach

Selection and Treatment of Background Characteristics

In selecting background variables to include in the analyses described in this chapter, priority was given to those that were deemed to have (i) policy and research relevance, (ii) good measurement properties and clear meaning, and (iii) low rates (generally less than 5%) of missing data. The variables included in the analyses of print and digital reading for 2009 were guided by the results of analyses presented in Chapters 6 and 7 and are listed in Table 8.1. Some variables are new to 2009, i.e. summarising and

[54] This chapter is presented in a non-technical style that is aimed at the general reader. For a technical overview of the statistical methods used to produce the results here, readers are referred to introductory texts on the subject such as Raudenbush and Bryk (2002), Raudenbush et al. (2004), and Snijders and Bosker (1999). Readers are also referred to Cosgrove and Cunningham (in press), Cosgrove et al. (2005), Cosgrove and Gilleece (2009), Gilleece, Cosgrove and Sofroniou (2010), Shiel et al. (2001), and Sofroniou, Shiel and Cosgrove (2002) for multilevel analyses of Irish student performance on PISA from previous cycles.

understanding strategies, remembering strategies, library use, and frequency of online reading.

Responses by principals and students to questions relating to ICTs have not been included, since their relationships with achievement are generally weak, and there is little variability in responses to some of these items (see Cosgrove et al., 2011). Furthermore, the measures were deemed to be too general to be directly relevant to explaining performance on the assessment of digital reading. An exception is a measure of students' online reading, which has been included in analyses relating to both print and digital reading.

For most variables, missing indicators were included (i.e., each variable with missing data is accompanied by an indicator variable with a value of 1 if data are missing, and 0 if not) (Table 8.1). This was done to preserve the entire dataset of 144 schools and 3,937 students, since, in the software used (HLM 6.0®), if a case is missing on just one variable, the entire record is deleted.

A school-level characteristic termed 'outlier school' was also included (Table 8.1). This was because the average performance of eight schools in PISA 2009 was unexpectedly low (about one standard deviation or 100 points or more below the national average) relative to previous cycles of PISA. The analyses attempt to determine if these eight schools achieved low performance because of socioeconomic or demographic intake characteristics, or if characteristics other than those included in the models contributed to their unexpectedly low performance.

Table 8.2 lists the variables common to 2000 and 2009 that have been included in analyses. These comprise a subset of the variables in Table 8.1. Socioeconomic characteristics (parental occupation and education, home educational resources, books in the home, and cultural and material possessions in the home) were included as separate variables in the 2009 analyses. The variables are treated separately since, although interrelated, individual components of socioeconomic background are likely to be differentially related to reading achievement (as has been found in previous analyses of PISA data; see also Chapter 6, Table 6.3). In the analyses comparing 2000 and 2009, however, the variables are treated as a single index of economic, social and cultural status (ESCS) (Table 8.2) for the sake of simplicity in making comparisons across time.

It should be noted that the variable 'attitude to reading' in Tables 8.1 and 8.2 is the same as 'enjoyment of reading' referred to in Chapter 7.

In all analyses presented in this chapter, achievement has been set to have a mean of 500 and a standard deviation of 100 to facilitate comparisons between the models of print and digital reading in 2009, and of print reading in 2000 and 2009. Thus, the means and standard deviations are not identical to those reported in Chapters 3 and 4. Similarly, all continuous background characteristics (e.g., attitudinal scales) have been set to have a mean of 0 and a standard deviation of 1.

In the case of categorical variables, one category was selected as the comparison group with which other categories are compared. With respect to year (grade) level, for example, Third Year (Grade 9) is the comparison group (since it is the modal grade for PISA students in Ireland), and the results show the expected achievement score difference for Second years, Transition years and Fifth Years (Grades 8, 10 and 11, respectively) compared to that of Third years.

Table 8.1: Background characteristics used in analyses of PISA 2009 print and digital reading literacy

Variable/Level	*Description*
School Level	
Sector/Gender composition	Community/comprehensive, Vocational, Girls' secondary, Boys secondary, with Mixed secondary as the reference group
Fee-paying school	No fees (0) - Fee-paying (1)
In SSP under DEIS	Not in SSP (0) - In SSP (1)
School socioeconomic intake (ESCS)*	Mean = 0, SD = 1.00
School language composition	School has a low percentage of other language speakers (0%), a high percentage of other language speakers (10% or more), with medium (1-10%) as the reference group
School location*	Village, City, with Town as the reference group
School competition/availability*	This is the only school in the local area (0) - There are one or more schools in the local area (1)
Ability grouping*	Ability grouping for no or some classes (0) - Ability grouping for all classes (1)
Academic school selectivity*	Low, High, with Medium as the reference category
School leadership*	Mean = 0, SD = 1.00
Disciplinary climate*	Mean = 0, SD = 1.00
Student-teacher relations*	Mean = 0, SD = 1.00
Outlier School	Not outlier (0) - Outlier (1)
Student Level	
Gender	Male (0) - Female (1)
Immigrant/Language status*	Immigrant other language, Immigrant same language, with reference group Native same language
Family structure*	Single parent (0) - Dual parent (1)
Number of siblings*	No siblings, three siblings, four or more siblings, with one or two siblings as the reference group
Parental occupation*	Mean = 0, SD = 1.00
Parental education*	Lower second level or below, Third level, with Upper second level as the reference group
Books in the home*	25 books or fewer, More than 200 books, with 26-200 books as the reference group
Home educational resources*	Mean = 0, SD = 1.00
Material possessions*	Mean = 0, SD = 1.00
Cultural possessions*	Mean = 0, SD = 1.00
In part-time work*	Works1 to 8 hours a week, Works more than 8 hours a week, with Does not work as the reference group
Grade (Year) level*	Grade 8 (Second), Grade 10 (Transition), Grade 11 (Fifth), with Grade 9 (Third) as the reference group
Preschool attendance*	Did not attend (0) - Attended (1)
Summarising strategies*	Mean = 0, SD = 1.00
Understanding and remembering strategies*	Mean = 0, SD = 1.00
Reading for enjoyment*	Does not read, Reads 30-60 minutes per day, Reads more than 60 minutes per day, with Reads up to 30 minutes as the reference group
Attitude to reading*	Mean = 0, SD = 1.00
Diversity of materials read*	Mean = 0, SD = 1.00
Library usage*	Mean = 0, SD = 1.00
Online reading*	Mean = 0, SD = 1.00
Early school leaving risk	Does not intend to leave school (0) - Intends to leave school (1)
Absences past two weeks	No absences past two weeks, Absent five days or more, with Absent one to four days as the reference group

Note: Variables shaded in grey are nationally-derived; Variables marked with * have a missing indicator.

Table 8.2: Background characteristics used in analyses of comparison models of PISA 2000 and 2009 print reading literacy

Variable	*Description*
School Level	
School socioeconomic intake (ESCS)*	Mean = 0, SD = 1.00
Student Level	
Gender	Male (0) - Female (1)
Student socioeconomic status (ESCS)*	Mean = 0, SD = 1.00
Grade (Year) level*	Grade 8 (Second), Grade 10 (Transition), Grade 11 (Fifth), with Grade 9 (Third) as the reference group
Reading for enjoyment*	Does not read, Reads 30-60 minutes per day, Reads more than 60 minutes per day, with Reads up to 30 minutes as the reference group
Attitude to reading*	Mean = 0, SD = 1.00

Note: Variables marked with * have a missing indicator.

Strategy Used in Analyses

Since many variables are considered simultaneously, consistent with previously-published multilevel analyses of achievement on PISA, an ordered and logical approach was taken to finalising the models of reading achievement. For each model, the following sequence of analyses was followed:

1. Characteristics were tested for statistical significance individually at the student level, then at the school level. Variables that were not statistically significant ($p \leq .05$) were discarded from subsequent analyses.
2. Student characteristics were tested together, as were school characteristics. Again, non-significant variables were discarded at this stage.
3. All school and student variables were examined together. All significant variables were retained; this can be considered the 'core' part of the model.
4. Some further analyses were conducted as follows to see if the 'fit' (explanatory power) of the model could be improved: (i) Does gender interact with any other student variables? (ii) Are any of the continuous variables related to achievement in a non-linear way (e.g., are there floor or ceiling effects associated with level of parental occupation)? (iii) Does the relationship between individual student variables and achievement vary depending on the school (i.e., do the slopes of the student-level regression coefficients vary significantly across schools)? (iv) Do any of the student-level variables interact with any of the school-level variables?

Following these steps, the models were finalised. The results presented in the sections that follow can be interpreted in two ways:

1. *Statistical versus substantive significance.* All variables in the final models are statistically significant; however, their substantive effects may be small in some instances. For example, a one-standard deviation increase in parental occupation is associated with an 8-point change in print reading literacy in PISA 2009, which amounts to only one-twelfth of a standard deviation on the reading scale (i.e., 8/100). This is a substantively smaller association than, say, that between frequency of online reading and reading achievement in print reading in 2009 (where a one-standard deviation increase in online reading is associated with a 16-point increase in reading achievement).

2. *Explained variance.* The large number of characteristics in the analyses of PISA 2009 were split into conceptually-related 'blocks'. After presenting the results of the models, we describe the variation in achievement that is explained by each block in its own right, as well as after accounting for student demographic and background factors, and (where applicable) school structural and socioeconomic characteristics. This approach allows us to address questions such as: How large is the effect for a set of related indicators (e.g., engagement in reading)? And, how large is the effect after accounting for differences in demographic, structural and socioeconomic characteristics? Table 8.3 lists the blocks and their constituent measures.

In interpreting results, it should be borne in mind that, in the case of continuous variables, the 'parameter estimate' (PE) is the expected change in achievement associated with a one-standard deviation increase in the continuous variable. In the case of categorical variables (such as frequency of reading for enjoyment) or binary variables (such as gender), the expected change in achievement corresponds to one group or category compared to the other, i.e. the expected change in one group compared to the reference group.

Table 8.3: Thematic blocks used in describing explained variances of achievement in PISA 2000 and 2009 print and digital reading literacy

Block ID	*Block Theme*	*Block Content*
A	School structure	Sector, fee-paying status, location, availability of other schools locally
B	School selectivity	Ability grouping, academic selectivity on intake
C	School climate/process	Leadership, disciplinary climate, teacher-student relations
D	School social composition	In SSP under DEIS, average socioeconomic composition, percentage of other language speakers, school is a performance outlier*
E	Student demographics	Gender, language/immigration status, family structure, number of siblings
F	Student social/home background	Parental occupation and education, home educational resources, cultural and material possessions at home, number of books at home, hours of paid work per week
G	Student educational background	Grade (year) level at the time of PISA, whether attended preschool or not
H	Student reading strategies	Use of summarising strategies, use of understanding and remembering strategies
I	Student engagement with reading	Frequency of leisure reading, engagement in reading, diversity of reading, library use and online reading
J	Student engagement with education	Early school leaving risk, frequency of absences in the two weeks preceding PISA

*Being a performance outlier does not necessarily relate to social composition; however, it was thought that outlier status fit most closely with Block D.

Finally, some technical considerations may be noted:

- To ensure that the results are representative of the population of schools rather than the sample of participating schools and students, sampling weights were applied to school and student data in all analyses. In earlier cycles of PISA, multilevel analyses did not include sampling weights, but generally, results of weighted and unweighted analyses are similar.

- Achievement estimates are based on the performance of individual students attempting just a portion of the assessment material, and each student is assigned five plausible values or achievement estimates which are imputed as five 'best guesses' with respect to how each student would have performed had they attempted all test questions in the assessment. There is some variation between individual students' plausible values, and this has been taken into account in the analyses (see OECD, 2009d, p. 100).
- While t-tests are used to evaluate the statistical significance of some characteristics, a deviance test is required in the case of categorical variables or ones with missing indicators. The latter test compares the change in the deviance or fit of the model with reference to the chi-square distribution and degrees of freedom set to the number of indicators contributing to each variable. For example, as student immigrant and language status has three indicators, changes in the deviance of a model with and without this variable are compared to a chi-squared distribution with degrees of freedom equal to three (see Raudenbush et al., 2004, p. 60).

A Re-examination of Between-School Variance

Before presenting the results, it is useful to review the manner in which variance in achievement is partitioned between and within schools. As noted in Chapters 2 and 6, the higher the between-school variance, the more schools differ with respect to achievement on a particular measure. Based on the data as analysed in HLM 6.0®, the percentage of total variance that is between schools is as follows:

- Print reading 2009: 26.7%
- Digital reading 2009: 21.7%
- Print reading 2000: 18.6%.

These estimates differ slightly from those reported in Chapter 6 and in Shiel et al. (2001, p. 96) in the case of PISA 2000 print reading due to the fact that the software used by the OECD to compute previously reported figures applied the sampling weights somewhat differently than HLM 6.0®.

In multilevel modelling, we seek to explain both between- and within-school variance, using a set of independent variables. Hence, when we say that performance on digital reading explains 57% of between-school variance, this means 57% of 21.7%, or 12.4% of the total variance.

Model of PISA 2009 Print Reading

The final model of PISA 2009 print reading is shown in Table 8.4. When all variables in the model are considered together, they explain 58.8% of the total variance in achievement, or 80.5% of between-school variance and 50.8% of within-school variance.

Table 8.4: Final model of PISA 2009 print reading

Variable	*Level/Comparison*	*PE*	*SE*	*Stat*	*Test Stat*	*df*	*p*
	Intercept	516.42	5.091	t	101.431	141	<.001
	School Level						
SSP	In SSP-Not in SSP	-37.97	17.086	t	-2.222	141	<.001
Outlier School	Outlier-Not Outlier	-22.76	5.972	t	-3.811	141	.028
	Student Level						
Gender	Gender (female-male)	14.67	5.433				
Immigrant/Language status	Immigrant other language-Native same language	-23.20	10.342	Ddiff	47.094	3	<.001
	Immigrant same language-Native same language	-7.68	6.275				
	Missing immigrant/language	-29.80	7.256				
Number of siblings	No siblings-one or two siblings	5.67	4.918	Ddiff	13.505	4	.004
	Three siblings-one or two siblings	-5.27	3.411				
	Four or more siblings-one or two siblings	-8.51	4.343				
	Missing siblings	-12.46	12.962				
Parental occupation	Parental occupation (HISEI)	8.39	1.402	Ddiff	56.132	3	<.001
	Parental occupation squared	-2.46	0.996				
	Missing parental occupation	-23.38	15.012				
Parental education	Lower second level or below-upper second level	-16.23	3.999	Ddiff	27.076	3	<.001
	Third level-upper second level	0.29	2.954				
	Missing parental education	-8.72	9.851				
Books in the home	25 books or fewer-26-200 books	-10.83	4.991				
	More than 200 books-26-100 books	5.31	5.235				
	Missing books in the home	-3.88	6.498				
Books * Gender	25 books or fewer*Female	-11.00	6.535	Ddiff	11.533	2	.003
	More than 200 books*Female	8.96	12.129				
In part-time work	Works up to 8 hours-does not work	-10.23	3.927	Ddiff	43.383	3	<.001
	Works more than 8 hours-does not work	-24.17	5.527				
	Missing in part-time work	-13.45	8.276				
Grade	Grade 8-Grade 9	-35.33	9.220	Ddiff	126.171	3	<.001
	Grade 10-Grade 9	19.25	3.066				
	Grade 11-Grade 9	19.73	3.978				
Summarising strategies	Summarising strategies	14.26	1.211	Ddiff	180.171	2	<.001
	Missing summarising strategies	-44.30	10.326				
Understanding and remembering strategies	Understanding and remembering strategies	10.87	1.532	Ddiff	128.404	2	<.001
	Missing understanding and remembering strategies	-39.80	8.621				
Reading for enjoyment	Reads up to 30 minutes-Does not read	11.17	3.428	Ddiff	35.865	4	<.001
	Reads 30-60 minutes-Does not read	17.44	4.077				
	Reads more than 60 minutes-Does not read	23.13	4.911				
	Missing reading for enjoyment	5.09	14.968				
Attitude to reading	Attitude to reading	23.96	2.215	Ddiff	271.594	3	<.001
	Attitude to reading squared	3.43	0.786				
	Missing attitude to reading	14.36	10.093				
Library usage	Library usage	-18.83	1.669	Ddiff	301.926	3	<.001
	Library usage squared	-8.85	1.517				
	Missing library usage	19.16	19.906				
Online reading	Online reading	5.70	1.129	Ddiff	60.742	3	<.001
	Online reading squared	-1.83	0.462				
	Missing online reading	22.59	26.690				
Early school leaving risk	Early school leaving risk (no-yes)	-20.88	4.406	Ddiff	33.261	2	<.001
	Missing early school leaving risk	-2.54	14.981				
Absences past two weeks	Absent one to four days-No absences	-1.72	2.886	Ddiff	22.410	3	<.001
	Absent five days or more-No absences	-14.21	5.482				
	Missing absences past two weeks	-29.68	13.673				

Note: The shaded cells for books in the home and student gender indicate that significance tests for these individual variables are not appropriate given the interaction between books in the home and gender.

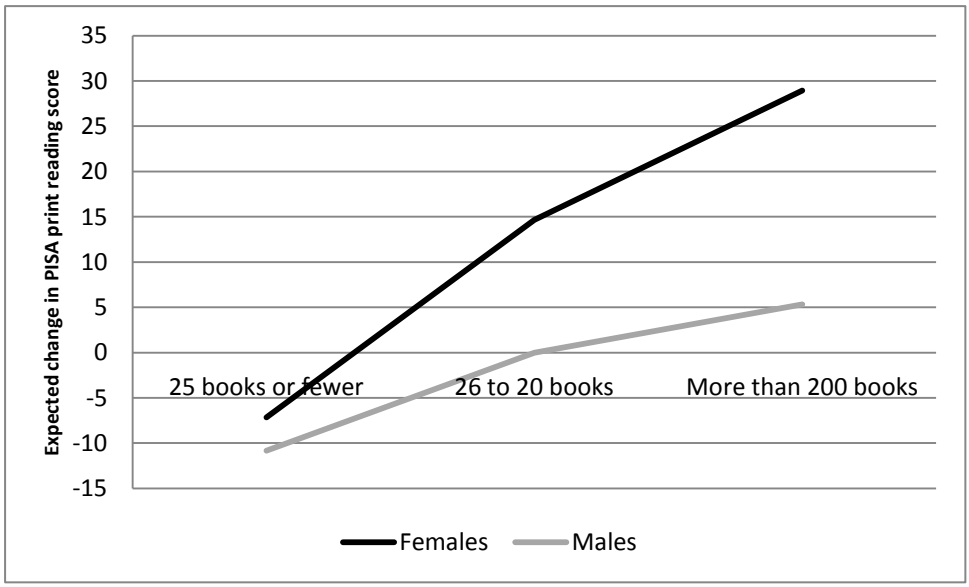
To check if the inclusion of a relatively large number of missing indicators may have resulted in a bias in the results, such as an inflated percentage of explained variance, the 'core' part of the model (including missing indicators) was re-run and compared to the 'core' part of the model that included all cases with valid responses on all data, i.e., excluding missing indicators (Appendix C, Table C8.1). Both models produced similar results. Thus, the interpretation of the associations between variables and achievement is broadly the same whether we include or exclude students with missing data. Excluding students with missing data (22.5% of all students) results in a dataset with an average achievement score of 518, implying that lower-achieving students would have been excluded from the analysis had we not included missing indicators.[55]

The first finding of note is that, of all school-level variables, only two (performance outlier and SSP status) remained significant; in other words, achievement variance associated with all other school variables described in Table 8.1 is not significant once the other characteristics are taken into account. That the outlier school variable remains in the model indicates that, over and above the other characteristics in the model, notably student socioeconomic and demographic characteristics, achievement differences between outlier and non-outlier schools are still significant.

In contrast to the school-level variables, the majority of student variables retain significance in the model, though family structure, home educational resources, cultural and material possessions, attendance at preschool, and diversity of reading are no longer significant in the presence of the other variables.

There is one significant interaction: gender with books in the home. The example values plotted in Figure 8.1 indicate that number of books in the home is more strongly associated with reading achievement for females than for males. There is a 36-point difference in the expected print reading scores of females with low and high numbers of books, compared to just 16 points for boys.

Figure 8.1: Plot of interaction between gender and books in the home, 2009 print reading



[55] There are various ways to treat missing data in analyses, such as multiple imputation. However, since the outcome variable is itself multiply imputed, this would have made the analysis extremely unwieldy. Thus, the missing indicator method was used (see Allison, 2001; Enders, 2010; Howell, 2008).

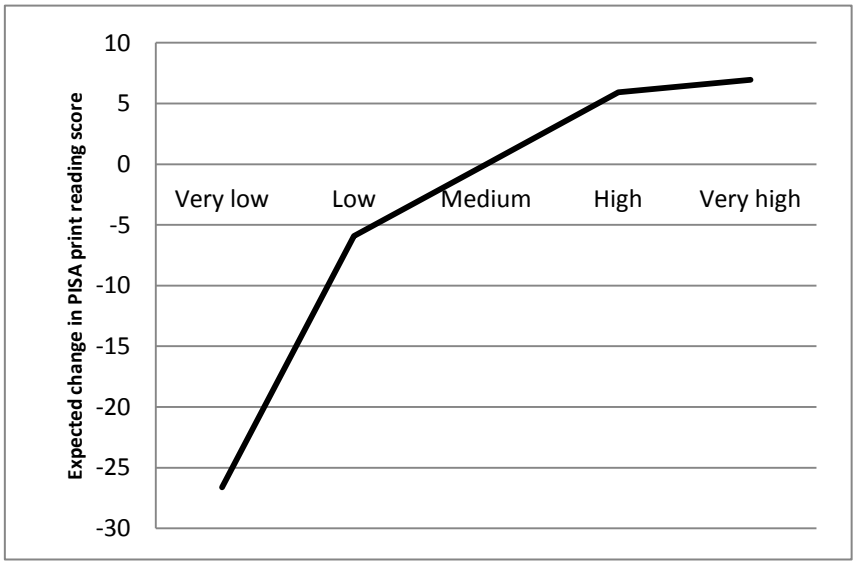
There are significant curvilinear relationships with achievement for four variables: parental occupation, attitude to reading, library usage, and frequency of online reading. Example values of these are plotted in Figures 8.2 to 8.5. [56] In the case of parental occupation, the association with print reading achievement is stronger at lower levels than at higher ones (Figure 8.2). For example, the expected achievement difference between students with very low and low scores on the occupation scale is almost 21 points, while there is only a one-point difference between students with high and very high scores on the occupation scale.

In contrast, the higher students' reports on attitude to reading, the stronger the relationship with achievement. The score difference between students reporting very low and low attitudes to reading is 7 points, compared to 34 points between high and very high attitudes (Figure 8.3).

In the case of library usage (Figure 8.4), students who reported very low and medium levels of usage have similar predicted print reading scores, while the expected score of students reporting very high levels of library usage is almost 80 points below that for medium levels of usage. This finding is perhaps unexpected (though consistent with results presented in Chapter 6), and we follow it up later in this chapter.

For online reading frequency, there is a flattening of the curve of plotted predicted values as online reading increases (Figure 8.5). While students reporting very low levels of online reading have a predicted print reading score that is 19 points below students with medium levels of usage, students reporting very high levels have an expected reading score that is only 4 score points above medium levels of online reading. This implies that high levels of online reading are only weakly associated with reading achievement.

Figure 8.2: Plot of relationship between parental occupation and print reading achievement, 2009



[56] When plotting estimated contributions to reading achievement on the basis of continuous variables, 'very low' is two standard deviations below the mean on the scale, 'low' is one standard deviation below the mean, 'medium' is at the average point in the scale, 'high' is one standard deviation above the mean, and 'very high' is two standard deviations above the mean. Another way of putting this is that the 'very low' and 'very high' values correspond to the 5th and 95th percentiles on the continuous variable, respectively, while the 'low' and 'high' values correspond to the 33rd and 67th percentiles, respectively.

Figure 8.3: Plot of relationship between attitude to reading and print reading achievement, 2009

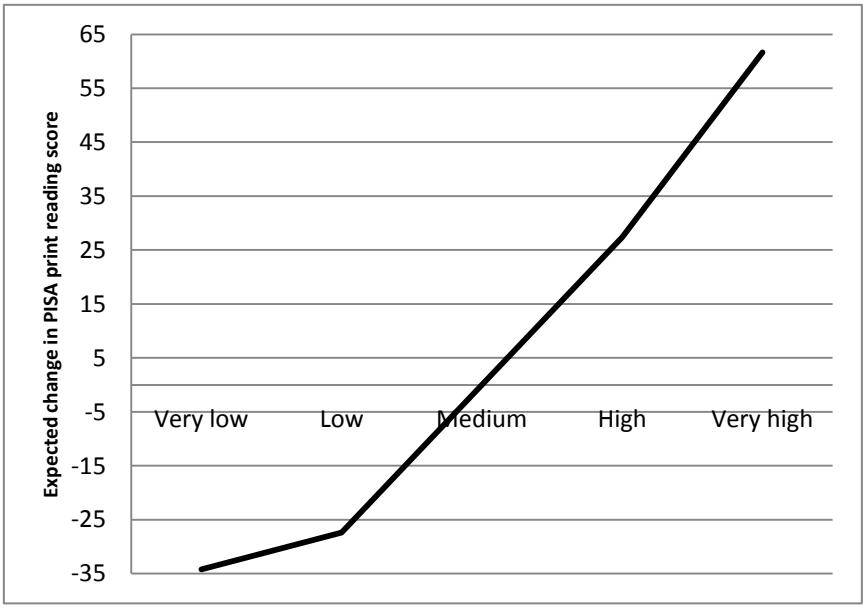


Figure 8.4: Plot of relationship between library usage and print reading achievement, 2009

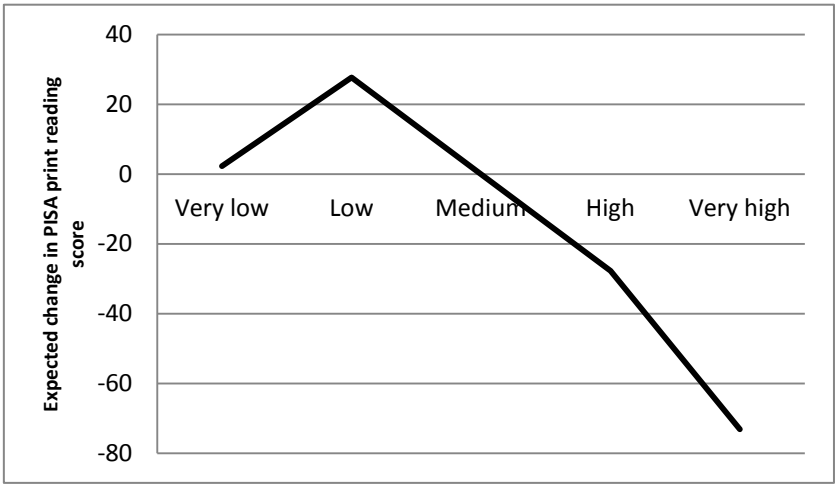
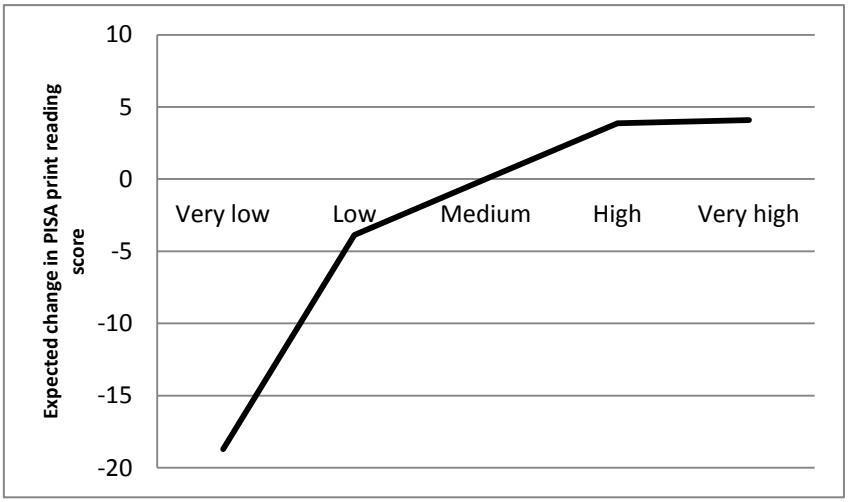


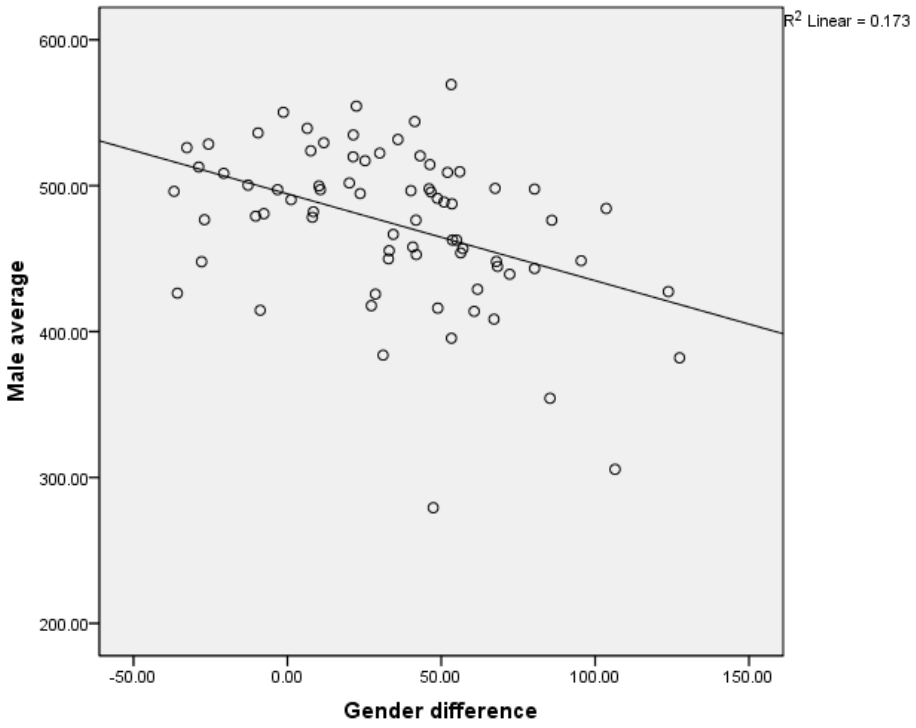
Figure 8.5: Plot of relationship between frequency of online reading and print reading achievement, 2009



The association between gender and print reading achievement varies significantly across schools (SD=18.32; df = 85; p<.001)[57]. Figure 8.6 shows the unadjusted school male average score plotted against the gender difference for schools that have at least five boys and five girls enrolled (N=75).[58] The graph indicates that higher male average scores are associated with smaller gender differences, with particularly large differences in a small number of schools in which males have particularly low average scores. The reverse pattern is not the case to the same extent when one plots female average scores against the gender difference (Figure 8.7). Indeed, in the 15 schools with the lowest *overall* average score on print reading, the gender difference is 45 score points, while it is 35 points on average in the 15 schools with the highest average performance. Overall, the pattern of results in Figures 8.6 and 8.7 suggests that the gender gap in achievement in favour of girls is larger in mixed schools with low average scores for females than in mixed schools with high average female scores.

Table 8.5 shows the variance explained by each block of background characteristics tested separately, then blocks H, I, and J when combined one by one with blocks D, E, F, and G, and finally, all blocks together (see also Table 8.3, which lists the characteristics that are included in each block).

Figure 8.6: Male average print reading plotted against the gender difference in print reading, for the 75 mixed schools in PISA 2009



[57] These figures are derived from the output provided by HLM 6.0®, for the final model of print reading.
[58] In Figures 8.6, 8.7, 8.12, 8.13, 8.16 and 8.17, the data are based on the school average of the first plausible value, weighted by the student weight.

Figure 8.7: Female average print reading plotted against the gender difference in print reading, for the 75 mixed schools in PISA 2009

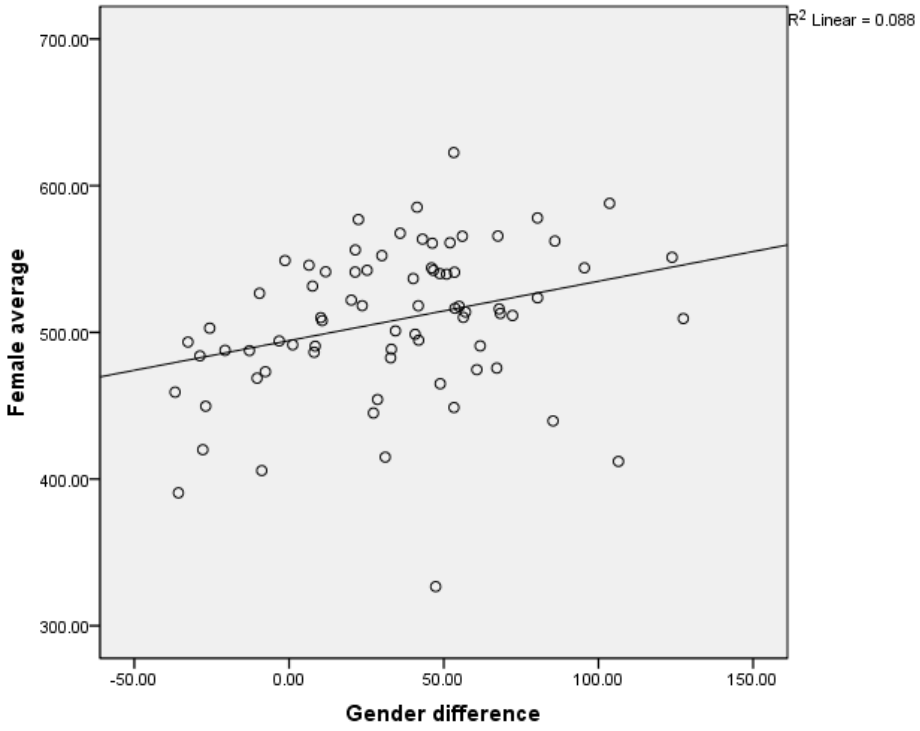


Table 8.5: Variances explained by the final model of PISA 2009 print reading

	Percentage of Variance Explained		
Block/Block Combination	*Between*	*Within*	*Total*
D: School social composition	65.1	0.0	17.4
E: Student demographics	19.1	8.0	11.0
F: Student social/home background	51.7	19.7	28.3
G: Student educational background	10.5	5.8	7.1
H: Student reading strategies	44.9	21.9	28.0
I: Student engagement with reading	40.3	32.4	34.5
J: Student engagement with education	23.9	11.0	14.4
Blocks DEF	74.9	23.5	37.2
Blocks DEFG	75.4	26.8	39.8
Blocks DEFGH	79.0	38.0	48.9
Blocks DEFGI	77.5	43.3	52.4
Blocks DEFGJ	75.4	29.6	41.8
All blocks together	80.5	50.9	58.8

Note: Explained variances have been computed in the absence of the random slope for gender. Block F includes the interaction between gender and books in the home. Block combination DEFG is highlighted as the reference block with which subsequent blocks are compared.

School social composition (i.e., SSP status and outlier school status) explains 17.4% of the total variance in achievement, all of which is between schools. Student demographics explain 11.0% of the total variance in achievement, and social/home background accounts for 28.3% of overall achievement variance. Blocks D, E and F considered together explain 37.2% of achievement variance. Blocks D, E, F and G explain 39.8% of the total achievement variance. Over and above these four blocks, Block H

(reading strategies) explains an additional 9.1% of the total variance in achievement (i.e., 48.9%-39.8%), Block I (engagement with reading) explains an additional 12.6% and Block J (engagement in education) just an additional 2.0%. Together, Blocks H, I and J explain 19.0% of the total variance in print reading achievement over and above that explained by Blocks D, E, F and G, most of which is within rather than between schools.

Model of PISA 2009 Digital Reading

Table 8.6 shows the final model of digital reading for PISA 2009. In all, the model explains 48.3% of total variance in achievement, or 57.3% of variance between schools, and 45.8% within schools. Thus, the explanatory power of the model for digital reading is not as strong as that for print reading. This may be for three reasons. First, the gender difference on digital reading is smaller than for print reading (see Chapter 4); second, digital reading achievement is more weakly associated than print reading with socioeconomic status (see Chapter 6); and third, wording of the questions forming some of the indicators of engagement in reading (e.g., frequency of reading; attitude to reading) may be more closely aligned to the reading of print texts.

No school variables appear in the final model. Thus, between-school differences are accounted for by student characteristics in the model, rather than by the particular set of school characteristics included in the analysis.

The student characteristics remaining in the model of digital reading are similar to those in the model for print reading. Family structure, home educational resources, cultural and material possessions, and diversity of reading are no longer significant in the presence of the other variables. In contrast to the model of print reading, student absence from school is not significant, while attendance at preschool is.

Again, a comparison of the 'core' model that includes all students with a model that includes only students with data available on all explanatory variables (Appendix C, Table C8.2) reveals no substantive difference in how the results might be interpreted. As in the case of print reading, the achievement score of students in the non-missing dataset (77.5% of all students) was some 14 points higher than that of students in the complete dataset, which implies that limiting the analysis to students with complete data would have excluded a significant proportion of lower-achieving students.

As in the case of the print reading model, there is an interaction between gender and books in the home in the digital reading model (Figure 8.8). The nature of this interaction is very similar in both models. In the latter, there is a 34-point difference between the expected scores of females with low and high numbers of books in the home, while the equivalent difference for males is smaller, at 15 points.

There are three non-linear associations between continuous variables and reading achievement (parental occupation, attitude to reading, and library usage) (Figures 8.9, 8.10, and 8.11, respectively). These may be interpreted in a similar manner to the associations described for print reading in Figures 8.2, 8.3 and 8.4. Unlike the model of print reading, however, the relationship between digital reading achievement and frequency of online reading is linear: achievement is expected to increase steadily with higher amounts of online reading.

Table 8.6: Final model of PISA 2009 digital reading

Variable	*Comparison*	*PE*	*SE*	*Stat*	*Test Stat*	*df*	*p*
	Intercept	499.85	6.967	t	71.750	108	<.001
Gender	Gender (female-male)	11.39	4.785				
Immigrant/Language status	Immigrant other language-Native same language	-33.33	11.479	Ddiff	43.693	3	<.001
	Immigrant same language-Native same language	-18.11	6.739				
	Missing immigrant/language	-15.27	7.596				
Number of siblings	No siblings-one or two siblings	13.91	5.430	Ddiff	47.466	4	<.001
	Three siblings-one or two siblings	-10.28	3.676				
	Four or more siblings-one or two siblings	-15.45	4.740				
	Missing siblings	-11.83	15.993				
Parental occupation	Parental occupation (HISEI)	9.03	1.568	Ddiff	61.076	3	<.001
	Parental occupation squared	-2.57	1.164				
	Missing parental occupation	-31.50	14.376				
Parental education	Lower second level or below-upper second level	-14.56	4.630	Ddiff	18.116	3	<.001
	Third level-upper second level	-1.76	2.982				
	Missing parental education	0.03	12.018				
Books in the home	25 books or fewer-26-200 books	-4.32	5.555				
	More than 200 books-26-100 books	8.57	5.132				
	Missing books in the home	10.32	12.591				
Books * Gender	25 books or fewer*Female	-12.76	6.776	Ddiff	10.255	2	0.006
	More than 200 books*Female	6.72	6.188				
In part-time work	Works up to 8 hours-does not work	-9.96	3.893	Ddiff	32.455	3	<.001
	Works more than 8 hours-does not work	-22.02	5.331				
	Missing in part-time work	-12.54	8.754				
Grade	Grade 8-Grade 9	-48.31	10.193	Ddiff	163.404	3	<.001
	Grade 10-Grade 9	21.44	3.309				
	Grade 11-Grade 9	24.19	4.848				
Attended preschool	Attended preschool (yes-no)	7.53	4.079	Ddiff	12.887	2	0.002
	Missing attended preschool	21.94	19.221				
Summarising strategies	Summarising strategies	13.08	1.423	Ddiff	137.688	2	<.001
	Missing summarising strategies	-43.43	11.240				
Understanding and remembering strategies	Understanding and remembering strategies	13.39	1.724	Ddiff	133.785	2	<.001
	Missing understanding and remembering strategies	-27.11	8.573				
Reading for enjoyment	Reads up to 30 minutes-Does not read	7.38	3.488	Ddiff	16.719	4	0.002
	Reads 30-60 minutes-Does not read	14.74	4.572				
	Reads more than 60 minutes-Does not read	14.75	5.132				
	Missing reading for enjoyment	38.60	19.405				
Attitude to reading	Attitude to reading	20.67	2.065	Ddiff	194.092	3	<.001
	Attitude to reading squared	3.39	0.786				
	Missing attitude to reading	23.36	11.563				
Library usage	Library usage	-19.65	1.455	Ddiff	279.363	3	<.001
	Library usage squared	-8.90	1.527				
	Missing library usage	-38.68	17.884				
Online reading	Online reading	15.75	1.425	Ddiff	183.760	2	<.001
	Missing online reading	7.04	30.109				
Early school leaving risk	Early school leaving risk (no-yes)	-16.93	4.948	Ddiff	21.145	2	<.001
	Missing early school leaving risk	-14.94	14.002				

Note: The shaded cells for books in the home and student gender indicate that significance tests for these individual variables are not appropriate given the interaction between books and gender.

Figure 8.8: Plot of interaction between gender and books in the home, PISA 2009 digital reading

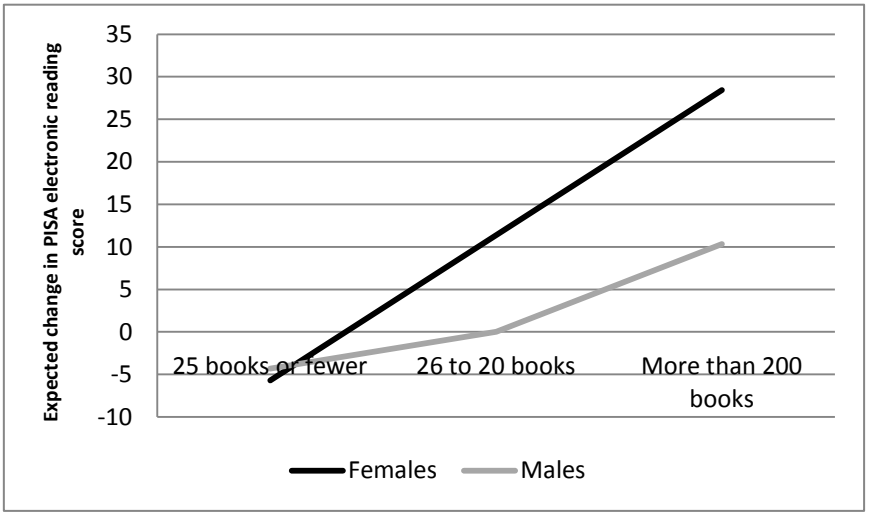


Figure 8.9: Plot of relationship between parental occupation and digital reading achievement, 2009

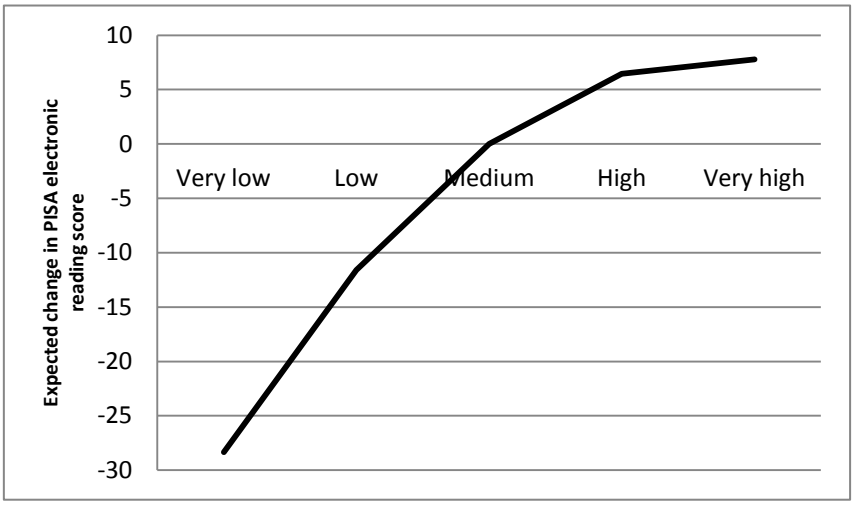


Figure 8.10: Plot of relationship between attitude to reading and digital reading achievement, 2009

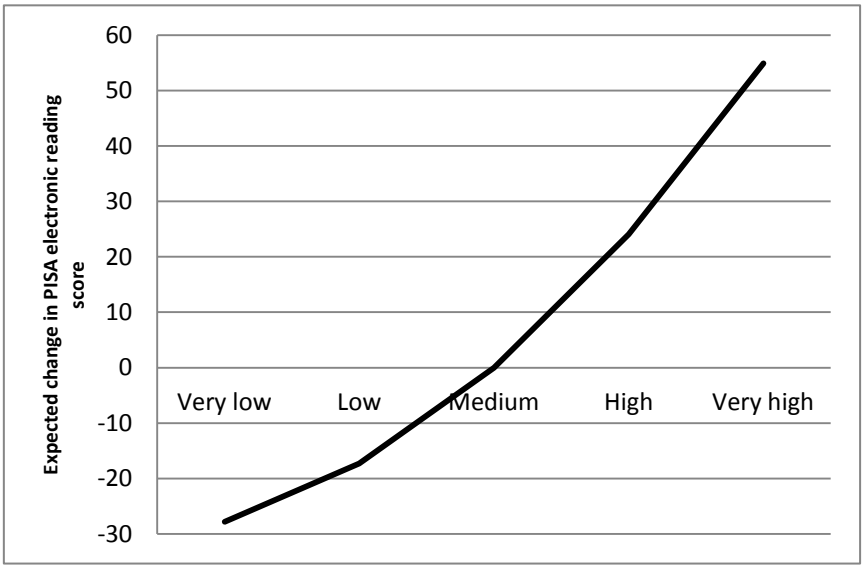
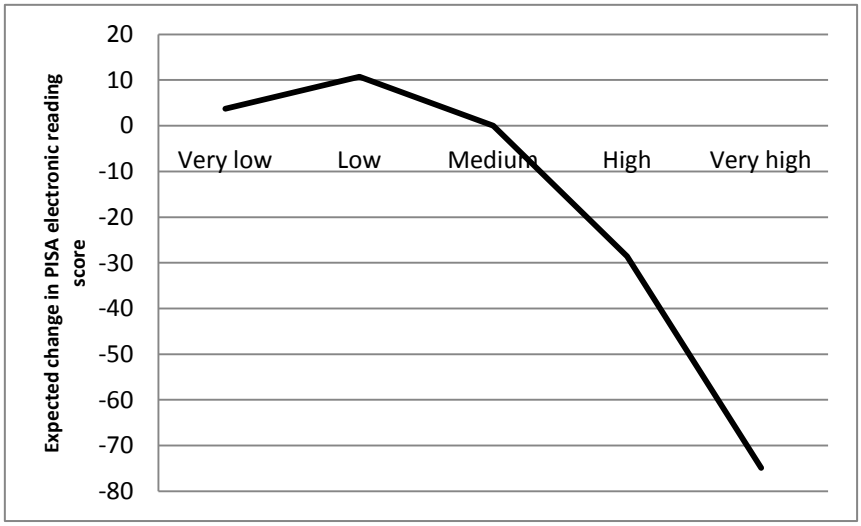


Figure 8.11: Plot of relationship between library usage and digital reading achievement, 2009



The association between gender and digital reading achievement varies significantly across schools (SD=18.21; df = 85, p<.001), which was also the case with print reading (see Figures 8.6 and 8.7). In Figure 8.12, the unadjusted male average score is plotted against the gender difference for schools that have at least five boys and five girls enrolled (N=75). Higher male average scores are associated with smaller gender differences. The reverse pattern is not the case to the same extent when female average scores are plotted against the gender difference (Figure 8.13). In the 15 schools with the lowest *overall* average score on print reading, the gender difference is 40 score points, while it is 30 points on average in the 15 schools with the highest average performance. This is similar to the pattern found in the case of print reading.

Figure 8.12: Male average print reading plotted against the gender difference in digital reading, for the 75 mixed schools in PISA 2009

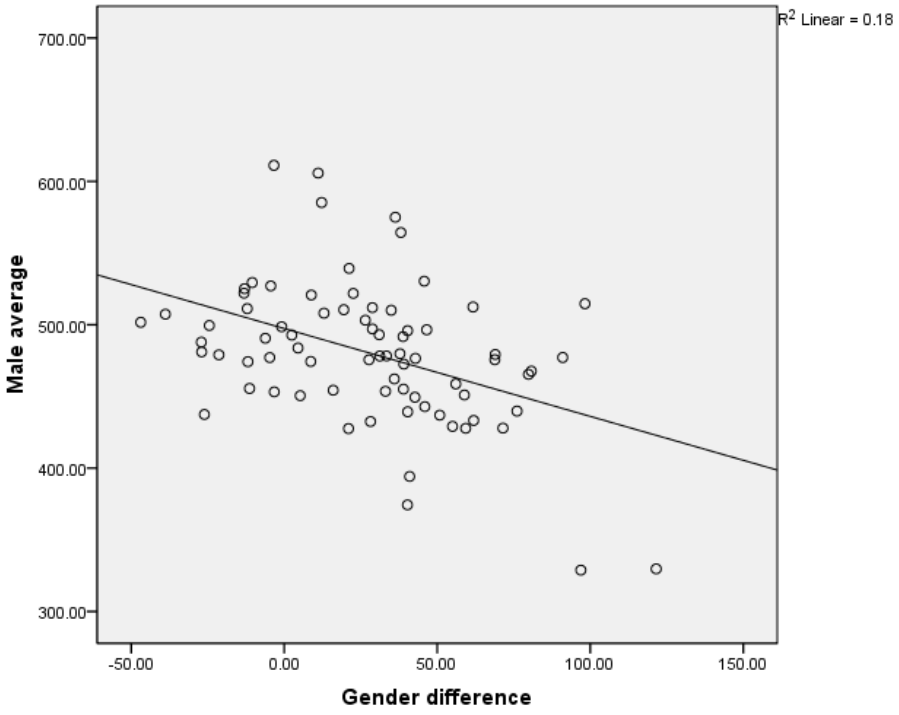


Figure 8.13: Female average print reading plotted against the gender difference in digital reading, for the 75 mixed schools in PISA 2009

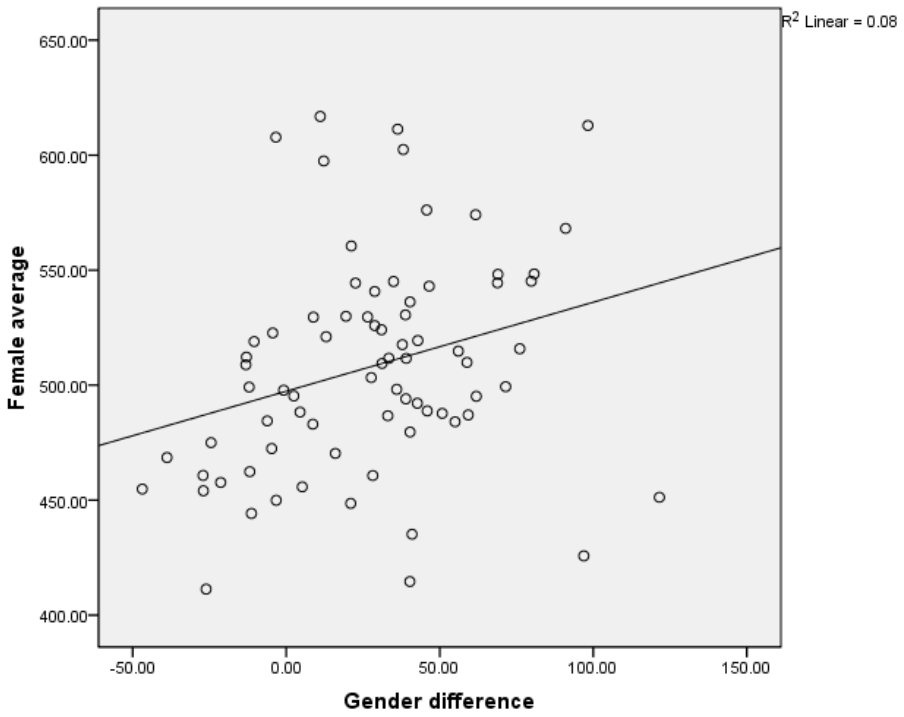


Table 8.7 shows the variance in digital reading achievement explained by each block of background characteristics tested separately, then blocks H, I, and J when combined one at a time with blocks E, F, and G, and finally, all blocks together (Table 8.3 lists the characteristics that are included in each block). Student demographics account for 7.6% of total variance, social/home background accounts for 20.9% of variation, and educational background accounts for 9.0%. Together, blocks E, F, and G account for 28.4% of the variance in achievement.

Table 8.7: Variances explained by the final model of PISA 2009 digital reading

	Percentage of Variance Explained		
Block/Block Combination	*Between*	*Within*	*Total*
E: Student demographics	13.1	6.1	7.6
F: Student social/home background	42.0	15.1	20.9
G: Student educational background	12.1	8.2	9.0
H: Student reading strategies	30.9	18.1	20.9
I: Student engagement with reading	37.7	28.4	30.4
J: Student engagement with education	12.9	6.9	8.2
Blocks EF	45.6	18.6	24.4
Blocks EFG	46.8	23.3	28.4
Blocks EFGH	54.0	33.8	38.1
Blocks EFGI	53.4	39.4	42.4
Blocks EFGJ	47.0	24.9	29.7
All blocks together	57.3	45.8	48.3

Note: Explained variances have been computed in the absence of the random slope for gender. Block F includes the interaction between gender and books in the home. Block combination EFG is highlighted as the reference block with which subsequent blocks are compared.

Over and above these three blocks, use of reading strategies (Block H) accounts for 9.7% of variance in digital reading achievement (i.e., 38.1% - 28.4%), while engagement with reading (Block I) accounts for an additional 14.1%. Engagement with education (Block J) accounts for just 1.3% of additional variance in achievement over and above Blocks E, F, and G. Altogether, Blocks H, I, and J explain 19.9% of the variance in digital reading achievement over and above Blocks E, F and G. Most of this additional explained variance is between students rather than between schools.

A Comparison of PISA 2009 Models of Print and Digital Reading

The background characteristics associated with both print and digital reading in PISA 2009 are broadly similar. As one would expect, student demographics, social/home background, and educational background are all significant. Over and above these characteristics, students' use of reading strategies and their levels of engagement with various reading activities explained significant portions of variance in achievement. In both models, there was an interaction between gender and books in the home which indicated that the association between books and achievement was stronger for females than for males.

In both models, the magnitude of the average gender difference varied across schools. The variance in the magnitude of this difference occurred over and above the other variables in the models, including socioeconomic ones. In analyses to follow up this finding, the gender gap was found to be wider in schools with lower overall average achievement in 75 of the 144 PISA 2009 schools that had at least 5 students of each gender in the PISA sample. (This analysis did not include male and female students who are enrolled in single-sex secondary schools.) The finding indicates that mixed sex schools vary in the size of the gender gap in reading achievement, and that boys do less well in mixed schools where overall average achievement is lower.

There are also some differences in the two models. Perhaps most striking is the lack of school-level variables in the final model of digital reading. School-level variables, of course, did not feature very strongly in the print reading model either. Only two remained in the final model: whether or not the school was in the SSP, and whether or not the school was a performance outlier. A comparison of the variance explained by various blocks of variables, however, indicates that a greater percentage of the total variance in achievement was explained by student social/home background, reading strategies, and attitude to reading in the case of print reading than in digital reading. Furthermore, a larger percentage of between-school variance in print reading than in digital reading achievement was explained by student demographics.

In Chapter 4, it was noted that the gender difference was smaller in digital reading achievement than in print reading. In the final models of print and digital reading described in this chapter, however, it proved difficult to interpret and compare the parameter estimates for gender due to the interaction between gender and books in the home. Therefore, to allow for a more straightforward interpretation, the extent to which gender differences in reading engagement and use of reading strategies might explain the gender difference itself was explored in a series of 'mini-models'. The results are shown in Table 8.8.[59] The results for print reading indicate that the gender difference

[59] The gender differences shown in the first row of Table 8.8 are slightly different than those reported earlier in this report because of differences in software used.

without adjusting for any other characteristics is about 37 points. This reduces to 19 points when engagement in reading variables are included and to 25 points when reading strategies are added. When both engagement in reading and reading strategies are included, the difference reduces to just 14 points. Thus, these two sets of variables account for almost two-thirds of the gender difference in print reading achievement.

The gender difference in digital reading when the contribution of other variables is not taken into account is 29 points. This reduces to 15 points with the inclusion of reading variables and to 18 points when reading strategies are included; or to 10 points when both sets of variables are included in the model. The reduction of the gender difference from 29 to 10 points means that the two sets of characteristics account for two-thirds of the gender difference in digital reading achievement.

A further observation based on the data in Table 8.8 is that gender, engagement in reading and use of reading strategies explain proportionally less of the overall variance in digital reading achievement (about 40% in total) than in print reading achievement (47% in total).

Table 8.8: Parameter estimates and percentages of explained variances for models of print and digital reading, with various combinations of gender, engagement in reading and reading strategy variables

Model	Print reading				Digital reading			
	Gender difference	Percent of variance explained			Gender difference	Percent of variance explained		
		Between	Within	Total		Between	Within	Total
Gender only	37.1	9.7	2.3	4.3	29.4	8.5	1.4	2.9
Engagement in reading only		40.3	32.4	34.5		38.6	28.8	30.9
Gender with engagement in reading	19.4	43.4	33.0	35.7	15.0	41.3	29.1	31.7
Reading strategies only		44.9	21.9	28.0		30.9	18.1	20.9
Gender with reading strategies	25.2	48.1	23.0	29.7	18.5	33.7	18.6	21.9
Gender with engagement in reading and reading strategies	13.8	59.0	42.5	46.9	9.9	51.0	37.4	40.3

Absenteeism remained in the final model of print reading, but not in the model of digital reading. Conversely, attendance at preschool remained in the model of digital reading, but not in the model of print reading. There are also some minor differences between the two models in terms of the magnitude of the parameter estimate for specific characteristics. For example, the expected score difference between native students and immigrant students speaking another language is larger for digital (-33.3) than for print (-23.2) reading, and the expected score difference between students in Grades 8 and 9 is also larger for digital (-48.3) than print (-35.3) reading.

It is perhaps surprising that, in both models of reading in 2009, there was a negative association between library usage and achievement. In both models also, there was a non-linear relationship between library usage and achievement: students with higher scores on this scale had considerably lower predicted reading scores than students with low and medium scores on the scale. However, similar findings emerge from the international dataset for PISA 2009 and indicate that in 52 out of the 65 participating countries, there was a significant negative association between library usage and print reading, and in 40 countries, there was a significant negative curvilinear

association between these variables.[60] Results were similar for digital reading: in 15 of the 19 countries that administered the digital reading assessment, a significant negative curvilinear association between library usage and achievement was found. Library usage is higher in Ireland in SSP (0.08) than in non-SSP schools (-0.02) but the difference amounts to just one-tenth of a standard deviation, so the negative association cannot be attributed to more frequent use of libraries by students in disadvantaged schools.

Overall, one could conclude that the similarities between the two models outweigh the differences, and that findings that are consistent across print and digital reading add robustness and credence to the conclusions about reading achievement that may be drawn. On the other hand, the differences between the models provide an indication of how students' achievements on digital and print reading may vary subtly depending on specific background characteristics. In this context, it may be worth noting that some of the measures, particularly ones relating to reading strategies and engagement in reading, may be more closely aligned with print reading activities than with digital reading activities.

The Performance of 'Outlier' Schools in all PISA 2009 Domains

It was noted in previous sections that the outlier school indicator remained in the final model of print reading, but not digital reading. The question arises: is performance in these schools a function of the mode of the assessment, i.e. print or digital? If so, then we would expect similar findings for print reading, mathematics and science, which in turn would differ from digital reading. To address this question, four models were run and compared. Each had the same explanatory variables, namely student ESCS and student gender, and school average ESCS and outlier status. The parameter estimates and significance levels for the outlier indicator only are shown in Table 8.9. In all four cases, the outlier school indicator is significant, and is largest in the case of print reading and smallest for digital reading. The estimates for mathematics (-76.8) and science (-84.1) are closer to print reading (-91.2) than to digital reading (-42.6). These findings indicate that students in outlier schools performed less well on the print assessment than on the digital assessment regardless of the domain, and that performance was particularly low in the case of print reading. This, in turn, may be related to the length of the assessment (the print assessment lasted two hours, while the digital assessment took 40 minutes).

Table 8.9: Parameter estimates and significance levels for the 'outlier' school indicator in models of achievement after adjusting for student gender and ESCS and school average ESCS

Domain	PE	SE	t	df	p
Print reading	-91.23	18.212	-5.009	140	<.001
Digital reading	-42.60	16.508	-2.581	140	.011
Print mathematics	-76.75	19.726	-3.891	140	<.001
Print science	-84.06	26.400	-3.184	140	.002

[60] This analysis was conducted by the ERC on the international weighted PISA 2009 dataset.

Models of PISA 2000 and PISA 2009 Print Reading

The variables used in constructing the models of print reading in PISA 2000 and PISA 2009 are shown in Table 8.2.[61] These comprise school ESCS, student gender, student ESCS, grade level, frequency of reading for enjoyment, and attitude to reading. Table 8.10 shows the final model for PISA 2000. No significant gender interactions were found, though all three continuous variables (school ESCS, student ESCS, and attitude to reading) had significant curvilinear relationships with achievement. Further, it was found that the relationship between gender and achievement varied significantly across schools (SD=14.17; df = 73; p=.032). The model shown in Table 8.10 explains 37.6% of the total variance in reading achievement, or 77.4% of between-school variation and 28.5% of variation within schools.

Table 8.10: Final model of PISA 2000 print reading (comparison model)

Variable	*Level/Comparison*	*PE*	*SE*	*Stat*	*Test Stat*	*df*	*p*
	Intercept	481.93	5.333	t	90.471	135	<.001
	School Level						
Average ESCS	Average ESCS	23.69	2.433	Ddiff	88.978	2	<.001
	Average ESCS squared	-5.97	1.505				
	Student Level						
Gender	Gender (female-male)	6.57	4.183	t	1.571	137	.118
ESCS	ESCS	14.82	1.505	Ddiff	112.239	3	<.001
	ESCS squared	3.42	1.036				
	Missing ESCS	-49.24	36.880				
Grade	Grade 8-Grade 9	-82.24	9.236	Ddiff	404.656	3	<.001
	Grade 10-Grade 9	39.85	3.815				
	Grade 11-Grade 9	43.85	4.122				
Reading for enjoyment	Reads up to 30 minutes-Does not read	9.80	4.170	Ddiff	33.441	4	<.001
	Reads 30-60 minutes-Does not read	6.19	4.546				
	Reads more than 60 minutes-Does not read	-13.42	6.684				
	Missing reading for enjoyment	-2.09	44.130				
Attitude to reading	Attitude to reading	36.33	2.085	Ddiff	398.321	3	<.001
	Attitude to reading squared	1.97	1.097				
	Missing attitude to reading	-19.84	53.559				

The squared term for school average ESCS indicates that as ESCS gets higher, its relationship with reading achievement becomes weaker, while at the student level, the higher the ESCS score, the stronger the relationship with achievement. Similarly, as scores on the attitude to reading scale increase, the expected reading scores also increase. In the presence of the other variables in the model, student gender is no longer significant, with just a 6-point difference in the expected scores of males and females. The unadjusted gender difference is 24.1 points. Although not significant, gender was kept in the model for PISA 2000 reading to allow comparisons with the 2009 model. Students who read for more than one hour a day have an expected reading score that is about 13 points lower than that of students who report not reading for enjoyment. This finding is consistent with the multilevel models of reading achievement reported in the national report for PISA 2000 (Shiel et al., 2001).

[61] In 2000, but not in 2009, 25 students, or 0.6% of the sample, were missing data on student gender and these students have been excluded from the 2000 analyses.

Table 8.11 contains the results for the model of PISA 2009 print reading which was computed to allow comparisons with 2000. This model explains 38.8% of variance in total, or 60.6% of the variance between schools, and 32.7% within schools. The slope for gender varies across schools (SD=13.80; df = 73, p<.001), similar to the model for 2000.

Table 8.11: Final model of PISA 2009 print reading (comparison model)

Variable	*Level/Comparison*	*PE*	*SE*	*Stat*	*Test Stat*	*df*	*p*
	Intercept	472.25	5.293	t	89.214	140	<.001
	School Level						
Average ESCS	Average ESCS	21.38	2.977	Ddiff	54.373	3	<.001
	Average ESCS squared	-4.18	1.371				
	Missing average ESCS	53.33	48.467				
	Student Level						
Gender	Gender (female-male)	21.00	4.218	t	4.978	47	<.001
ESCS	ESCS	15.16	1.667	Ddiff	134.983	3	<.001
	ESCS squared	-2.59	0.974				
	Missing ESCS	-46.05	19.625				
Grade	Grade 8-Grade 9	-75.96	12.375	Ddiff	268.23	3	<.001
	Grade 10-Grade 9	29.11	3.621				
	Grade 11-Grade 9	27.96	4.394				
Reading for enjoyment	Reads up to 30 minutes-Does not read	12.01	3.850	Ddiff	67.797	4	<.001
	Reads 30-60 minutes-Does not read	23.59	5.356				
	Reads more than 60 minutes-Does not read	18.98	6.596				
	Missing reading for enjoyment	-59.10	17.518				
Attitude to reading	Attitude to reading	29.19	5.538	Ddiff	277.691	3	<.001
	Attitude to reading squared	2.55	0.923				
	Missing attitude to reading	-10.29	12.222				

The model contains three curvilinear relationships corresponding to each of the three continuous variables (school average ESCS, student ESCS, and the attitude to reading scale). However, in the case of student ESCS, the squared term is negative implying that student ESCS operates in a manner analogous to school ESCS (while in the 2000 model, these appear to operate in opposite directions).

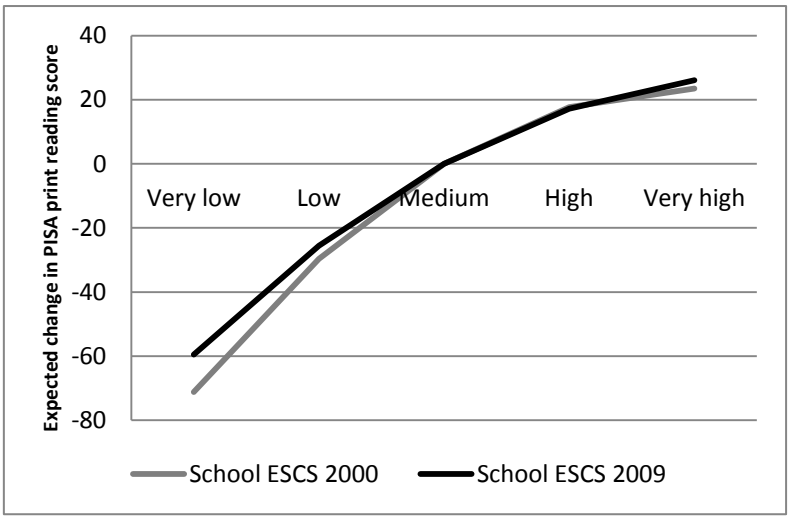
The gender difference in the final (comparison) model for PISA 2009 (21 points) is larger than that in the final model for 2000 (6 points), indicating that the other variables in the 2000 model (such as reading for enjoyment and attitude to reading) accounted for the observed gender difference to a greater degree in 2000 than in 2009. It should also be recalled, however, that the unadjusted gender difference was larger in 2009 than in 2000. Furthermore, the relationship between reading for 60 minutes or more a day and reading achievement was positive in PISA 2009, but negative in 2000.

In the model for PISA 2009, the estimated reading score differences between Third Year (Grade 9) students and students in Transition and Fifth Years (Grades 10 and 11) is about 10 points smaller than the corresponding difference in the model for 2000. The expected difference between Third and Fifth Year students in 2009 is some 16 points smaller than in 2000.

Figures 8.14, 8.15, and 8.16 show, for PISA 2000 and PISA 2009, the expected reading score change for students associated with low, medium and high values on the

continuous variables in the models.[62] Figure 8.14 indicates an overall similar pattern of the relationship with achievement between school average ESCS and reading achievement in both years. However, in 2000, students in schools with very low average ESCS scores had an expected reading score about 12 points lower than students in equivalent schools in 2009. This means that schools with very low average ESCS performed less well in 2000 than in 2009.

Figure 8.14: Plot of relationship between school average ESCS and reading achievement, PISA 2000 and PISA 2009 comparison models



In contrast to school average ESCS, the association between student ESCS and reading achievement differed markedly in 2000 and 2009 (Figure 8.15).[63] In 2000, achievement differences were larger between students with medium and high levels of ESCS, while in 2009, differences were larger between students with low and medium levels of ESCS. Taken together, Figures 8.15 and 8.16 suggest that there has been a shift in the relationship between achievement and ESCS, both between and within schools, such that individual students with low ESCS, rather than schools with low ESCS, may now be a more vulnerable group.

The association between attitude to reading and reading achievement is similar in both 2000 and 2009, but exhibits a slightly steeper curve in 2000 such that students with low levels of enjoyment of reading performed comparatively better in 2009 than in 2000 (Figure 8.16).

[62] As in previous figures in this chapter, when plotting estimated contributions to reading achievement on the basis of continuous variables, 'very low' is two standard deviations below the mean on the scale, 'low' is one standard deviation below the mean, 'medium' is at the average point in the scale, 'high' is one standard deviation above the mean, and 'very high' is two standard deviations above the mean.

[63] The different patterns may have been due to differences in the averages and distributions of ESCS in 2000 and 2009. In fact, these are very similar for the two years: average (unstandardised) ESCS 2000=-0.032, SD 2000=0.865; average (unstandardised) ESCS 2009=-0.011, SD 2009=0.895.

Figure 8.15: Plot of relationship between student ESCS and reading achievement, PISA 2000 and PISA 2009 comparison models

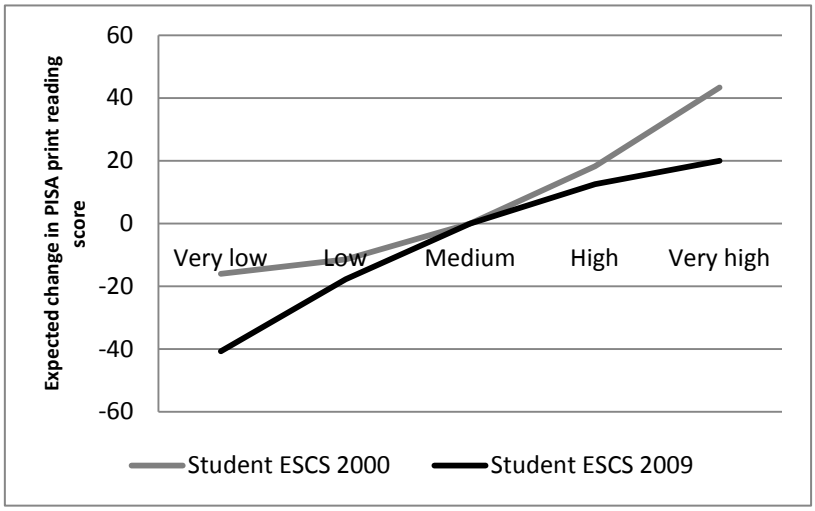


Figure 8.16: Plot of relationship between attitude to reading and reading achievement, PISA 2000 and PISA 2009 comparison models

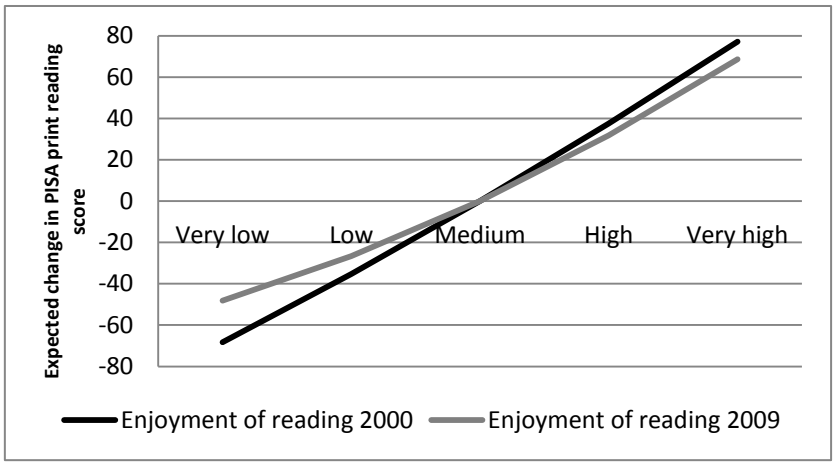


Table 8.12 shows the percentages of variance in print reading achievement that each variable/variable set accounted for in the comparison models for PISA 2000 and PISA 2009. Overall, the total variance explained (37.6% in 2000 and 37.4% in 2009) is similar. However, some differences are worth noting. First, on its own, gender explains less of the total variance in 2000 (2.0%) than in 2009 (4.3%), and this is the case for explained variance both within and between schools. Second, gender explains little variance in achievement over and above that explained by reading for enjoyment and attitude to reading in both years, and as noted, gender was not significant in the final model for PISA 2000. In other words, gender covaries strongly with these two variables. Third, student and school ESCS taken together accounted for more of the explained variance in reading achievement in 2009 than in 2000. This means that the effects associated with ESCS were stronger in 2009 than in 2000. Fourth, student grade level explained less variance in 2009 than in 2000, perhaps reflecting changes over time in the percentages of students in junior and senior cycles.

Table 8.12: Variances explained by the comparison models for PISA 2000 and PISA 2009 print reading

	2000			2009		
Variance explained by…	Between	Within	Total	Between	Within	Total
Gender only	4.6	1.4	2.0	9.7	2.3	4.3
Student ESCS only	34.9	4.7	10.3	33.2	6.7	13.8
School ESCS only	64.1	0.0	11.9	50.2	0.0	13.4
Grade only	9.8	10.1	10.0	10.5	5.8	7.1
Student and school ESCS	64.3	4.8	15.9	53.3	6.7	19.2
Student and school ESCS and grade	67.9	14.4	24.3	58.6	12.0	24.4
Reading for enjoyment and attitude to reading	22.9	17.7	18.7	27.9	21.6	23.3
Reading for enjoyment, attitude to reading and gender	22.7	17.8	18.7	31.7	22.2	24.8
Final model	77.4	28.5	37.6	56.7	32.1	37.4

Note: Explained variances have been computed in the absence of the random slope for gender.

The slope for gender varied significantly across schools in PISA 2000. Similar to Figures 8.6 and 8.7 (for PISA 2009), Figures 8.17 and 8.18 plot the unadjusted average gender difference against the unadjusted male and female averages, for the 68 schools in PISA 2000 that had at least five students of each gender enrolled. Again similar to PISA 2009, there is a relationship between male average and gender difference which is stronger than that between female average and gender difference.

Figure 8.17: Male average print reading plotted against the gender difference in print reading, for the 68 mixed schools in PISA 2000

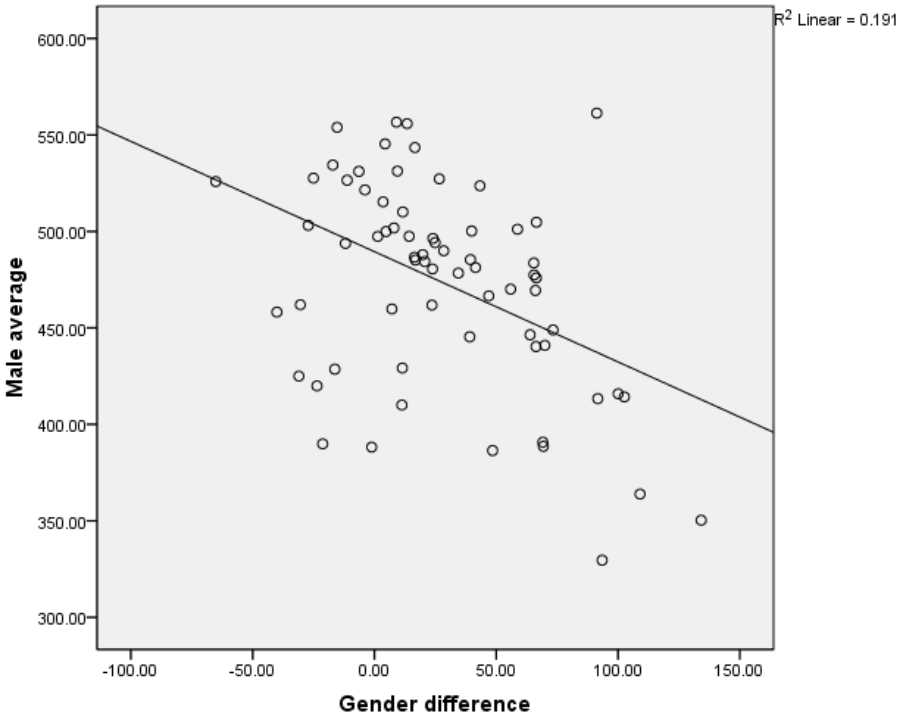
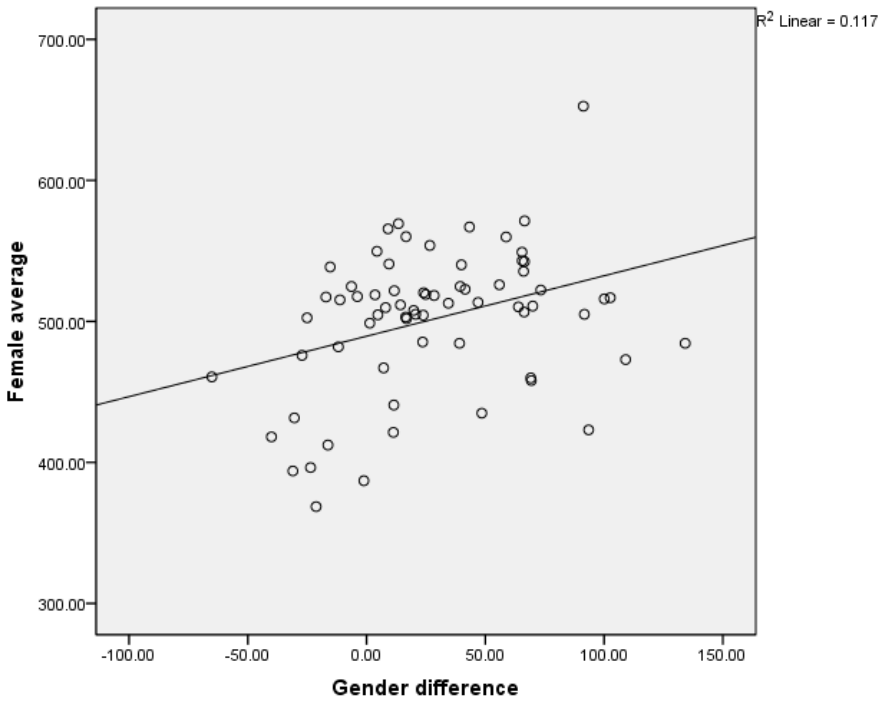


Figure 8.18: Female average print reading plotted against the gender difference in print reading, for the 68 mixed schools in PISA 2000



Chapter Summary and Conclusions

This chapter presented the results of three sets of multilevel analyses that examined performance in print reading in PISA 2009, in digital reading in PISA 2009, and in print reading in PISA 2000. Multilevel modelling allowed us to examine a range of background school and student characteristics simultaneously in terms of their associations with achievement, whilst taking the clustered nature of the sample into account. Analyses also allowed us to compare and contrast characteristics associated with achievement in print and digital reading in 2009, and to identify changes in the associations between the characteristics and print reading between PISA 2000 and PISA 2009.

Using HLM 6.0® to analyse the data, the percentage of variance between schools on each of the three assessments was as follows: 2009 print reading: 27%; 2009 digital reading: 22%; and 2000 print reading: 19%.

The final model of print reading in 2009 explained 59% of total variance in achievement (81% between schools and 51% within schools) while the final model of digital reading explained less of the total variance (48%; 57% between schools and 46% within schools). Less variance in digital reading than in print reading was explained by student demographics, social/home backgrounds, engagement in reading, and usage of reading strategies.

In broad terms, the models for 2009 print and digital reading produced similar results, indicating the importance of the following characteristics in explaining variation in achievement: student gender, language spoken, parental occupation and education, books in the home, working part-time, grade/year level at the time of the PISA assessment, and intention to leave school prior to the Leaving Certificate. Over and above these demographic and socioeconomic characteristics, engagement in reading and

use of reading strategies explained substantial amounts of variance in achievement in both print and digital reading.

Some of the findings merit more careful investigation. For example, the negative relationship between library usage and achievement in both models may appear counter-intuitive (though it was also present in most of the other countries in PISA 2009). What precisely is measured by the two reading strategies scales needs further clarification. It may be that high scores on the scales in part reflect higher levels of exposure to, and practice with, reading and using texts; in other words, their relationship with achievement may be circular or recursive in nature.

In both models, the association between number of books at home and reading achievement was stronger for females than for males. Numerous studies provide support for the measure of books as a proxy for a positive educational home climate. However, the processes and characteristics associated with this indicator are unclear; even less clear are the reasons why the variable should operate differently for males and females in Ireland (a result that was also found in previous analyses of PISA 2000; Shiel et al., 2001).

In both models, the slope for student gender varied across schools. That is, the size of the gender difference was not the same across schools with both male and female students enrolled. Moreover, follow-up analyses suggested that where the gender difference was smaller, the average achievement of boys tended to be higher. The reasons for these findings are unclear, but they indicate that mixed sex schools are differentially effective in developing/enhancing the reading skills of male and female students. This finding warrants further research in order to offer the possibility of identifying the characteristics of those (mixed) schools that are more successful in reducing the gender gap in reading achievement. To do this, it would be necessary to have a prior measure of reading achievement, since part of the gender gap may be due to characteristics of male and female students at the time of entry to post-primary schools.

Gender differences in engagement in reading (e.g., with more leisure reading by females) and use of reading strategies (with higher usage by females) accounted for two-thirds of the gender difference in both print and digital reading. It would therefore seem important to gain a clearer understanding of how these characteristics operate, and if their development in males could be enhanced.

Two variables at the school level remained in the model of print reading, but not in the model for digital reading: school SSP status and an indicator of whether the school was an outlier (i.e., performed 100 points or more below the national average on reading). The reasons for this latter finding are not obvious, since one would have expected achievement differences between outlier and other schools to be accounted for by socioeconomic and demographic differences. To investigate this further, models of print reading, mathematics, science, and digital reading with adjustments for student gender and ESCS and school average ESCS as well as outlier status were computed and compared. Outlier schools were found to have particularly low adjusted scores on the print assessment compared with the digital assessment. Why this is so cannot be inferred from the present analyses, but patterns of percent correct and skipped responses on both digital and print assessments (discussed in Chapter 9) provide strong evidence that differential engagement may have had a large part to play.

To examine changes over time in print reading achievement, data from PISA 2000 and PISA 2009 were analysed. The following characteristics were in the final 'comparison' models: school average ESCS, student gender, student ESCS, student grade/year level, reading for enjoyment, and attitude to reading. The models for both years explained similar percentages of the total variance in achievement (38% in 2000 and 39% in 2009). However, there were also some differences in the explained variances associated with individual variables. First, gender explained more of the total variance in achievement in 2009 than in 2000, which is consistent with the observed increase in the gender difference in reading achievement since 2000 (see Chapter 3). Second, school and student ESCS measures were slightly more strongly associated with achievement in 2009. This suggests that schools were somewhat less equitable, or more differentiated in terms of socioeconomic characteristics in 2009 than they were in 2000, particularly with respect to individual student ESCS. Third, achievement differences across grade levels were not as pronounced in 2009 as in 2000, and this is consistent with findings described in Chapters 6 and 9. Finally, engagement in reading and gender covaried more in 2000 than in 2009; or, more of the gender difference in 2000 was attributable to male-female differences in engagement than in 2009.

These findings suggest a widening in the gender gap in achievement that cannot be accounted for by socioeconomic differences, distribution across grade levels, or changes in reading engagement. They also suggest that the education system may be somewhat less equitable than it was in 2000. In both 2000 and 2009, the slope for gender varied across schools in a similar fashion, indicating that the apparent differential effectiveness of mixed schools in addressing the gender gap is not a new issue, but rather an established one in need of further examination.

The findings presented in this chapter confirm previous research and serve to underline the need for continued supports for some students in their reading, in particular boys, disadvantaged students, and students who speak a language other than English or Irish at home. Findings also indicate the need to further examine the gender gap in achievement across schools and to address engagement in reading and in education more generally in some students. It would also be desirable to gain a deeper understanding of what the PISA reading strategies scales are measuring.

As with any single study, however, PISA has its limitations. Causal inferences may not be drawn from the cross-sectional design of PISA, no matter how sophisticated the analyses may appear. Results pertaining to attitudinal and behavioural measures rely on subjective self-reports, which are not error-free. The PISA schools and students represent a sample of the entire population, and though data are weighted to reflect the population, results in particular as they relate to differences in the gender gap in achievement across schools and trends as they relate to school-level characteristics should not be generalised in the absence of supporting data sources.

Chapter 9: Explaining Changes in Achievement on PISA

In Chapters 3 and 5, changes in achievement on print reading (since 2000), mathematics (since 2003) and science (since 2006) were described. When published in December 2010, the results for reading, and to a lesser extent mathematics, attracted media attention and commentary, and were presented to the Joint Oireachtas Committee on Education and Skills in January 2011.[64] In its presentation to the Committee, the Educational Research Centre described the extent and nature of declines in achievement on the PISA tests, and some of the methodological issues involved in measuring change (e.g., assumptions underlying the statistical models). The ERC concluded that some of the decline was related to demographic changes in the PISA cohort in Ireland since 2000. These included an increase in the proportion of immigrant students, a small increase in retention rates, greater participation of students with special educational needs in mainstream schools, and changes in the distribution of students across junior and senior cycles. The ERC also commented that an increase in the percentages of questions that students did not respond to in 2009 could be indicative of less proficiency, less engagement with the test, or both, and that some of the decline may have been due to chance fluctuations in the sampling of schools. The need for further analysis of the results was indicated.

Explaining the results, particularly in the case of reading, presented a challenge, since it is accepted that, in the absence of widespread and significant educational reform or demographic shifts, changes in educational standards of the magnitude suggested by the PISA results do not occur over such a short period of time. Moreover, the reported changes were not supported by collaborating evidence from national assessments administered in Ireland. In 2004, the National Assessment of English Reading was administered to pupils in Fifth Class, and the National Assessment of Mathematics was administered to pupils in Fourth Class. The cohorts which these pupils represented would have participated in PISA 2009. The Fifth Class pupils would have been in Transition and Fifth Years in post-primary schools in 2009, while the Fourth Class pupils would have been in Third Year. Further evidence from national assessments over a longer time period also failed to support the idea that standards in Irish schools had changed. Comparisons of the results of national assessments of English and mathematics prior to 2004 indicate that no changes in achievement had occurred since 1998 (reading) and 1999 (mathematics) (Eivers et al., 2005; Shiel et al., 2006).[65]

In response to PISA 2009, the Department of Education and Skills requested an independent review of the results by Statistics Canada. The ERC also conducted a detailed review (see Cosgrove et al. (2010), Shiel et al. (2010), and LaRoche and Cartwright (2010)). These highlighted a need to further analyse students' responses on the PISA assessments, as well as some of the specific issues related to PISA's methods to scale and link achievement. It had been noted, for example (Cosgrove et al., 2010, pp. 28-29; LaRoche & Cartwright, 2010, pp. 4-5; p. 32) that students in Ireland appeared to be disengaged from the PISA 2009 print assessments to a greater degree than in previous

[64] http://debates.oireachtas.ie/EDJ/2011/01/13/00004.asp; the PISA results were also considered by the Joint Oireachtas committee in May 2011.

[65] Unfortunately, changes to the design of the 2009 national assessments of mathematics and English reading mean that we cannot compare the most recent results with the 2004 assessments (see Eivers et al., 2010).

cycles as was evidenced in their behaviour during some of the testing sessions and in the percentages of test questions that they did not attempt. Further, it was not possible to establish, at the time of writing of these reports, whether students' levels of engagement were the same on the digital reading assessment as on the print assessment; however, it was thought that this may not have been the case since students in Ireland had a mean score that was some 13 points higher on the digital reading assessment than on the print reading assessment (Cosgrove et al., 2011).

Subsequent to these initial reviews, Cosgrove (2011) examined students' responses on the PISA print assessments in PISA 2003, 2006 and 2009 for changes that might be related to achievement, while Cosgrove and Moran (2011) conducted a detailed comparison of students' response patterns on the print and digital reading assessments in PISA 2009. Meanwhile, LaRoche and Cartwright (2010) recommended further examination of PISA's methods to link and scale the achievement data, and this, along with an examination of the PISA test design and students' response patterns on the PISA tests more generally, are described by Cartwright (2011).

This chapter provides a synthesis of findings; the six reports referred to can be accessed at www.erc.ie/pisa. The chapter is organised into seven sections. It is important to note that the length of the sections is not representative of the relative importance of each set of issues considered. First, we provide a brief summary of the changes in achievement that were described in Chapters 3 and 5. Second, we review aspects of the implementation of PISA in Ireland and show, on the basis of the available evidence, that, with the exception of the sampling of a small number of very low-performing schools in 2009, none appears to be relevant to the observed changes in achievement. Third, we describe changes in the demographic characteristics of students who participated in PISA, along with curricular changes, highlighting those which are relevant in considering achievement trends. Fourth, we consider how aspects of the PISA test design are related to student achievement. Fifth, we present the results of analyses that support the view that some of the observed changes in achievement scores may be due to changes in the extent to which students engaged in the assessment tasks. Sixth, we review aspects of PISA's approach to producing achievement scores and to linking scores across cycles, noting those which appear to be problematic when we measure change. At the end of the sections that consider reasons for Ireland's decline, a box with a brief set of main findings is summarised. Finally, we bring these strands of analysis together in a summary and set of conclusions.

Summary of Changes in Achievement on PISA in Ireland

The average score for print reading in Ireland in PISA 2009 represented a drop of 31 score points since PISA 2000, which includes a non-significant 11-point drop between 2000 and 2003. In 2009, the average score for Ireland (496) was not significantly different to the OECD average (493). The decline in Ireland was the largest reported drop across all countries with data that can be compared. There has also been an increase in the percentage of students below Level 2 on the PISA proficiency scale from 11% in 2000 to 17% in 2009, and a decrease in the percentage of students at Levels 5 and 6 from 14% in 2000 to 7% in 2009. The gender gap in achievement in Ireland also widened between 2000 and 2009, from 29 points to 39 points, such that the average scores of male students in Ireland decreased by 37 points, while the decrease for females was 26 points. However, the OECD average gender gap has also increased, albeit to a lesser extent (7

score points). The percentage of low achievers in Ireland (below Level 2) has increased more in the case of boys (by 10 percentage points) than girls (by 3 percentage points).

In mathematics, the average score for Ireland in PISA 2009 (487) was significantly lower than the OECD average (496). This represents a 16-point decline in average achievement since PISA 2003 (the last year in which mathematics was a major domain; Ireland had a mean score that was not significantly different from the OECD average in that year). It is the second-largest reported decline in mathematics across the countries with comparative data. Most of this decline (14 of 16 points) occurred between 2006 and 2009. In Ireland, the proportion of low achievers (scoring below Level 2) in 2009 (21%) represented an increase of 4 percentage points since 2003, while the proportion of high achievers decreased from 11% in 2003 to 7% in 2009. In 2003, the gender gap in favour of males was 15 score points, which is larger than the gender difference in 2009 (8 points). The gender difference in Ireland in 2009 was not significant, and slightly smaller than the (significant) OECD average gender difference of 12 points. The decline in mathematics achievement was slightly larger in the case of males (19 points) than females (12 points). Consistent with this, the percentage of low-achieving male students increased from 15% to 21%, while the increase in the percentage of low-achieving females was somewhat less (from 19% to 21%). While 14% of males in Ireland scored at Level 5 in 2003, just 8% were at this level in 2009; the corresponding percentages for females in 2003 and 2009 are 9% and 5%, respectively.

Science achievement in Ireland has remained stable since 2006 (the year in which it was a major domain). In 2009, the Irish average science score (508) was significantly above the OECD average (501): both scores are about the same as they were in 2006. The percentage of students in Ireland scoring below Level 2 did not change since 2006 (15.5% in 2006; 15% in 2009). The small decline in the percentage of high achievers in science (at Levels 5 and 6) (from 9.4% to 8.7%) is not statistically significant. In 2006 and 2009, gender differences both in average science achievement, and in the percentages of high and low achievers were not significant. Gender differences in Ireland in both cycles were consistent with OECD averages.

Between-school differences in Ireland increased since 2000. In print reading, between-school variance in 2000 was 18% and it was 29% in 2009. The respective figures for mathematics are 11% and 24%, and for science, they are 14% and 25%. Nonetheless, between-school variance remains below the OECD average. For example, in 2009, the OECD average between-school variation in print reading was 39%, compared with 29% in Ireland.

PISA's Implementation Procedures

In this section, we consider aspects of PISA's implementation procedures that may have had an impact on students' performance on the reading and mathematics assessments. In this context, it may be noted that PISA implements a stringent quality control programme in all aspects of administration, from sampling, translation, printing, and test administration to data processing, scaling, and student and school participation rates. Ireland met all technical standards in PISA 2009 as it has with all previous cycles of PISA (see OECD, 2011b, Chapter 14).

A number of procedural changes were introduced in PISA 2009 which, along with other changes (e.g., demographic), could have impacted on student engagement with the assessment. These are not necessarily mutually exclusive. First, in order to

incentivise student participation, a prize draw was introduced in which participating students were entered into a draw and three students in each school received a 15 euro voucher. While this may have served to attract a somewhat higher number of disengaged students, analyses on the sampling outcomes suggest that this was unlikely (Cosgrove et al., 2010). While no major issues with testing were identified by the PISA Quality Monitor for Ireland, some disengagement among students was observed by test administrators (LaRoche & Cartwright, 2010). While it is possible that other countries may also have found student engagement to be a problem, systematic information on this is lacking.

A second change that occurred in PISA 2009 was that the 'school associate' model of test administration was used for the first time in Ireland; that is, tests were administered by teachers in their own school rather than by external staff. About three-quarters of schools in Ireland employed this model, while an external administrator was used in the remaining schools. All individuals administering the assessment instruments in schools received the same training from ERC staff. Although students in schools where teachers administered the assessment achieved a mean score 5 points lower than students in schools with an external administrator, the difference is not significant and can be explained by differences in the socioeconomic composition of the schools; schools that used an external administrator were slightly more economically advantaged in terms of student intake (Cosgrove et al., 2010).

Third, Ireland participated in two large-scale international assessments in Spring 2009 (PISA and the International Civics and Citizenship Study [ICCS]). Both of these drew on samples of post-primary schools. To prevent overlap of sampled schools across the studies, the list of post-primary schools was split into equivalent halves and each sample was drawn from half of all schools. The ICCS sample was selected before the PISA sample and no schools selected for ICCS were selected for PISA. To ensure that both halves of the pool of schools were representative, a new implicit stratification variable was introduced in PISA 2009 (the percentage of students in each school with a Junior Certificate fee waiver). These changes in sampling methodology meant that for the first time in PISA very large schools were selected with certainty (as the split in the pool of schools meant that fewer of these schools were available for selection than in previous cycles). This may have had an impact on the PISA sample if the very large schools selected had very different achievement levels than those selected for ICCS. However, analyses conducted by LaRoche and Cartwright (2010) verified the PISA 2009 sample and confirmed that the changes made to the sampling methodology did not affect the computation of sampling weights, representativeness of the PISA sample, or response rates in any measurable way (see also Cosgrove et al. (2010) for a detailed comparison of the 2000 and 2009 samples).

Fourth, in 2000, all schools that participated in PISA achieved a mean reading score that was within one standard deviation of the mean (i.e., the mean ± 100 points). In 2009 however, eight schools had very low reading achievement scores (their mean reading scores were more than 100 points below the mean score for Ireland). This finding is best considered as one which spans across implementation procedures, demographic changes and response patterns on the test (the latter two are considered in later sections). Test administration records for the schools were examined but failed to reveal any difficulties with test administration. A comparison of the Junior Certificate

English results for these schools and other schools in the PISA 2009 sample confirmed the eight schools as low achieving. Analyses showed that:

- Students in the eight schools had almost three times as many missing responses on their test booklets as students in other schools; for example, 30% of students skipped more than a quarter of the questions in their test booklets.
- The eight schools had a mean score in all three print domains that is one standard deviation below the mean of the non-outliers.
- The mean ESCS score of students in the eight outlier schools was 0.6 standard deviations below the non-outliers; the outlier schools also had about twice the rate of Junior Certificate fee waiver.
- There were fewer girls in the outlier schools (31%) than in the non-outlier schools (50%).
- Almost 12% of students in outlier schools spoke a language other than English or Irish at home, compared to just over 3% of students in other schools.
- About 60% of students in outlier schools were in vocational schools, compared to 22% in non-outlier schools.
- Participation rates in PISA were lower in outlier schools (57%) than in non-outliers (80%) (Cosgrove et al., 2010).

Table 9.1: Student percent correct and percent missing, overall and by item type, for print reading, mathematics, science, and digital reading – comparisons by school 'outlier' status (Ireland)

	All Items				Written Items				Multiple Choice Items			
Domain/Outlier	Correct		Missing		Correct		Missing		Correct		Missing	
Print Reading	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Not outlier	59.8	0.63	7.4	0.36	59.5	0.67	11.3	0.51	59.3	0.62	3.5	0.26
Outlier	33.9	2.37	32.5	3.65	31.7	2.47	42.6	4.06	34.8	2.54	22.6	3.77
Mathematics												
Not outlier	44.3	0.58	10.9	0.40	35.8	0.65	18.4	0.63	55.1	0.63	3.2	0.24
Outlier	25.6	1.44	31.0	3.76	17.7	1.71	42.4	3.06	35.5	1.88	17.0	4.14
Science												
Not outlier	55.1	0.62	5.2	0.30	50.5	0.75	9.3	0.49	58.0	0.60	3.2	0.23
Outlier	31.4	2.73	30.4	4.16	25.3	2.77	41.6	4.14	34.9	3.01	24.9	4.23
Digital Reading												
Not outlier	59.0	0.76	6.2	0.37	43.7	0.88	12.3	0.66	68.1	0.78	3.9	0.32
Outlier	45.8	5.14	13.4	2.53	27.7	5.90	26.2	4.30	57.0	4.73	8.4	2.18

Note: 'Missing' refers to the percentages of students who did not respond to a question, whether or not that item was followed by a valid response to another item in the booklet they attempted. Source: Cosgrove and Moran, 2011, Table 9.

Although these schools differed in socioeconomic and demographic composition, students in outlier schools engaged much more in the digital than the print assessment. Results in Chapter 8 show that, when other factors including gender and socioeconomic composition were taken into account, students in the outlier schools did not differ from those in other schools in terms of their achievement on digital reading, but still performed significantly less well on the assessment of print reading. Consistent with this, comparisons of responses of students on print and digital reading assessments indicate very different levels of engagement in the two (Cosgrove & Moran, 2011). Table 9.1 shows item statistics (percent correct and missing on all items, written items and multiple-choice items) for students in outlier and non-outlier schools for all four assessment domains. In the case of print reading, mathematics, and science, there are

very marked differences between outlier and non-outlier schools in the percentages of correct and missing responses.

In print reading, there is a difference of 25.9 percentage points in overall percent correct, and the percentage of missing responses also differs substantially (7.4% missing in non-outlier schools compared to 32.5% in outlier schools). The same pattern holds across item types, with particularly high rates of missing responses (42.6%) in outlier schools on questions requiring a written response. For mathematics, there are again marked differences: students in outlier schools responded correctly to just 17.7% of written items. Missing responses are much higher for written mathematics items (42.4%) than for multiple-choice mathematics items (17.0%) in outlier schools. In science, the percent correct also is much lower, and percent missing much higher, for students in outlier schools, particularly on written response items.

Response patterns on digital reading contrast quite strongly with those for the print assessment. There is only a 13.2% difference in overall percent correct on digital reading (compared with 25.9% on the print reading assessment), and rates of missingness are also lower for students in outlier schools on the digital reading items (13.4%) than on the print reading items (32.5%). Percentage of missing responses is again highest for written response items for students in outlier schools on the digital reading assessment (26.2%), though notably lower than that for written print reading items (42.6%).

Cosgrove and Moran (2011, Tables 15, 16, A6) have shown that the differences in response patterns between outlier and non-outlier schools still hold in the case of print reading, even after student gender, grade level, socioeconomic status, school sector, and school SSP status (whether in the School Support Programme under DEIS) are taken into account. In the case of digital reading, outlier status had a much smaller impact on response patterns, when these student and school characteristics were held constant.

Conclusions Regarding PISA's Implementation

In all cycles of PISA, Ireland met the technical standards required for full inclusion of its results in international reporting.

Changes in the test administration procedures introduced in 2009 do not seem to have affected the results in any quantifiable respect.

Small changes to sampling procedures which were necessary on the basis of Ireland's participation in the International Civic and Citizenship Education Study (ICCS) in 2009, as well as slight improvements to the stratifying (grouping) characteristics used to draw the sample, had no measurable impact on the quality of the sample or the resulting sampling weights.

The participation of eight schools with exceptionally low average achievement in PISA 2009 represents a change from previous cycles. It may be the case that such schools existed in the system in 2000 but were not sampled due to chance. It is also possible that demographic and socioeconomic characteristics and very low engagement of students in these schools on the print assessment contributed to some of the decline in achievement in Ireland in 2009. It is also possible that these factors impacted on all schools, albeit to a lesser degree.

Changes in Demographics and Curriculum

There have been some marked demographic changes in the school-going population in Ireland since 2000. One such change was the increase in both the percentage of students with immigrant status and the percentage who spoke a language other than English or Irish at home (Table 9.2; see also Tables 6.19 and 6.20). Furthermore, the relationship between immigrant status, language spoken at home and achievement changed since 2000. In 2000, immigrant and 'other language' students had higher mean scores than native students, while in 2009, immigrant students and 'other language' students did significantly less well than native students. This is likely to be due to the differing composition of these two groups in 2000 and 2009 (e.g., in 2000 'other language' students had a higher socioeconomic status than the students who spoke English or Irish whereas in 2009 the socioeconomic status of the two groups did not differ) (Cosgrove, et al., 2010).

There was also a decrease in the percentage of students selected to participate in PISA who had already left the education system (from 2.1% to 1.5%). Higher retention of these students could have contributed to some of the decline observed in the achievement scores as historically these students have tended to be lower achievers. Furthermore, greater numbers of children with special educational needs (SEN) have been integrated into mainstream schools since 2000, which may have also impacted on the PISA 2009 results. However, while we know that 3.5% of students who participated in 2009 were classified as having an SEN, corresponding data for 2000 are not available. It is difficult, therefore, to quantify what, if any, effect this may have had on the PISA results.

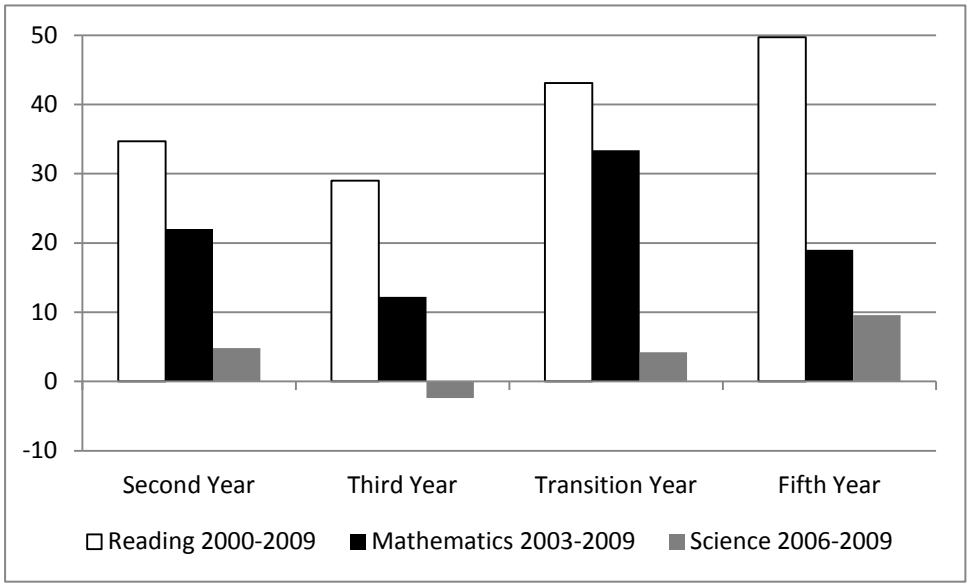
Table 9.2: Percentages and mean scores of students in Ireland by immigrant status and language spoken at home, 2000 and 2009

	PISA 2000		PISA 2009		Difference (2009-2000)
	%	Mean reading score	%	Mean reading score	
Immigrant status					
Native students	97.7	527.5	91.7	501.9	**-25.6**
Immigrant students	2.3	551.8	8.3	473.1	**-78.7**
Difference (native – immigrant)		**-24.3**		**+28.8**	
Language spoken at home					
English/Irish	99.1	**527.4**	96.4	**500.4**	**-27.0**
Other language	0.9	**532.8**	3.6	**443.9**	**-88.9**
Difference (English/Irish – other language)		-5.4		**+56.6**	

Note: significant differences are in bold.

Another difference between the PISA 2000 and 2009 samples is the change in the distribution of students across grade levels. The percentage of students in Transition Year increased (from 16.0% to 24.0%), while there was a decrease from 18.6% to 14.4% in the percentage of students in Fifth Year, reflecting the greater availability of the Transition Year programme in schools. The largest declines in average reading achievement occurred among students in Fifth Year (Figure 9.1; see also Table 6.21). The largest decline in mathematics (between 2003 and 2009) occurred in Transition Year (Cosgrove et al., 2010).

Figure 9.1: Mean achievement differences in print reading (2000-2009), mathematics (2003-2009) and science (2006-2009) in Ireland, by grade/year levels



While it is clear that changes in the demography of the school going population had some impact on the PISA results, it is difficult to quantify it. The appearance of the outlier schools in the sample may or may not be a function of the demographic changes.

If we consider changes in achievement levels with respect to curricular change, it could be argued that recent changes in science at primary and post-primary levels, i.e. the introduction of the revised primary curriculum in 1999 which included social, environmental and scientific education (Government of Ireland, 1999) and changes to the junior cycle science syllabus (Department of Education and Science, 2003), may have offset an otherwise lower performance in this domain in 2009.

There has also been curriculum change at post-primary level in mathematics with the introduction of *Project Maths* into 24 pilot schools[66] in September 2008. However, given that this curriculum had only just been introduced and the very small number of students in PISA 2009 who had exposure to *Project Maths*, it is very unlikely that this would have had a direct impact in mathematics performance in Ireland in 2009.

In contrast to mathematics, the junior cycle English syllabus has not been revised for over two decades (Department of Education, 1989). It is one of the subjects under consideration in the NCCA's current review of the junior cycle, but proposed changes have yet to be implemented (NCCA, 2008; 2011).

Alongside any recent or current curricular changes, it is important to consider the instructional time dedicated to subject areas and whether this has changed over time, as well as whether and how instructional practices have changed. These issues are beyond the scope of the present report.

[66] Originally, there were 24 pilot schools. By 2011-12 this was 23, due to amalgamation.

Conclusions Regarding Demographic and Curriculum Changes

Demographic shifts relating to increases in the percentages of newcomer students, a small reduction in early school leaving, potentially higher levels of inclusion of students with special educational needs, and shifts in the distribution of students across grade levels are likely to explain some of the decline in achievement in Ireland. The appearance of outlier schools is new to PISA 2009 and appears to be somewhat related to the overall demographic shift as well as high levels of disengagement from the PISA tests in these schools. However, it could be the case that very low-performing schools also existed in 2000, but were not sampled due to chance. Quantification of the effects of these changes on the decline in achievement is very difficult given the complexity of and overlap between these factors.

It may be the case that recent changes to science curricula at primary and post-primary levels have offset a decline in science performance which has remained stable, in contrast to reading and mathematics, where current curricula have been in place for many years.

PISA 2009 provides a learning opportunity by highlighting the importance of detecting and monitoring changes in the demographic composition of the PISA population. Identification and examination of schools with very low and high average performance will be important in future cycles of PISA. PISA 2012 will also provide an important opportunity to examine achievement trends in the context of curricular reform in mathematics with the implementation of *Project Maths.*

Aspects of the PISA Test Design Within and Across Cycles

This section considers how item formats and cognitive subscales of the PISA tests varied across cycles. Table 9.3 shows the percentages of items of differing format for all PISA cycles conducted to date. Although the fact that the number of items in a test changes from major to minor domain makes comparisons difficult, two general patterns are evident. First, there is a decrease in the percentage of written response items in all domains (in reading, this is more evident since 2003). This decrease is offset by an increase in the percentages of complex multiple-choice items[67]. Second, changes in the representation of regular multiple-choice items vary from domain to domain: the percentage of such items increased across cycles in mathematics and decreased in science, with reading showing a decrease in 2003 and 2006, and an increase in 2009 (Cartwright, 2011).

The representation of PISA cognitive subscales by domain also varies across assessment cycles (Table 9.4). Since the representation of subscales is not inherently part of the PISA design until a scale is established as a major domain, figures for mathematics prior to 2003 and for science prior to 2006 are not included in the table. In mathematics, changes in the representation of subscales primarily involve an increase in Quantity and decreases in Space and Shape and Uncertainty. In reading, the changes are primarily a decrease in Access and Retrieve items with a corresponding increase in Integrate and Interpret items. No clear pattern is evident in science (Cartwright, 2011).

[67] Complex multiple-choice items require students to pick one response from a small number of 'yes-no' or 'true-false' statements.

Table 9.3: Representation of item response types by PISA domain and cycle

Domain/Response Type	Distribution of items (%)			
	2000	2003	2006	2009
Reading				
Written response	54.6	64.3	64.3	52.9
Complex multiple choice	4.4	3.6	3.6	8.1
Multiple choice	41.0	32.1	32.2	39.0
Mathematics				
Written response	67.3	66.1	56.3	54.0
Complex multiple choice	12.9	13.4	18.7	20.2
Multiple choice	19.9	20.5	24.9	25.8
Science				
Written response	41.6	41.1	35.6	34.1
Complex multiple choice	17.9	20.7	29.7	31.9
Multiple choice	40.5	38.3	34.7	34.0

Source: Cartwright, 2011, Table 4.

Table 9.4: Representation of cognitive subscales by PISA domain and cycle

Domain/Subscale	Distribution of items (%)			
	2000	2003	2006	2009
Reading				
Access and retrieve	27.7	25.0	24.9	22.8
Integrate and interpret	49.3	49.9	50.1	52.1
Reflect and evaluate	23.0	25.1	25.1	25.1
Mathematics				
Change and relationships		24.3	25.1	25.7
Quantity		26.5	26.9	31.5
Space and shape		25.2	24.9	22.8
Uncertainty		24.0	23.0	20.0
Science				
Explaining phenomena scientifically			47.5	41.5
Identifying scientific issues			22.8	24.4
Using scientific evidence			29.7	34.1

Source: Cartwright, 2011, Table 5.

Cartwright (2011) has shown how these aspects of the PISA test design interact with students' response patterns to influence overall performance on PISA with reference to (i) performance by domain and item type across cycles, (ii) performance by subscale across cycles, and (iii) the manner in which variance in achievement was partitioned into student, school, PISA design, and unexplained components.

First, the results in Table 9.5 summarize student performance in Ireland (expressed as percent correct) on each of the item response types for each domain across cycles. On the mathematics assessment, students' performance by item type varies across cycles. Between 2003 and 2009, performance on written response mathematics items declined markedly (from 50% to 38% correct), while performance on both regular and complex multiple-choice items has remained stable. On the reading assessment, between 2000 and 2009, performance on both regular multiple choice and complex

multiple choice items declined substantially (from 72% to 63% correct, for the former, and from 63% to 43% for the latter). There is no clear pattern on the science assessments, but from 2006 to 2009, a small increase in the percentage of correct responses to written response items occurred, and a decline in the percentage of correct responses to complex multiple choice items is also evident.

Table 9.5: Difficulty of item response types for students in Ireland by PISA domain and cycle

Domain/Item Type	Percent Correct			
	2000	2003	2006	2009
Reading				
Written response	61.6	60.8	59.3	60.4
Complex multiple choice	62.7	61.8	57.1	43.2
Multiple choice	72.1	72.2	71.7	63.4
Mathematics				
Written response	43.4	50.0	46.5	37.9
Complex multiple choice	37.9	48.4	43.8	49.8
Multiple choice	64.7	55.6	56.0	57.9
Science				
Written response	46.3	46.9	45.7	48.8
Complex multiple choice	53.4	51.7	60.0	55.2
Multiple choice	56.6	57.3	61.5	59.6

Source: Cartwright, 2011, Table 6.

Second, there are also changes over time in performance on cognitive subscales for all domains (Table 9.6). In mathematics, performance decreased on most subscales, with the largest average decrease in Space and Shape. Uncertainty is the only subscale where performance remained relatively constant. Some of the effects of these different changes over time interact with the balance of content representation. For example, increasing representation of Quantity items moderates the more strongly negative influence of Space and Shape. In reading, there was a noticeable improvement between 2006 and 2009 in performance on Access and Retrieve items. However, the increase was more than offset by the decrease in representation of these items and the more gradual performance decline on Integrate and Interpret items. There are no clear patterns over time in the changes in difficulty for science items by subscale.

Third, Table 9.7 summarizes the results of a decomposition of variance of item responses into components attributable to school, student, item response type, item cognitive subscale, and unexplained or residual variance. School and student variance components appear to vary randomly (which is a pattern that one would expect in an analysis of trends). However, the components attributable to the PISA design vary substantially. In 2009, for example, the percentage of variance in item scores attributable to item response type was more than double the percentage attributable to schools for both mathematics and reading. Essentially, Table 9.7 shows that fluctuations in design elements of PISA (item type and subscale) influence student performance, particularly with respect to item response type for reading and mathematics, though they are not intended to.

Table 9.6: Difficulty of item cognitive subscales for students in Ireland by PISA domain and cycle

Domain/Subscale	Percent Correct			
	2000	2003	2006	2009
Reading				
Access and retrieve	69.0	58.1	54.2	70.4
Integrate and interpret	67.8	69.3	68.4	58.0
Reflect and evaluate	58.2	61.2	61.6	55.5
Mathematics				
Change and relationships		52.3	52.0	45.4
Quantity		58.3	55.6	51.5
Space and shape		43.1	37.9	32.1
Uncertainty		49.7	47.3	51.3
Science				
Explaining phenomena scientifically			56.5	55.0
Identifying scientific issues			57.8	56.0
Using scientific evidence			51.9	52.8

Source: Cartwright, 2011, Table 7.

Table 9.7: Percentages of variance in scored item responses attributable to various components

Domain/Year	Variance accounted (%)				
	School	Student	Response type*	Subscale	Unexplained
Mathematics					
2000					
2003	2.5	11.3	0.7	1.8	83.7
2006	2.5	10.7	2.6	3.1	81.2
2009	2.0	11.6	4.6	2.8	79.0
Reading					
2000	2.8	12.4	1.3	1.0	82.5
2003	3.6	13.4	0.8	0.4	81.8
2006	3.2	15.8	0.9	0.9	79.1
2009	3.3	12.0	6.6	3.2	75.0
Science					
2000					
2003					
2006	2.3	11.9	3.0	0.0	82.8
2009	2.9	11.8	1.2	0.1	84.0

Note: *Written response, complex multiple-choice, regular multiple-choice. Source: Cartwright, 2011, Table 3.

Cartwright (2011) has argued that students in Ireland perform consistently more poorly on items which require a longer time commitment to respond to. For example, reading items which tend to have longer stimuli exhibited the greatest drop in performance. Similarly, multiple choice reading items, which tend to have lengthier options than multiple choice items in mathematics or science, showed a decline, whereas performance on multiple choice items in mathematics and science was stable or improved. In contrast, written response items in mathematics, which typically require two or more cognitive steps, showed a performance decline, while written response

items in reading, which may simply require identification of a single textual element, show stable performance over time. However, a systematic analysis based on a reliable classification system of items in terms of the time and effort required to respond to them would be required to reach definitive conclusions on this issue.

Analyses by Cosgrove and Moran (2011) of the PISA 2009 data indicate that, even within a cycle, student responses vary substantially across domains and item types. Table 9.8 shows the distribution of responses by domain and item type expressed as percentages for students in Ireland. Overall student percent correct is highest for print and digital reading (58.7% and 58.4%, respectively), then science (54.1%), and is lowest for mathematics (43.6%). Students also skipped more of the mathematics items, with an average of 11.8% missing on this domain. Skipped responses are second highest for print reading (8.5%), while the percent missing for science (6.3%) and digital reading (6.5%) are lower.

Table 9.8: Student percent correct and percent missing, overall and by item type, for print reading, mathematics, science, and digital reading, PISA 2009 (Ireland)

Domain	All item types				Written Response				Multiple Choice			
	Correct		Missing		Correct		Missing		Correct		Missing	
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Print Reading	58.7	0.61	8.5	0.48	58.3	0.65	12.6	0.61	58.3	0.61	4.3	0.40
Mathematics	43.6	0.56	11.8	0.45	35.0	0.63	19.4	0.61	54.3	0.60	3.8	0.33
Science	54.1	0.61	6.3	0.47	49.5	0.71	10.6	0.63	57.1	0.61	4.1	0.42
Digital Reading	58.4	0.71	6.5	0.36	43.1	0.83	12.9	0.63	67.7	0.73	4.1	0.31

Note: 'Missing' refers to the percentages of students that did not respond to a question, whether or not that item was followed by a valid response to another item in the booklet they attempted. Source: Cosgrove and Moran, 2011, Table 4.

Percent correct on written responses is also lowest for mathematics (35.0%), and highest for print reading (58.3%), while percent correct for science (49.5%) and digital reading (43.1%) occupy intermediate positions. Percent correct in all three print domains on multiple choice items are similar (54.3% in mathematics, 57.1% in science, and 58.3% in reading), while percent correct of digital reading multiple choice items is higher (67.7%).

In all domains, percent missing is low (about 4%) for multiple-choice items. However, there is greater variability in the percent of skipped written responses across domains, which may reflect a combination of factors, including the content of the domain itself, average item difficulty and task characteristics of written responses in each domain, and the overall proportion of written response items in each domain. In all domains, however, percent of skipped responses is higher on written response items than on multiple-choice ones, ranging from 10.6% for science to 19.4% for mathematics, with print and digital reading occupying intermediate positions.

Cosgrove and Moran (2011) have also demonstrated that percent correct and percent missing not only varied by domain and response type in PISA 2009, but also by population subgroups. They examined response patterns across gender, school type, grade level, socioeconomic status, school SSP status, and school outlier status. They concluded that, because domains varied in terms of the distribution of item types, average percentage of written response and multiple choice items and their relative difficulties, together with the fact that response patterns by item type and domain varied considerably across subgroups, improvements could be made in how PISA balances item type and item difficulty across domains. Cartwright's (2011) analysis has

demonstrated that this is an issue across PISA cycles as well as across domains. He concludes that 'the fact that PISA design has such a large influence on student performance in Ireland, especially relative to the influence of schools, suggests that changes in Irish PISA performance over time may be a function more of unintended interactions with the testing situation than with student proficiency in the domains intended to be measured by PISA' (p. 29).

Conclusions Regarding the Test Design of PISA

In 2009, it was found that response patterns across domains (e.g., percent correct and percent missing) varied considerably. They also varied depending on the item type examined (e.g., written response compared to multiple-choice). Furthermore, the content of the PISA tests has not remained stable in terms of the distribution of items across item formats and cognitive subscales, and student response patterns to these aspects of PISA also varied across cycles. These can be regarded as unintended consequences of changes to aspects of the PISA design.

The analyses of the PISA test design and student response patterns are also consistent with a reduction in the amount of effort invested, an issue which is taken up in the next section.

In summary, 'The sensitivity of students in Ireland to factors related to test design and format suggests that some caution should be employed in attributing changes in performance solely to changes in student proficiency' (Cartwright, 2011, p. 29).

Response Patterns on the PISA Test Across Domains and Cycles

When considering performance on a test, it is assumed that a test score represents an underlying trait (e.g., 'mathematics ability'; 'reading proficiency') which is not directly observed. However, factors other than the trait that a test is intended to measure can affect achievement scores. These include levels of motivation (which can vary on high-stakes and low-stakes tests) or fatigue (which may be related to the test itself, such as its length or difficulty level); and factors outside of the test (including level of familiarity with the concepts and content being assessed, differing propensity to respond to varying text and item formats, and differing levels of anxiety, expectations or motivation).

While these 'nuisance' factors are very common in all testing situations, they become problematic in the estimation of achievement when they become systematic rather than random. Recent research (e.g., Boe, May & Boruch, 2002; Eklöf, 2007) has provided evidence that variations in student engagement and fatigue levels during testing can impact systematically on performance, with the result that they are confounded with estimates of student ability. Thus, it can be argued that a systematic reduction in levels of engagement or effort in a cohort of students over time who have otherwise equivalent levels of achievement would be likely to result in an increase of skipped responses to test questions, resulting in a decline in estimates of performance.

Analyses of the PISA 2003 and 2006 international datasets (Borghans & Schils, 2011) are particularly relevant to the results that are presented in this section. Borghans and Schils (2011) reported that across all countries, although there was a substantial drop in the performance of students as they progressed through the test, the size of this drop varied substantially across countries. They also found that the magnitude of the drop was generally smaller for girls, students with higher test scores, and (in the case of

the Dutch sample), and higher levels of agreeableness and extraversion. Interestingly, the relationship between the size of the performance drop was generally not associated with socioeconomic status in the majority of countries (and only weakly and positively so in the remainder). Furthermore, the drop in performance was correlated across cycles, but only weakly related to achievement scores within cycles. Borghans and Schils argued that the observed performance drop may be taken as a proxy for test motivation, which is related to characteristics other than cognitive ones. The magnitude of the performance drop, which they term the 'motivation effect', explained 34% of the variation in PISA scores between countries. In Ireland, the magnitude of the performance drop in PISA 2006 (when science was a major domain) was small relative to a majority of countries, while the gender difference in the size of the performance drop was the third largest across the 38 countries in their analysis. It should be noted that Borghans and Schils did not examine the 'motivation effect' by domain or different item formats; rather, they pooled performance together.

This section is based on work by Cosgrove (2011), Cosgrove and Moran (2011) and Cartwright (2011) who conducted follow-up analyses of students' responses on the PISA tests following recommendations in initial analyses of changes in achievement documented by Cosgrove et al. (2010) and LaRoche and Cartwright (2010). The focus of the section is on patterns of students' responses to the PISA tests over successive cycles. A key observation that drove these analyses is the substantial increase in the percentages of missing responses displayed by students in Ireland in PISA 2009 relative to previous cycles, and to their peers in other PISA countries.

In considering students' responses to the PISA tests over time, we have structured this section as follows. First, we outline some general guidelines in interpreting the analyses. Second, we examine students' response patterns in reading in 2003, mathematics in 2006, and science in 2009. Third, we draw on international comparative analyses conducted by Cartwright (2011) that show that the response patterns of students in Ireland are quite idiosyncratic.

Interpreting the Analyses

In the comparisons of response patterns in print reading, mathematics and science in 2003, 2006, and 2009, a distinction is made between percent correct, percent missing, and percent of not reached items (Cosgrove, 2011) [68]:

- Percent correct is the number of questions answered correctly out of the total number presented to each student, expressed as a percentage.
- Percent incorrect is the number of questions answered incorrectly out of the total number presented to each student, expressed as a percentage.
- Percent missing is the number of questions that were not answered by a student out of all items presented, but which have one or more valid responses (whether correct or incorrect) subsequent to the missed item, expressed as a percentage.
- Percent not reached is the number of questions that were not answered by a student out of the total number presented, which were not followed by any

[68] In the analyses described earlier (in Cosgrove & Moran, 2011), no distinction was made between missing and not reached response: these were combined into a single 'missing' category, mainly due to the fact that the percentage of not reached items tended to be very small.

subsequent valid responses, whether correct or incorrect. Not reached items are generally found at the end of test booklets.

Table 9.9: PISA 2003 test design

Booklet	P1	P2	P3	P4
1	M1	M2	M4	**R1**
2	M2	M3	M5	**R2**
3	M3	M4	M6	PS1
4	M4	M5	M7	PS2
5	M5	M6	S1	M1
6	M6	M7	S2	M2
7	M7	S1	**R1**	M3
8	S1	S2	**R2**	M4
9	S2	**R1**	PS1	M5
10	**R1**	**R2**	PS2	M6
11	**R2**	PS1	M1	M7
12	PS1	PS2	M2	S1
13	PS2	M1	M3	S2

P1=position 1, P2=position 2, etc. M=mathematics, R=reading, S=science, PS=problem solving. Clusters marked in bold are those selected for analysis.

Table 9.10: PISA 2006 test design

Booklet	P1	P2	P3	P4
1	S1	S2	S4	S7
2	S2	S3	M3	R1
3	S3	S4	M4	**M1**
4	**S4**	M3	S5	M2
5	S5	S6	S7	S3
6	S6	R2	R1	**S4**
7	S7	R1	M2	M4
8	**M1**	M2	S2	S6
9	M2	S1	S3	R2
10	M3	M4	S6	S1
11	M4	S5	R2	S2
12	R1	**M1**	S1	S5
13	R2	S7	**M1**	M3

P1=position 1, P2=position 2, etc. M=mathematics, R=reading, S=science. Clusters marked in bold are those selected for analysis.

Some of the analyses were conducted on the full sample of PISA students in a relevant cycle; in others, a subset of the sample was analysed. This was because it was necessary at times to focus on the response patterns of subsets of items (which were attempted by sub-samples of students). Furthermore, for the analyses involving the full PISA sample, sampling weights were applied and standard errors were corrected to account for sampling error (see OECD, 2009d). For analyses of sub-samples, it was not appropriate to apply sampling weights. It is advisable, overall, to treat these results as descriptive and indicative of general patterns of students' responses.

It was necessary to identify a common set of items across cycles that was administered in a manner (sequence) similar enough to allow comparisons of responses. The PISA test design (see Tables 9.9, 9.10 and 9.11 for the test designs for PISA 2003, 2006, and 2009) is such that each student attempts a booklet consisting of four half-hour blocks, and, since 2003, the test design has been balanced, meaning that each block appears in each of the four positions[69]. This 'rotation' is done to eliminate the confounding effect of test fatigue in the estimation of item difficulties and, subsequently, student achievement scores.

Table 9.11: PISA 2009 test design

Booklet	P1	P2	P3	P4
1	M1	**R1**	R3A	M3
2	**R1**	S1	R4A	R7
3	**S1**	R3A	**M2**	S3
4	R3A	R4A	S2	**R2**
5	R4A	**M2**	R5	M1
6	R5	R6	R7	R3A
7	R6	M3	S3	R4A
8	**R2**	M1	S1	R6
9	**M2**	S2	R6	**R1**
10	S2	R5	M3	**S1**
11	M3	R7	**R2**	**M2**
12	R7	S3	M1	S2
13	S3	**R2**	**R1**	R5

P1=position 1, P2=position 2, etc. M=mathematics, R=reading, S=science. Clusters marked in bold are those selected for analysis.

In PISA 2000, the test design was not balanced: not all blocks appeared in all positions. This makes comparisons of booklet position effects between 2000 and all other cycles inherently problematic. Hence, comparisons for reading are confined to data from 2003 and 2009. For mathematics, it was necessary to make comparisons between 2006 and 2009, since no intact mathematics blocks from 2003 were administered in 2006 or 2009. In the case of science, since intact blocks were not selected from 2006 to form the blocks used in 2009, the analysis is more limited in that it involves comparing the same block *within* a cycle in positions 1 and 4 without being able to compare responses to the same block *across* cycles. The particular blocks of items that were selected for analysis by Cosgrove (2011) are marked in bold in Tables 9.9, 9.10, and 9.11.

Some caveats should be borne in mind when interpreting the results. First, and perhaps most importantly, it is difficult to disentangle the influences of proficiency (ability) and of effort or engagement in any analysis of student responses to a test. Second, analyses are based on whether or not students responded to questions on PISA: we do not have a direct measure of the levels of effort invested during the test, nor any systematic observational data (such as those gathered by MacRuairc, 2011). Having said this, the PISA test and its timing are explicitly designed to allow sufficient time for students to respond to all (or most) questions presented to them (Cartwright, 2011; OECD, 2011b). Hence, it is unlikely that students would have skipped items due to lack of time. In our analyses, we take the position that an indirect indication of engagement is

[69] For example, in Table 9.9, it can be seen that reading block 1 (R1) is in the first position of booklet 10, the second position of booklet 9, the third position of booklet 7, and the fourth position of booklet 1.

the extent to which students skip questions rather than attempt them (whether the attempt is correct or not). In doing so, we exploit the PISA test design, as described below.

The analyses examine two (possibly overlapping) potential explanations: (i) the decline in PISA reading is due to a decrease in engagement (ii) the decline in PISA reading is due to a decrease in proficiency.

One would expect that, because of test fatigue, percent correct would generally be lower and the percent missing and not reached higher in position 4 relative to position 1, regardless of PISA cycle. One would also expect the response patterns across cycles for items in position 1 to be stable, all other things being equal. However, if the hypothesis about a decline in proficiency is to be supported, one would expect to see a decline in percent correct and a corresponding increase in percent missing and not reached in *both* positions. If the disengagement hypothesis is to be supported, one would expect stable percent correct and missing/not reached in position 1, but a decrease in percent correct (and an increase in missing responses) in position 4. The response patterns associated with these possibilities are illustrated in Table 9.12 (see also Borghans & Schils, 2011).

Table 9.12: Hypothesised response patterns associated with stable proficiency, a decline in engagement, a decline in proficiency, and test fatigue (example for reading, 2003 and 2009)

Stable achievement	P1 2009-P1 2003	P4 2009-P4 2003
Percent correct	No change	No change
Percent missing	No change	No change
Decline in engagement	**P1 2009-P1 2003**	**P4 2009-P4 2003**
Percent correct	No change	Decrease
Percent missing	No change	Increase
Decline in proficiency	**P1 2009-P1 2003**	**P4 2009-P4 2003**
Percent correct	Decrease	Decrease
Percent missing	Increase	Increase
Test Fatigue	**P1 2003-P4 2003**	**P1 2009-P4 2009**
Percent correct	Decrease	Decrease
Percent missing	Increase	Increase

P1=position 1; P4=position 4.

To examine the extent to which response patterns in Ireland may be considered idiosyncratic, data for Ireland were compared with the OECD averages, as well as a small set of comparison countries whose scores have remained stable over time. It was reasoned that if response patterns in Ireland differ from those in other countries, this would provide support for an idiosyncrasy in Ireland that may or may not be related to proficiency. Comparisons between Ireland and the OECD averages only are presented here; comparisons with specific countries are shown in Cosgrove (2011).

Response Patterns on Reading

Table 9.13 shows percent correct, incorrect, missing and not reached for block R2 in positions 1 and 4 in 2003 and 2009 for Ireland and the OECD. Block R2 is one of the two reading blocks (along with R1) that has been used to estimate trends in PISA since 2003.

Responses to block R1 (which are similar to block R2) are not described here (but are described in Cosgrove, 2011).

As would be expected due to test fatigue, the percent of correct responses is lower in position 4 than in position 1 in both cycles and in both Ireland and across the OECD on average. The percentage of correct responses remained stable in position 1 both in Ireland and on average across the OECD. However, there is a marked decline in the percentage of correct responses for Ireland in position 4 in 2003 and 2009 (from about 60% to 46.5%), while the average percentages of correct responses across the OECD have remained relatively stable in position 4. It is noteworthy that the decrease in the percentage of correct responses in position 4 for Ireland is not accompanied by an increase in incorrect responses. Rather, there has been an increase in both missing responses (from about 6% to 10%) and not reached responses (from about 2% to 9%) in this position. In contrast, percent incorrect, missing, and not reached responses remained stable in 2003 and 2009 in position 4 across the OECD on average.

Table 9.13: Average percent correct, incorrect, missing and not reached for block R2 (reading), positions 1 and 4, 2003 and 2009 – Ireland and OECD averages

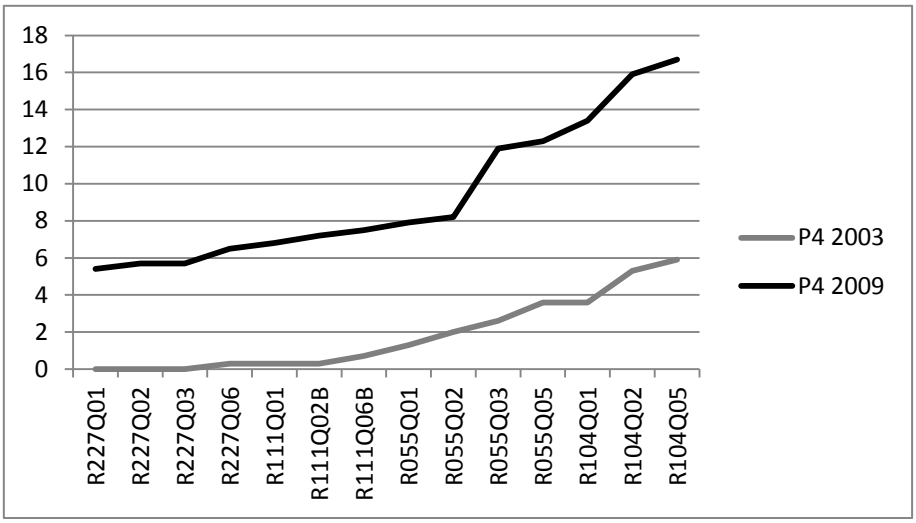
% Correct	P1 2003	P1 2009	P4 2003	P4 2009
Ireland	65.1	64.4	59.9	46.5
OECD	65.6	65.9	54.4	52.4
% Incorrect				
Ireland	31.4	30.7	32.1	33.9
OECD	28.2	28.3	28.2	29.2
% Missing				
Ireland	3.5	4.9	6.1	10.2
OECD	6.2	5.8	10.4	10.8
% Not Reached				
Ireland	0.0	0.0	1.9	9.4
OECD	0.0	0.0	7.0	7.6
% Missing + Not Reached				
Ireland	3.5	4.9	7.9	19.6
OECD	6.3	5.8	17.5	18.4

Source: Cosgrove, 2011, Table 12.

Cosgrove (2011) also examined response patterns by item format (multiple-choice, short response, and open response) to determine if changes in response patterns were more strongly associated with particular item types. She found that the decrease in percent correct in position 4 in Ireland was more marked in the case of longer written response and multiple-choice items than for short written response items. Furthermore, the decrease in percent correct in the case of multiple-choice items was accompanied by an increase in the percentage of incorrect responses, while in the case of written response items, percent incorrect remained stable. In other words, fewer written response items were answered correctly in 2009 due to students skipping them, whereas fewer multiple-choice items were answered correctly in 2009 due to students responding to them incorrectly. This suggests that students were guessing the answers to multiple-choice items to a greater degree in 2009 than in 2000.

Figure 9.2 shows the percentage of not reached items in Ireland in both cycles for block R2, position 4 only. The data indicate a steady increase in not reached items in 2009 as students progressed through the block; for example, from about 8% halfway through the block to almost 17% at the end of the block in 2009. Close to 6% of students did not reach or attempt any items in this block in 2009. In contrast, in 2003 the rate of not reached items was much lower than in 2009: about 6% of items at the end of the block were not reached in 2003, which is much lower than the equivalent figure for 2009 (about 17%).

Figure 9.2: Percent not reached by item, block R2 (reading), Ireland, 2003 and 2009, position 4



Note: Items are shown in the order they appear in the booklet Source: Cosgrove, 2011, Figure 9.

Cosgrove (2011) has presented analyses that indicate that the positioning effects for reading items in Ireland in 2009 relative to 2003 in position 4 may be stronger for link items than for items that were introduced for the first time in PISA 2009, but was hesitant to draw firm conclusions, since not all new reading items were included in her analysis. Cosgrove has also found that changes in the percent correct, incorrect, missing, and not reached responses for reading according to position varied with ESCS and gender of respondents. An increase in the strength of positioning effects appeared to be more strongly associated with low-ESCS students and boys than with girls and medium- and high-ESCS students.

Key Findings Regarding Response Patterns on Reading

Across the OECD on average, percent correct and missing responses in both positions 1 and 4 remained stable in 2003 and 2009. In contrast, the percent correct for responses in Ireland dropped sharply in position 4 in 2009. This drop in percent correct was not accompanied by an increase in the percent of incorrect responses, but rather, an increase in the percent of missing responses. Overall, the response patterns in Ireland for reading across positions and cycles are strongly suggestive of a decline in engagement among students in 2009 as they progress through the test booklets.

The percentage of students in Ireland who did not attempt any questions in position 4 of the test booklet in 2009 was close to 6%, while it was 0% in 2003. Also in 2009, 17% of students in Ireland did not complete their test booklets, while in 2003, just 6% did not complete their booklets. This pattern is also consistent with a decline in engagement with the PISA test in 2009 relative to 2003.

Response Patterns on Mathematics

Table 9.14 shows percentages correct, incorrect, missing and not reached for the same mathematics block (of two blocks in total) administered in 2006 and 2009 for Ireland and on average across the OECD. Again, consistent with test fatigue, percent correct is lower, and percent missing higher, in position 4 relative to position 1 both in Ireland and across the OECD on average. However, in contrast to reading, there is a decline in percent correct in Ireland between 2003 and 2009 in both position 1 (from 52.7% to 49.5%) *and* position 4 (from 49.2% to 44.5%). In contrast, percent correct across the OECD on average is stable within position across 2006 and 2009. The percentages of missing and not reached responses increased in position 4 in Ireland in 2009 relative to 2006 while the OECD averages remained stable. There is also a small increase in the percentage of missing items in Ireland in position 1. The percentage of incorrect responses remained stable in both positions across cycles, both in Ireland and across the OECD on average. In fact, there was a small drop in the percentage of incorrect items in Ireland and on average across OECD countries between 2006 and 2009.

Table 9.14: Average percent correct, incorrect, missing and not reached for block M1 (mathematics), positions 1 and 4, 2006 and 2009 – Ireland and OECD averages

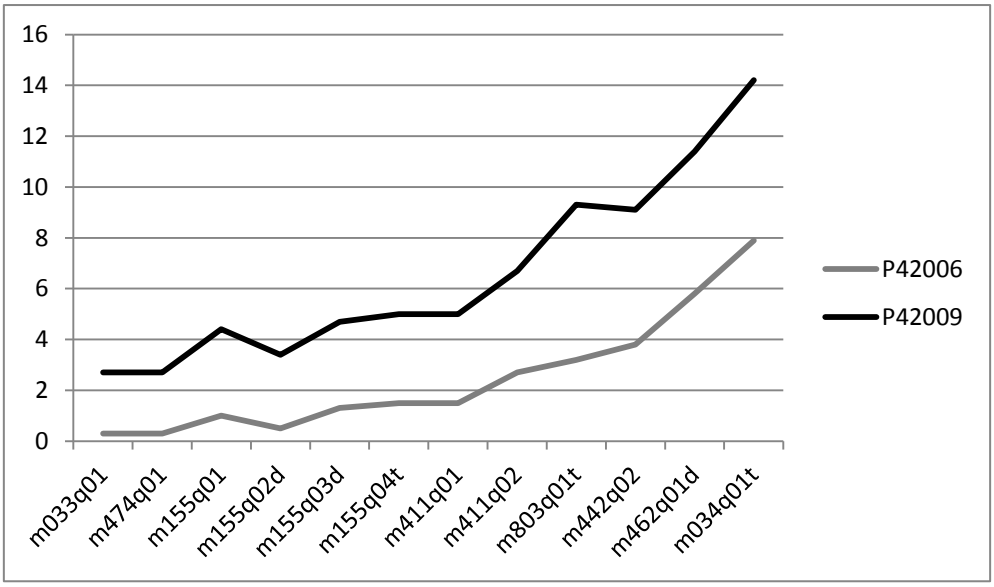
% Correct	P1 2006	P1 2009	P4 2006	P4 2009
Ireland	52.7	49.5	49.2	44.5
OECD	51.1	51.5	45.7	46.1
% Incorrect				
Ireland	40.4	41.5	39.4	36.9
OECD	38.8	38.9	37.9	37.4
% Missing				
Ireland	6.9	8.7	8.9	12.0
OECD	10.1	9.6	12.2	12.2
% Not Reached				
Ireland	0.0	0.3	2.5	6.6
OECD	0.0	0.0	4.2	4.3
% Missing + Not Reached				
Ireland	6.9	8.9	11.4	18.6
OECD	10.1	9.6	16.4	16.5

Source: Cosgrove, 2011, Table 23.

Cosgrove (2011) examined response patterns by item type for mathematics in the same manner as for reading. In position 1, the largest decrease in percent correct was associated with short written response items (down by 6.3%), then multiple-choice items (down by 2.1%), while there was no change in the percent correct in position 1 for longer written response items. In position 4, the change in percent correct by item type followed a slightly different pattern. Percent correct on all item types in this position decreased from 2006, but was greatest for multiple-choice items (-7.5%), then short written response items (-4.7%), followed by longer written response items (-2.7%). The percentage of missing and not reached responses for all item types in position 4 increased in Ireland. In 2009, it ranged from 9.2% for multiple-choice items, to 16.3% for short written response items, and 28.4% for longer written response items.

Figure 9.3 shows data on the percentage of each not reached in Ireland in both cycles for the mathematics block selected for analysis, for position 4 only. The data reveal a steady increase since 2006 in not reached items as students progressed through the block, but the differences between cycles are not as marked for mathematics as for reading (cf. Figure 9.2).

Figure 9.3: Percent not reached by item, block M1 (mathematics), Ireland, 2006 and 2009, position 4



Note: Items are shown in the order they appear in the booklet Source: Cosgrove, 2011, Figure 27.

Key Findings Regarding Response Patterns on Mathematics

Across the OECD on average, percent correct and missing responses in both positions 1 and 4 remained stable in 2006 and 2009. However, the percent correct in Ireland dropped in both positions 1 (by three percentage points) and 4 (by 5 percentage points). In position 1, the drop is reflected in small increases in both the percentages of missing and incorrect responses, while in position 4, it is attributable to an increase in missing and not reached responses.

The percentage of not-reached responses in position 4 in Ireland rose from 11% to 19%, which is substantial, though not as marked as for reading.

Taken together, changes in students' response patterns in mathematics in comparisons of 2006 and 2009 suggest declines in both proficiency and in engagement.

Response Patterns on Science

Table 9.15 shows the percent of correct, missing, and not reached responses for science blocks S1 (2009) and S4 (2006). It should be recalled that, unlike the previous analyses of mathematics and science, it was not possible to compare the same block across cycles; hence, comparisons are limited to block position *within* a cycle.

In 2006, there was a 6.5% decline in percent correct across positions 1 and 4 in Ireland. In 2009, this decline was 8%. Across the OECD on average, the decline in percent correct in 2006 across positions 1 and 4 was 10%, and it was 11% in 2009. Thus, Ireland is not unusual in its decline in percent correct across positions; in fact, the decreases are somewhat less in Ireland relative to the OECD. Similarly, the changes in

the percentages of incorrect and missing responses across positions 1 and 4 in Ireland are comparable to the OECD averages in both years.

Perhaps most revealing is the finding that the percentage of not reached items in position 4 in Ireland in both 2006 and 2009 remained low, at about 2% in both cycles. This pattern contrasts with the percentages of not reached items in position 4 in reading (Table 9.13) and mathematics (Table 9.14). The results suggest that students in Ireland remained more engaged in the science part of the assessment when science items appeared at the end of the test booklet, compared to reading and mathematics.

Table 9.15: Average percent correct, missing and not reached for block S1/S4 (science), positions 1 and 4, 2006 and 2009 – Ireland and OECD averages

% Correct	P1 2006	P4 2006	P1 2009	P4 2009
Ireland	63.8	57.3	62.0	54.0
OECD	59.8	50.9	64.3	53.1
% Incorrect				
Ireland	34.6	38.1	35.3	39.0
OECD	37.0	41.5	31.7	39.3
% Missing				
Ireland	1.6	4.6	2.7	7.0
OECD	3.2	7.6	4.0	7.6
% Not Reached				
Ireland	0.0	2.2	0.0	2.1
OECD	0.0	5.2	0.1	5.7
% Missing + Not Reached				
Ireland	1.6	6.8	2.7	9.1
OECD	3.2	12.8	4.1	13.3

Source: Cosgrove, 2011, Table 26.

It is important to note that the manner in which information is presented to students in the science assessment differs to that of the reading assessment. In science, students are usually presented with a short text, followed by one or two questions in such a way that the text is shorter and there are fewer items per piece of text. In contrast, in reading, students are frequently presented with a longer stimulus, and all questions in that unit refer to that stimulus. This implies that the science assessment in PISA requires a lesser degree of searching through text for the answers to questions, and that less memory load is required for the science tasks, relative to the reading tasks.[70] It could also be argued that some of the science questions are relatively independent of the text; that is, they can be answered on the basis of general science knowledge rather than information presented in the stimulus text.

[70] See Appendix B: it is instructive, for example, to compare the content and questions of print reading passage 3 ('The Play's the Thing') and science passage 2 ('Grand Canyon').

Key Findings Regarding Response Patterns on Science

Analyses of science are limited in that comparisons of responses on the same set (block) of items across cycles are not possible. However, it appears that relative to the respective OECD averages, the response patterns on science questions for students in Ireland have remained relatively stable in both positions 1 and 4 in PISA 2006 and PISA 2009. In particular, engagement of students, as indicated by the percentages of not reached items in the latter parts of the test booklets, has remained effectively unchanged across cycles.

The way in which information is presented to students in the science assessment implies lower cognitive processing demands in the form of searching through text and remembering information in the text. Some of the questions in the science assessment are, arguably, less dependent on its content, as they could be answered on the basis of general science knowledge.

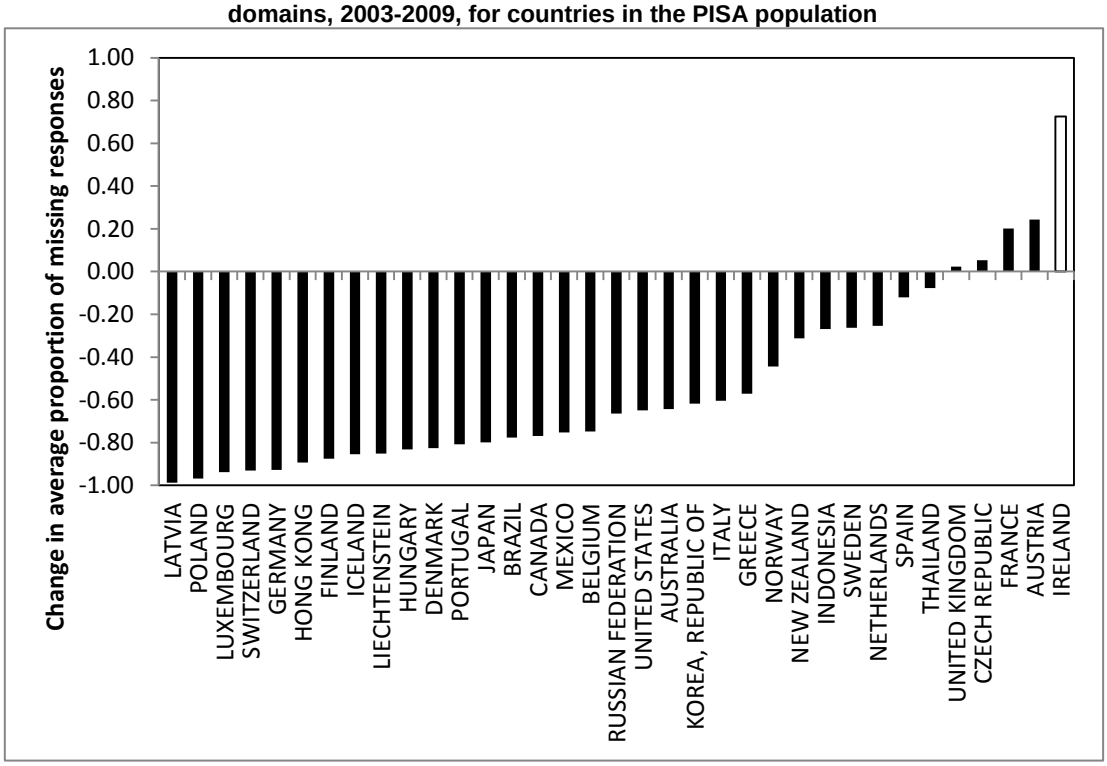
Are Irish Students' Response Patterns Different from Other Countries?

Cartwright (2011) conducted an analysis of relationships between achievement and response patterns across countries and PISA cycles. Several of his findings are of note, and are consistent with Borghans and Schils (2011). First, he has found that (i) country-level correlations between missing (as opposed to not reached) responses are stronger for adjacent years and decrease with time, and (ii) correlations between the percentages of missing and not-reached responses at the country level are stronger between adjacent PISA cycles than they are with achievement within the same year. He comments: 'not only are non-response and test incompletion in PISA distinct from proficiency, they are also nationally distinctive characteristics that change over time' (p. 33). He argues that this strongly implies that test-taking behaviour in PISA is affected by country-specific features of the way in which PISA is contextualised and implemented, which in turn is related to the amount of effort elicited from students. Second, on the basis of changes in the percentages of not reached items and percent correct scores at the country level across cycles, he concludes that 'changes in student effort have a large influence on changes in student performance' (p. 33).

These two findings, based an analysis of response patterns internationally, are relevant to Ireland since changes in the average percentages of not reached items and missing responses are highly idiosyncratic. Cartwright (2011) has shown that while other countries, on average, have tended to show decreases in the percentages of missing and not-reached items in successive PISA cycles, percentages in Ireland have either remained stable or increased.

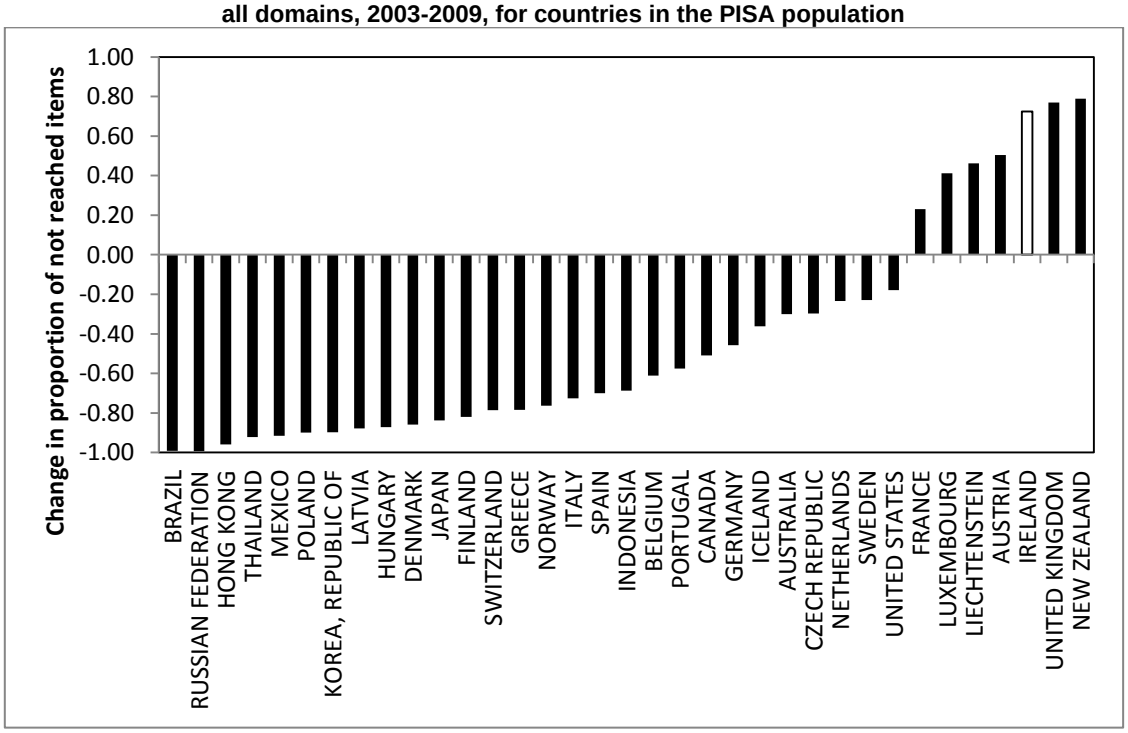
Figures 9.4 and 9.5 illustrate the extent to which Ireland may be considered idiosyncratic in this respect by displaying the results of time-series correlations that represent changes in average proportions of missing and not reached items, respectively. Ireland may be considered unique among the countries examined in the consistency in the increase in missing responses over time, and is one of a small number of countries (along with France, Luxembourg, Liechtenstein, Austria, the United Kingdom, and New Zealand) that show consistent increases in not reached responses. These findings are of key importance since they show that Ireland's response patterns are not only relatively unique among PISA countries, they are also related to changes in achievement over time.

Figure 9.4: Time series correlations for the change in average proportion of missing responses from all domains, 2003-2009, for countries in the PISA population



Source: Cartwright, 2011, Figure 19.

Figure 9.5: Time series correlations for the change in average proportion of not reached responses from all domains, 2003-2009, for countries in the PISA population



Source: Cartwright, 2011, Figure 18.

Conclusions Regarding Students' Response Patterns on the PISA Tests

In Ireland, positioning effects for blocks of test items in 2009 were stronger than in previous cycles. This is evidenced in a substantial decline in the percent of correct responses in position 4 relative to position 1 of the test booklets examined, along with an increase in missing responses. This pattern was found in both reading and mathematics, but was particularly marked in reading. In science, no change in positioning effects was detected across cycles, though comparisons were more limited due to features of the PISA test design.

Broadly speaking, changes in students' response patterns by item type are consistent with a hypothesis that student effort in Ireland on PISA has declined. For example, there are more marked increases in missing responses on written items, and more noticeable increases in percent of incorrect responses on multiple choice items. However, in the absence of a direct and reliable measure of effort, no firm conclusions may be drawn.

Results for mathematics suggest declines in both proficiency and effort or engagement that are reflected in the PISA scores reported by the OECD, while those for reading suggest that changes in engagement play a more central role in the observed declines. Response patterns on the science assessment do not show a clear pattern since analyses were more limited. However, the stimulus texts in the science assessment are generally shorter with fewer items per text, which contrast with the reading assessment, and some questions on the science assessment could be answered on the basis of general science knowledge rather than on the content of the stimulus texts.

Ireland's consistently increasing rates of missing responses on the PISA tests over successive PISA cycles marks it out as an outlier in this respect among participating countries. There is evidence to suggest that national factors related to the implementation of PISA influenced students' test-taking behaviour in terms of whether or not items were attempted. Thus, 'Even if there are true changes in student proficiency in Ireland, the role of student effort on changes in student performance is likely greater than that in other countries' (Cartwright, 2011, p. 35).

In conclusion: 'Given the evidence suggesting that student effort does play a strong role in the PISA results for Ireland, particularly compared to other participating countries, any statements that interpret the PISA results beyond the context of the PISA test itself should be regarded with appropriate scientific scepticism' (Cartwright, 2011, p. 40).

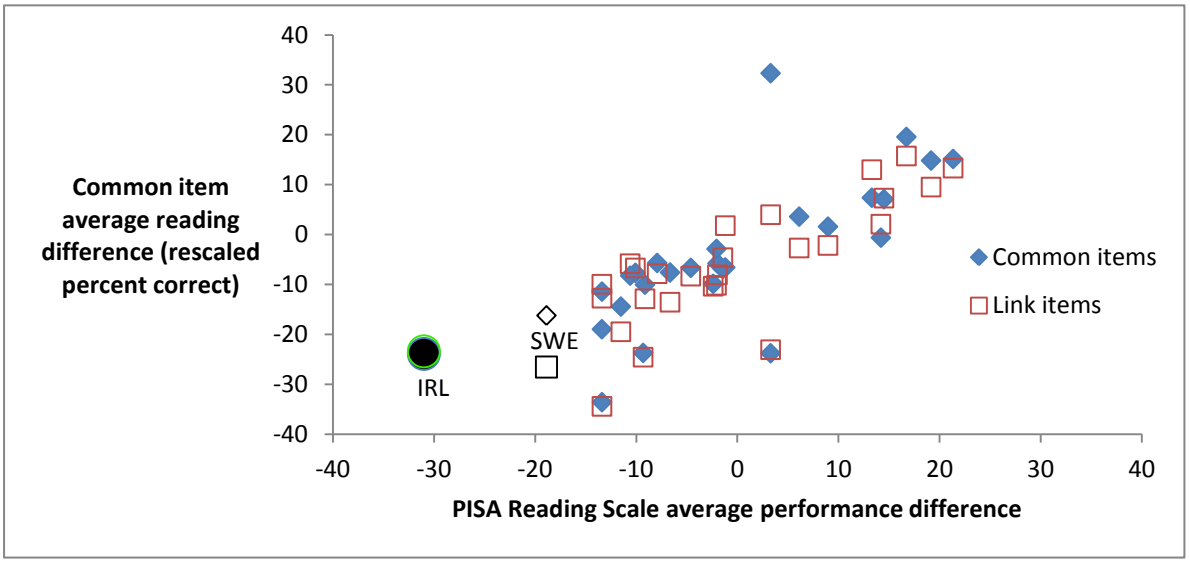
PISA's Approach to Estimating Changes in Achievement

Following the overall theme of this chapter, this section considers aspects of the scaling and linking methods used in PISA to produce information on changes in achievement.[71] As a starting point, it is useful to illustrate the correspondence between changes in percent correct scores on reading link items and changes in the PISA reading scaled scores between 2000 and 2009 as reported by the OECD (2010e). If the scaling and linking methods are unbiased, one would expect a close correspondence between these

[71] For more general overviews and critiques, readers are referred to LaRoche and Cartwright (2010) and Cartwright (2011). For the methods used to scale and link PISA achievement data, see Chapter 1 of this report and Chapter 14 of OECD (2011b).

two estimates. Figure 9.6 plots the changes in percent correct and PISA achievement scores for reading between PISA 2000 and PISA 2009. In producing this figure, Cartwright (2011) estimated changes in percent correct both for link items (used in 2000, 2003, 2006, and 2009) and for common items (used in 2000 and 2009 only). Across countries, there is a fairly close correspondence between the two estimates, with some exceptions, between the two estimates of change. The figure indicates that there has been a decline in the percentage of correct responses in the case of Ireland, but that the decline is not as large as PISA scores would indicate (see the black dot in the figure, which represents Ireland). For example, Sweden (marked in white) has the same change in the percent correct on link items as Ireland, yet its PISA reading score decline is only 19 points (as compared to 31 points in the case of Ireland) (Cartwright, 2011, Data Annex).

Figure 9.6: Comparison of differences in average item performance in reading to reported differences in PISA reading proficiency for countries in the PISA population between 2000 and 2009



Source: Cartwright, 2011, Figure 4.
Ireland is represented by the black dot, which is the location of both common and link items. Sweden is represented by the white markers.

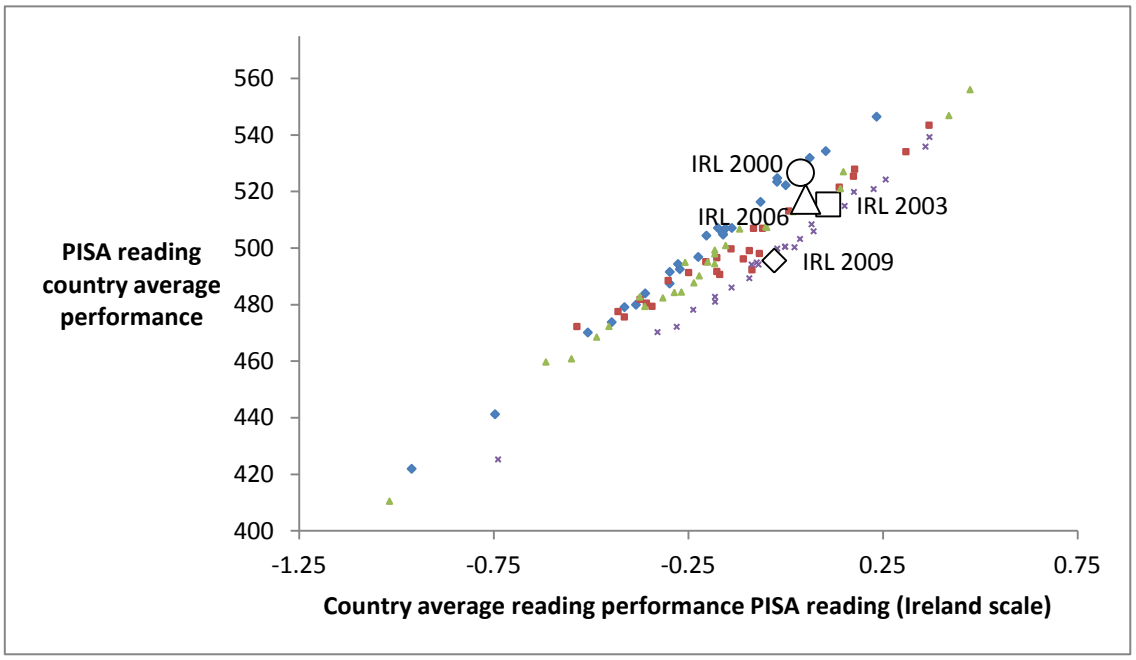
Two practical issues concerning the particular Item Response Theory (IRT) statistical model (the Rasch model) that is used to produce PISA achievement scores have been identified by Cartwright (2011) as potentially problematic in the estimation of change. First, item discrimination is fixed, i.e. items are constrained to be equivalent in terms of the strength of their relationship with proficiency. Second, the items are assigned parameters that are calculated based on an artificial population (the PISA calibration sample, which consists of a random sub-sample of the same number of students from each participating OECD country). These two issues become problematic if the Rasch model represents a systematic misfit to a specific country (rather than misfitting in a non-systematic or random way).

With respect to the first issue, Cartwright (2011) has demonstrated that the constraint on item parameters imposed by the Rasch model is inappropriate for both the OECD on average and Ireland, and that proper modelling of the PISA items would require an item response model that can allow item discrimination to vary (see also

Mazzeo & von Davier, 2008). Thus, the first issue may be considered a general one, not confined to Ireland.

Cartwright (2011) has also conducted a re-calibration of achievement for Ireland and internationally in reading, mathematics, and science on the basis of national item difficulties computed using Irish data rather than international item difficulties, and with a model that accounts for differences in item discrimination. Results indicate that PISA reading data are more sensitive to model specification and item calibration than mathematics or science (see also Monseur, 2009). In particular, international and Irish performance on PISA reading would have been higher, on average, had Irish item parameters been used to estimate achievement. Nonetheless, a decline in performance on PISA reading in Ireland is evident, particularly in 2009, even on the basis of national item calibration. The sensitivity of the PISA reading assessment to model specification may be due to a number of factors: the smaller number of link items used to estimate change, the fact that responses to individual items are more dependent on the passage on which they are based than in science or mathematics, or some other aspect of the PISA design (see Figure 9.7; Ireland is marked in white).

Figure 9.7: PISA country average reading performance versus Ireland-parameter derived average reading performance, 2000-2009



Source: Cartwright, 2011, Figure 6. Blue markers refer to PISA 2000, red markers to PISA 2003, green markers to PISA 2006 and purple markers to 2009. The data points for Ireland are shown in white.

LaRoche and Cartwright (2010) have also provided evidence to suggest that there is likely to be a systematic model misfit in the case of Ireland for reading, resulting in the reported PISA reading score for students in 2009 being an underestimate of achievement. This appears to be due to the non-equivalence of new and link reading items administered in PISA 2009, while the assumption of the scaling model is that they are equivalent in terms of difficulty, discrimination, etc. It is not possible to quantify the extent to which the misfit has contributed to the reported decline of 31 points. Furthermore, since the analyses were limited to Ireland, it is not possible, either, to comment on the extent to which model misfit may have affected estimates of change for other countries.

A further problem that arises when PISA scaling methods are used for trends is the manner in which the link error is computed (LaRoche & Cartwright, 2010; see also Gebhardt & Adams, 2007). The method used for PISA 2000 to PISA 2003 underestimated the link error (Monseur & Berezner, 2007) and was subsequently revised (OECD, 2005). However, details on the precise derivation of the link errors are lacking. LaRoche and Cartwright (2010), having explored alternative methods to compute linking error, concluded that the OECD (2010e, 2011b) underestimated it. If the OECD has estimated changes in achievement using standard errors that were larger, fewer significant differences would have been found. This, together with the chain linking method (2009-2006-2003-2000) used to estimate changes in achievement, is why Cartwright (2011) is critical of the manner in which the OECD has represented changes in achievement. Figure 3.1 in Chapter 3 (based on Figure V.2.1 in OECD, 2010e) shows a simple score difference between two end-points. This representation does not take into account the issues relating to the estimation of the link error, nor the complexities underlying the trend estimates.

Conclusions Regarding PISA's Approach to Estimating Changes in Achievement

The evidence suggests that Ireland is not particularly unique in terms of how it is affected by the scaling and linking of achievement data used to produce trend estimates in PISA. There is some evidence, however, for a model misfit in the case of reading, resulting in the underestimation of the achievement in Irish students in 2009 (the extent of it is not possible to quantify). The model misfit does not mean, however, that Irish student achievement did not actually decline in 2009. It will be possible to revisit this issue in 2012, when, instead of using items administered first in 2000, the link for reading between 2009 and 2012 will be established using items that were new to PISA 2009, though it remains to be seen how the link from 2012 back to cycles previous to 2009 will be established.

Two other key conclusions may be summarised as follows:

'Having examined the statistical models used to create the PISA results, there are two major findings. Firstly, there is unequivocally a consistent decline in PISA performance in Ireland in both reading and mathematics. … Secondly, the magnitude of this decline is smaller than that suggested by [the] presentation of PISA results in Figure 1 *[Figure V.2.1. in OECD, 2010e]*. The difference in magnitude appears to be the result of both statistical methodology and poor choice of data visualization.'(Cartwright, 2011, p. 20)

'While it appears that PISA can be used to identify trends over time, it does not appear that the quantification of these trends can be reported with much accuracy. …ambiguity about the stability of the PISA international trend estimates [raises] questions [about] the straightforward interpretations of arithmetic differences in performance over time. … Additional research is required to identify the reasonable limits of interpretation for PISA trends.' (LaRoche and Cartwright, 2010, p. 34)

Chapter Summary and Conclusions

This chapter considered possible reasons for the reported declines in reading since PISA 2000 and mathematics since PISA 2003, with references to science where relevant. Five somewhat inter-related themes were considered: implementation of PISA, demographic and curricular changes, changes in the content of the PISA tests, students' response patterns on PISA, and issues concerning the estimation of PISA achievement scores within and across cycles.

In PISA 2009, we identified eight schools with unexpectedly low average achievement on all PISA print assessment domains. Students in these schools were more likely to be boys, have a first language other than English or Irish, to be more disadvantaged, and to be in vocational schools. Other aspects of implementation (e.g., sampling, participation rates, test administration procedures) were examined in detail and all failed to explain the declines in achievement. It is not possible to say whether the outlier schools represent chance fluctuations in sampling, or are reflective of wider demographic changes and lowered levels of students' engagement with assessments such as PISA. What we can say is that students in these schools were much more engaged in the digital reading assessment than in the print assessment.

An independent review of the PISA 2009 results for Ireland, as well as analyses conducted by the ERC, concluded that changes in the procedures for administering PISA in Ireland did not affect the results in 2009. However, several demographic changes were identified as potentially contributing to at least some of the decline in achievement: an increase in the number of immigrant students (coupled with changes in the socioeconomic composition of this group), slightly lower rates of early school leaving, and possible increases in the number of SEN students who have been integrated into mainstream education.

There were large fluctuations in aspects of the PISA test design across cycles which are likely to have unintended consequences for the estimation of trends. Students in Ireland seem particularly sensitive to changes in the distributions of item formats. Their response patterns also indicate a general decline in engagement in the test in 2009, particularly reading, and this was most evident in items that required more effort, such as written response items. Results suggested that the drop in achievement scores in mathematics may have arisen from declines in both proficiency and engagement. Response patterns on digital reading are indicative of higher levels of engagement particularly among disadvantaged students. Information was more limited with respect to response patterns on science, although it was noted that the manner in which the stimulus texts are presented to students in science differs to that for reading. It may also be the case that some of the science questions can be answered correctly using general science knowledge rather than information drawn from the stimulus texts. These results, together with existing research (e.g. Borghans & Schils, 2011), indicate a need to better understand the role that non-cognitive factors play in test-taking behaviour and the resultant PISA scores. Data from PISA 2012 should allow a deeper exploration of variation in levels of engagement by assessment mode (print versus digital).

Another way in which the PISA test design could have impacted on performance is through context effects, which arise due to PISA's mixed-domain design. Mazzeo and von Davier (2008) comment: 'We believe the most serious challenge mixed designs are facing from a trend perspective is the potential impact of context effects on assessment

results, both within an assessment cycle and across time. Context effects… occur when the psychometric functioning of items or clusters of items differs depending on factors such as the item position within a cluster… or the other material that an item or cluster is paired with. In our experience, context effects or their absence can only rarely be predicted' (p. 2).

While the performance of Irish students does not seem to have been differentially affected by the scaling and linking methodology used to produce trend estimates in PISA, there is some evidence of a problem relating to model data fit for reading. It appears that the model may have underestimated the performance of Irish students in reading in 2009. Model data fit for other countries remains as yet unexplored. Furthermore, the use of the Rasch model, the PISA mixed-booklet design, and the manner in which link error was computed have been identified as problematic not just for Ireland, but for estimating trends internationally.

The task of disentangling methodological issues from ones which indicate substantive changes in achievement is complex and, in a sense, the circumstances in which the Irish results for PISA 2009 have emerged represent the 'perfect storm'. It should also be borne in mind that the benchmark against which achievement in 2009 was compared is not itself unproblematic in that the booklet design for PISA 2000 was not balanced. Furthermore, the monitoring of demographic characteristics and their association with achievement emerge as being of key importance, as well as continued analyses of school average performance and achievement differences between schools. While student engagement appears to be a major factor in understanding changes in achievement, knowledge of how it operates or how to promote engagement and effort is not forthcoming from the analyses presented in this chapter. While it is too early to suggest that curriculum reform in mathematics in Ireland may be evident in students' achievements, future cycles of PISA will provide opportunities to monitor achievement in the context of such reform.

Regardless of the precise reasons for the declines in achievement, there is cause for concern about reading and mathematics standards in Ireland that need to be considered in the wider context of teaching, learning and assessment. For example, 23.2% of boys in Ireland compared to just 11.3% of girls achieved below the baseline proficiency Level 2 on reading in 2009. Also, over one in five students (22.0%) performed below Level 2 on mathematics in Ireland in 2009. Chapter 10 places the PISA 2009 results in a broader context, and considers recommendations arising from them.

Chapter 10: Conclusions and Recommendations

This chapter is organised into sections covering ten overlapping themes: print reading literacy, digital reading literacy, mathematics, science, gender and performance, high and low achievers, national assessment data, engagement in international assessments, maintaining equity in the face of change, and PISA test design and scaling. For each, a preamble and brief rationale precede one or more recommendations.

In drawing conclusions based on the PISA 2009 data, it needs to be acknowledged that the size of the declines in print reading and mathematics Ireland was unprecedented and appears to have occurred for a variety of reasons. Hence, care needs to be exercised in drawing firm conclusions and in considering implications for policy making.

There are a number of contexts in which our conclusions and recommendations arise. In July 2011, the Department of Education and Skills launched a *National Strategy to Improve Literacy and Numeracy among Children and Young People 2011-2020* (Department of Education and Skills, 2011). The *National Strategy* outlines a series of actions to be taken by the Department that are designed to raise standards in literacy and numeracy across the educational spectrum, including post-primary schools. At the time of writing, circulars (0056/2011 and 0058/2011) have been issued to primary and post-primary schools in relation to implementation of certain aspects of the Strategy. In the case of post-primary schools, the focus of strategy implementation has thus far related to mathematics teaching only.

Another key context in which our conclusions and recommendations are presented is the ongoing implementation of *Project Maths* in schools. When PISA 2009 was being implemented, *Project Maths* was available on a pilot basis in just 24 post-primary schools. It has now been introduced to all post-primary schools, and implementation will continue on an incremental basis for several years.[72]

A third context concerns the changes to be made to the junior cycle more generally, and to the Junior Certificate Examination in particular (NCCA, 2011). First, it is likely that students will take fewer subjects in the examination from 2017 onwards (i.e., students beginning First Year in 2014). Second, it is probable that students' examination grades will be based on a combination of paper-and-pen tests (60%) and continuous assessments (40%). These changes can be expected to impact on literacy and numeracy, both in terms of enabling schools to allocate additional time to these key aspects of the curriculum, as well as supporting teachers to use a broad range of assessment tasks, including student self-assessment.

A fourth context is the development and publication of *Reading Literacy in PISA 2009: A Guide for Teachers* (Perkins et al., 2011). Drawing on the outcomes of PISA 2009, the Guide made 16 recommendations in the area of reading literacy. Some are reiterated below. Others in the Guide arose from a questionnaire administered to teachers of

[72] Due to the phased approach to implementation, only Second- and Fifth-Year students in non-*Project Maths* schools in PISA 2012 will have studied under Project Maths.

English to Third-Year students in PISA 2009 schools, and are not considered in this report.

A final context is the developing research base on teaching literacy skills to adolescents. This includes work completed by the Junior Certificate School Programme Support Service, particularly in the areas of school development and vocabulary instruction (see Cassidy & Kiely, 2001; 2008), as well as international research on the literacy development of adolescents (e.g., Biancarosa & Snow, 2006; Kamil et al., 2008; see Perkins et al., 2011, for a review).

In considering the conclusions and recommendations presented here, it may be noted that Ireland has participated in IEA's most recent international assessments of reading, mathematics and science at primary level (TIMSS and PIRLS), and results from these two studies will be published in December 2012. Ireland is also participating in the OECD's Programme for the International Assessment of Adult Competencies (PIAAC), results of which will be published in 2013. Taken together with PISA, it is hoped that the findings from these studies will provide a more complete picture of literacy and numeracy in Ireland, since information will span the primary, post-primary and adult populations.

Print Reading

Although one might dispute the size of the decline in overall print reading literacy in Ireland between 2000 and 2009, it is clear that performance has dropped. Furthermore, a significant decline occurred among students at all levels of reading ability, including both higher achievers (just 7% of students in 2009, compared to 14% in 2000 achieved Level 5 or higher) and lower achievers (17% scored below Level 2 in 2009, compared to 11% in 2000). Part of this decline took place between 2000 and 2003, and performance has dropped further between 2003 and 2009. While some of the decline is probably due to demographic change – almost 4% of students spoke a language other than English or Irish at home compared to fewer than 1% in 2000, and the socioeconomic status of immigrant students is lower – our analyses suggest that other factors, including greater student disengagement from PISA in 2009, the procedures used by the OECD and its contractors to establish statistical linkages across PISA cycles, and changes in the distribution of 15-year-olds across grade (year) levels, may also have played a role.

Given the need to raise standards, and to ensure that all students reach their potential in reading literacy, we endorse the *National Strategy to Improve Literacy and Numeracy*, which is designed to put stronger supports in place for students from early childhood onwards. The focus on literacy as well as literature at post-primary level, and the recognition that each subject area has its own literacy requirements, which should be addressed by students' subject teachers, are important aspects of the Strategy. The focus on enhanced pre-service training, induction and professional development in literacy and numeracy for teachers at all levels in the education system is to be welcomed, as are plans to revise the Junior Certificate English syllabus. Proposals for standardised testing in Second Year also seem sensible, though care needs to be taken to ensure that a balance is struck between standardised assessments, and classroom-based assessments, taking into account the strengths and weaknesses of both.

Our recommendations in the area of print reading literacy focus on a need to enhance the teaching of basic and higher-level reading strategies, both in English classes and other subject areas. They are also motivated by the decline in reading engagement

among students in Ireland, where over 40% reported that they never read for enjoyment, and by the low levels of library usage by students. The latter perhaps reflects the restricted nature of the courses provided in some subject areas, and the effects of public examinations on teachers' and students' practices. Our recommendations on print reading literacy for post-primary schools reflect a need for all teachers in a school, not just teachers of English or support teachers, to take responsibility for addressing the literacy needs of all students, and especially those with reading difficulties, a view that is consistent with the *National Strategy*.

Recommendations for Print Reading

R1. The Department of Education and Skills and its agencies should support schools and teachers in becoming familiar with and implementing a range of strategies for improving literacy across the curriculum, including English. These should include teaching subject-specific vocabulary and reading comprehension skills, integrating oral language, reading and writing, involving students in extended discussion of text meaning and interpretation, and increasing motivation and engagement. Support should also be given to teachers in assisting them in selecting appropriate instructional materials and adapting them to suit particular teaching and learning contexts, and in assessing student progress in achieving key literacy outcomes.

R2. The Department of Education and Skills and its agencies should support schools and teachers in addressing the literacy and learning needs of at-risk groups, such as students from socioeconomically disadvantaged settings, students who speak a language other than English or Irish at home, and students with special educational needs. Support should include professional development that covers both basic and higher-order reading skills.

R3. Schools and teachers should seek to further enhance students' engagement in reading literacy in all subject areas by providing a range of relevant supports. These should include co-developing learning goals with students, linking text content to students' real-life experiences, supporting students in making choices among meaningful alternative activities, matching a broad range of texts to students' reading needs and interests, using library resources to support learning, and providing opportunities for students to engage in collaborative learning and interpretation of texts.

R4. Schools should follow a whole-school approach in planning students' literacy learning. School plans should make provision for developing a culture of reading that incorporates access to books, time for reading, interventions that motivate adolescent readers, and classroom strategies to support purposeful, independent reading. Plans should also specify the roles of teachers, parents, community members, and the students themselves in improving students' literacy skills.

R5. In assessing student achievement, teachers of English and other subject areas should ensure that students are knowledgeable about, and can apply, both basic reading skills (e.g., identifying word meanings, making basic inferences, identifying main ideas, and integrating and interpreting information) and higher-level skills (e.g., making complex inferences, summarising ideas, and reflecting on and evaluating information) as they read an appropriate range of texts.

Digital Reading

Students in Ireland achieved a mean score on the digital reading assessment that was significantly higher than the OECD average, and a ranking of 8th among the 19 countries that participated in this optional assessment. In Ireland, the percentage of high-achieving students (scoring at proficiency Level 5 or above) (8%) was the same as the corresponding OECD average, while the percentage of low-achieving readers (scoring at proficiency Level 2 or below) was lower (12% vs. 17%). The stronger performance of students in Ireland on digital reading than on print reading is noteworthy and may have been due to the greater engagement of students in Ireland on the digital reading tasks, though evidence for this is indirect.

It is apparent, however, that students in Ireland engage in a relatively narrow range of digital reading tasks compared to students in the majority of OECD countries. Ireland's mean score on the online reading scale (-0.50) was half a standard deviation below the OECD average. Areas in which students in Ireland had comparatively low levels of engagement were reading online news, using online reference materials, searching online for information about particular topics, and searching for practical information. Given the ever-increasing importance of digital literacy in students' lives and in their learning, it is important that students at all levels of reading ability are provided with appropriate instruction in using digital texts and have adequate opportunities to use and practise these skills. Hence, our recommendations for digital reading for post-primary students focus on providing access to digital texts at school, and supporting students to read them critically.

Recommendations for Digital Reading

R6. The Department of Education and Skills and its agencies should support schools and teachers of all subject areas to integrate digital technologies into teaching and learning, and to build on students' out-of-school literacies, by providing appropriate infrastructure (hardware and software) and intensive professional development. Curriculum revision and assessment reform should also identify and implement ways in which digital technologies can be integrated more effectively into teaching, learning and assessment.

R7. Schools plans for information and communication technologies should identify, for each subject, the contexts in which students can engage with digital texts to support teaching and learning, including schoolwork and homework. Attention should also be given to the range of ICT and digital reading skills that students should acquire within and across subjects.

R8. Teachers of English and other subject areas should support students in identifying similarities and differences between reading print and digital texts, and in applying critical reading skills (e.g., identifying the source, relevance, and credibility of texts) as they engage with digital texts.

R9. Data from current and future cycles of PISA should be further exploited to investigate differences in the performance of students at varying ability levels on digital and print reading tasks, and to identify reasons underlying this variation.

Mathematics

The performance of students in Ireland on PISA mathematics was disappointing. Ireland's mean score declined from 503 points in 2003 to 487 in 2009, with most of the drop occurring between 2006 and 2009. Ireland's mean score is now significantly below the OECD average. In 2009, 22% of students in Ireland performed below Level 2 on the mathematics proficiency scale (indicating inadequate mathematical knowledge and skills), compared to 17% in 2003. While 22% performed at Level 5 or higher in 2003, just 7% did so in 2009. Clearly, large numbers of students in Ireland struggle to engage with and solve the types of mathematics problems in PISA, which are frequently non-routine and embedded in real-life contexts.

As in the case of reading literacy, it is likely that performance in mathematics declined for a number of reasons. Again, these include demographic change, changes in the distribution of 15-year-olds across year levels (with more students now in Transition Year, where mathematics is taught less formally), and a lack of engagement among students during the assessment, which was particularly evident on items requiring a written response.

Nevertheless, the fact remains that Ireland's mean performance in mathematics has declined to a significant degree, and Ireland is now among the lowest-performing OECD countries in this domain. While *Project Maths,* the new syllabus introduced in a sample of 24 pilot schools in 2008, and in all post-primary schools in 2010, is intended to raise mathematics performance and increase students' interest in the subject, it is not yet clear how quickly it can attain these goals. We are aware of only two published reports that refer to the implementation of *Project Maths* in schools – a report on the trialling of Leaving Certificate Sample Papers (State Examinations Commission, 2010), and a report by the *Project Maths* Implementation Support Group (Department of Education and Skills, 2010). Neither report provides information on overall achievement in *Project Maths* classrooms.

The National Council for Curriculum and Assessment, which issued a call for tender for an evaluation of *Project Maths* in both pilot schools and in all schools in 2010, has yet to report any outcomes.[73] The State Examinations Commission (2010) report suggests that there are some significant challenges to overcome, when it notes, in the context of a recommendation on syllabus development, that 'Consideration should continue to be given to the difficulties that students have traditionally had with achieving and displaying conceptual understanding, with solving non-routine problems, and with contextualised mathematics in general' (p. 111).

In formulating our recommendations, we were aware that as mathematics was a minor assessment domain in PISA 2009, only limited information on achievement was available. We believe that further analyses of the data (e.g., an examination of performance on an item-by-item basis) could provide additional information that would be useful in furthering our understanding of the performance of students in Ireland. Moreover, we feel that such information could inform teaching and learning in mathematics classrooms. We believe that additional analyses of the 2009 National Assessment of Mathematics in Sixth Class might also usefully be undertaken, in conjunction with the mathematics data from the Trends in International Mathematics

[73] The NCCA re-issued its call for tender in November 2011.

and Science Study (TIMSS; administered to a national sample of pupils in Fourth Class in 2011), to ascertain if pupils in the Senior classes in primary schools are being adequately prepared for the mathematics demands of post-primary schooling. Our recommendations also reflect our concerns with the lack of information on progress in implementing *Project Maths* and the need to generate reliable information on implementation and outcomes as soon as possible.

We note the advice offered to post-primary schools in Circular 0058/2011: 'the Transition Year, where available, should be used to provide innovative learning opportunities and increased mathematics teaching hours to the extent feasible as an important part of the strategy to develop core transferable skills' (p. 3). In the absence of information on the current strengths and weakness of mathematics courses in Transition Year, or additional teaching supports, it is difficult to see how this advice, in and of itself, can be expected to substantially raise performance levels among Transition Year students.

Recommendations for Mathematics

R10. Student performance on individual PISA 2009 mathematics items should be examined to identify areas of strength and aspects that need further attention, and these outcomes should contribute to decisions on curricular emphasis, assessment, and feedback at national, school and classroom levels. Given that mathematics is a major domain in PISA 2012 with detailed comparisons with 2003 planned, results for 2012 should be examined in similar detail.

R11. The teaching of mathematics in Senior classes in primary schools should be examined more intensively, drawing on data from the 2009 National Assessment of Mathematics (in Sixth Class), the 2011 TIMSS assessment (in Fourth Class), inspections/observations of the teaching of mathematics, and teachers' mathematical and pedagogical knowledge, with a view to identifying ways in which performance levels can be raised, and how pupils might be better prepared for post-primary mathematics. A key focus of the review should be on the teaching of, and performance on, higher-level mathematical processes and tasks. The review should encompass the performance of both higher- and lower-achieving pupils, and should pay particular attention to the teaching and learning of mathematics in schools with high levels of socioeconomic disadvantage.

R12. The implementation of *Project Maths* in post-primary schools (now in its fourth year) should be examined in detail so that strengths and weaknesses can be identified and acted on as early as possible. Evaluation should focus on (a) implementation in school and classroom settings; and (b) attitude and achievement outcomes (including examination results). Issues that should be examined include the adequacy of school plans, the appropriateness and intensity of teacher professional development, the adequacy of time allocated to teaching mathematics, the assessment of mathematics in classrooms, and ways in which the organisation of mathematics classes in schools (e.g., streaming) is linked to performance levels.

R13. Proposed new assessment arrangements for mathematics at junior cycle level, including the use of classroom assessments for certification purposes, should be tried out and evaluated in a sample of post-primary schools to identify the constructs being assessed, how these relate to the outcomes of conventional tests and examinations, and how they contribute to students' overall grades in mathematics. The effects of the new assessment arrangements on implementation of the *Project Maths* syllabus should also be examined.

R14. Future cycles of PISA, and especially cycles in which mathematics is a major assessment domain, should be exploited to obtain additional information on the implementation of *Project Maths* and its effects on student performance.

R15. The increase in the percentage of 15-year-olds in Transition Year and the finding that performance in PISA mathematics declined to a greater extent among these students than students at other grade levels warrant a review of mathematics teaching and learning in Transition Year that focuses on (i) the nature of mathematics curricula; (ii) the nature of teaching, learning and assessment; and (iii) the extent to which Transition Year mathematics curricula build on performance at junior cycle and supports learning in senior cycle.

Science

Overall performance in PISA science in Ireland was about the same in 2009 as in 2006, when it was last a major assessment domain. Although above the OECD average, Ireland's mean score of 508 was lower than the mean scores of 15 countries, including Finland, New Zealand, Canada, Australia, and the United Kingdom. Fifteen percent of students in Ireland performed at or below Level 1 on the science proficiency scale, compared with an OECD average of 18%. Nine percent of students in Ireland and on average across OECD countries performed at Level 5 or higher. Hence, Ireland's relatively strong performance in science can be attributed to above average performance among lower-achieving students, rather than superior performance among high achievers.

There are a number of possible reasons why the performance of students in Ireland in science is better than in reading literacy or mathematics. First, there may be a stronger match between the junior cycle science syllabus (Department of Education and Science, 2003) and PISA science than between PISA mathematics and the junior cycle mathematics syllabus (prior to *Project Maths)*. This is evidenced, at least in part, by the strong performance of students in Ireland in PISA 2006 on items dealing with knowledge about science (i.e., knowledge about scientific enquiry and scientific explanations). Second, and related to this, coursework and instruction in geography may contribute to performance in PISA science, as there is some overlap between the framework for PISA science and the junior cycle syllabus for geography (Department of Education and Science, n.d.).

Third, there is evidence that student engagement in PISA science (as indicated by lower rates of missing and not-reached responses) was greater than in both reading and mathematics. The percentage of questions to which students did not respond in science was similar to that for digital reading. It is possible, therefore, that the content of the science test was of greater interest to students in Ireland, compared to the content of the reading literacy and mathematics tests, leading to higher levels of engagement and

persistence. It is relevant to note that relative to reading and mathematics, the science assessment in PISA contained fewer written response items, which were the items on which student declines in effort or engagement were most apparent. It is also of note that the stimulus texts in science tended to be shorter and accompanied by fewer questions, unlike in reading, where the stimulus texts tended to be longer, and accompanied by more items.

Fourth, some of the technical problems associated with PISA's estimation of change have been improved in the case of science, since this was a major domain for the first time only in 2006. These include increasing the number of questions used to establish linkages across cycles, and administering clusters of test items in a more consistent manner across cycles.

Despite relatively strong (and stable) performance on PISA 2009 science, however, there is a clear need for improvement. It should be a matter of concern that science does not receive the same priority as a subject in the new framework for junior cycle (NCCA, 2011) as English, Irish and mathematics. The possibility that students who do not study science as a subject may be able to avail of short courses in the subject may go some way towards addressing this issue.

Recommendations for Science

R16. Although mean performance in science in Ireland has been significantly above the OECD average in all PISA cycles to date, there is a need to identify ways in which performance can be raised, as Ireland continues to lag significantly behind a large number of countries. Strategies for raising performance should focus on enhancing knowledge of scientific concepts and addressing the relative underperformance of high achievers.

R17. In overseeing the implementation of the new junior cycle framework in schools, the Department of Education and Skills and its agencies should seek to ensure that all students complete at least some science coursework, and monitor the outcomes of coursework.

R18. In overseeing the implementation of the new junior cycle framework in schools, the Department of Education and Skills should monitor the effects of the proposed common syllabus in science.

Gender and Achievement

In PISA 2009 in Ireland, approximately twice as many boys (23.2%) as girls (11.3%) scored below Level 2 on reading literacy. The gender difference widened since PISA 2000, from 29 to 39 score points. Furthermore, the size of the gender gap varied across mixed schools. Smaller differences (in favour of females) were observed on digital reading than on print reading in 2009.

In PISA 2009 mathematics, male students in Ireland had a mean score (491) that was higher than that of females (483). However, the difference was not statistically significant. This contrasts with the three previous cycles of PISA in which males significantly outperformed females. While similar percentages of male and female students in Ireland scored at Level 1 or lower (21% in each case) in 2009, slightly more males (8%) than females (5%) scored at Level 5 or higher.

In PISA 2009 science, females in Ireland had a higher mean score (509) than males (506). Again, however, the difference was not significant. Slightly more males (16%) than females (14%) scored at Level 1 or below, while 9% of males and 8% of females scored at Level 5 or higher.

Recommendations primarily reflect a concern with the increase in the gender gap in PISA reading literacy in Ireland since 2000 (although the difference in favour of girls also increased on average across OECD countries), which is underscored by a sizeable percentage of low-achieving boys, as well as gender differences on measures of engagement in reading and usage of reading strategies. They also reflect a need to gain a better understanding of why gender differences on PISA mathematics and science are small, given that PISA questions in these domains seem to require a significant reading input from students. We are, furthermore, of the view that the *National Strategy to Improve Literacy and Numeracy* would benefit from a more nuanced approach to addressing gender differences in reading literacy, particularly for low-achieving boys. The PISA 2009 *Guide for Teachers* (Perkins et al., 2011, pp. 76-77) includes additional recommendations relating to gender differences in reading and a further consideration of the *National Strategy* in this regard.

Recommendations for Gender and Achievement

R19. Gender differences in reading achievement in Ireland should be investigated through follow-up research that would allow the identification of schools that have high and low average gender differences in reading, and the characteristics that are associated with those schools. In doing so, aspects of good practice should be identified and disseminated.

R20. Schools and teachers should support students in identifying ways in which gender is socially constructed, both inside and outside of school. They should consider how this impacts on the lives of their students, how gender is enacted in the texts that students read in different subject areas, including English, and how such texts are relevant to real life.

R21. Gender differences in PISA mathematics and science should be examined in greater detail to determine how they are related to the reading literacy demands of PISA test questions in these domains, and how and why they differ from the gender differences that are observed in the Junior Certificate Examinations in mathematics and science.

High and Low Achievers

Higher-achieving students in Ireland underperformed in 2009 across all four PISA domains (print reading, digital reading, mathematics and science). Underperformance among higher achievers in Ireland was also evident in earlier cycles of PISA, with the exception of reading literacy in 2000. These observations are of concern if progress is to be made with *Building Ireland's Smart Economy* framework (Government of Ireland, 2008; 2010). The finding that just 7% of students in Ireland achieved at Level 5 or higher in mathematics in 2009, compared to 13% on average across OECD countries, is a matter of considerable concern. Moreover, it occurs at a time of significant system-level curriculum change in mathematics.

Our recommendations in this section reflect the urgency of addressing underperformance among higher achievers. There is a need for additional research to improve our understanding of the issues involved. There is also a need to modify instructional and assessment practices to extend the abilities of higher-achieving students. However, this should be accomplished while also attending to equity issues (e.g., maintaining or reducing differences between socioeconomically advantaged and disadvantaged students, and, where they exist, between males and females).

Recommendations for High and Low Achievers

R22. Bodies involved in curriculum development and examinations should note the relative underperformance of higher-achieving students across all PISA domains, mathematics in particular, and should identify strategies to raise performance and engagement that can be implemented in schools and classrooms within existing and future curricular and educational reforms.

R23. The Department of Education and Skills should commission research into the low performance of higher-achieving students in schools, taking into account such factors as gender, the reading requirements in different subject areas, and the impact of the examination system on performance levels.

R24. Implementation of *Project Maths*, the new framework for junior cycle, and further development of Transition Year programmes should seek to raise the performance of higher-achieving students in reading literacy, mathematics and science.

The Potential of National Assessment Data

Apart from aggregated public examination results, no data are currently available on achievement levels in reading literacy, mathematics or science of students in post-primary schools. This presented a significant difficulty in interpreting the outcomes of PISA 2009 as no corroborating evidence (or otherwise) on changes in performance was available. As argued elsewhere, the Junior Certificate Examination does not provide reliable information on trends in performance, since examination papers and marking schemes vary from year to year (Shiel, Kellaghan & Moran, 2010). Implementation of the plan in the *National Strategy to Improve Literacy and Numeracy* to administer national sample-based assessments in English reading and mathematics at primary level to the Second Year at post-primary level go some way towards addressing this issue. There would also be value in identifying ways in which the Junior Certificate Examination could be modified to provide regular information on standards (e.g., through administration of secure blocks of items on a periodic basis, perhaps delivered via computer). Modification of the examination in this way would have the advantage of providing achievement data for the population of students without the need to design and draw samples of students.

Recommendations for National Assessment Data

R25. The plan in the *National Strategy to Improve Literacy and Numeracy 2011-20* to administer a sample-based national assessment in English reading and mathematics at Second Year in post-primary schools should be implemented so that reliable national data on student proficiency are available at post-primary level at regular intervals and can be referred to in interpreting the outcomes of other assessments such as the Junior Certificate Examination and PISA.

R26. Ways in which the Junior Certificate Examination could be modified to provide periodic or regular information on standards in key subject areas such as English, mathematics, and science, should be explored.

Participation in International Assessments

In analyses of PISA, engagement of students in the assessment emerged as an important factor in explaining changes in achievement of Irish students over time. Our recommendation in this section reflects a need to convey to schools, parents, and students the importance of PISA so that students will engage in the assessment to the best of their ability and the resulting data will allow reliable inferences to be made about performance and trends. We note that the transition to computer-based assessment in PISA may also help to increase student engagement.

Recommendation for Participation in International Assessments

R27. The Department of Education and Skills and the Educational Research Centre should work closely with schools, parents, and students in future cycles of PISA and other international assessments to ensure that procedures are put in place to convey the importance of such assessments, and to encourage active and engaged involvement of students who are selected to participate.

Maintaining Equity in the Face of Change

Earlier cycles of PISA in Ireland were characterised by estimates of between-school variance in reading, mathematics, and science that were well below the corresponding OECD averages. However, estimates were higher in 2009 than in 2000, increasing from 18% to 29% in reading literacy, from 11% to 24% in mathematics, and from 14% to 25% in science. To the extent that between-school variance is a valid indicator of equity in an education system, one could conclude that equity in the system has diminished.

Demographic and system-related changes that may have contributed to increased estimates of between-school variance include increases in the proportion of immigrant students, particularly those who spoke a language other than English or Irish and in the proportions of students enrolled in Transition Year. The very low performance of eight schools in the 2009 sample may also be relevant here.

Our recommendations highlight threats to overall levels of equity as a result of demographic and system changes, and the need to monitor changes, and their impact on performance and equity over the next decade. Impending changes to the junior cycle that will impact on subject choice, access to courses, and assessment procedures may also be relevant. The current economic situation in Ireland may also have implications for equity in educational outcomes.

Recommendations for Maintaining Equity

R28. Key demographic and system-related changes identified in this report should be carefully monitored and described in future cycles of PISA, and, where possible, through other means. Changes relate to increases in the proportion of immigrant students, particularly students with a language other than English or Irish, and to the number of students enrolled in Transition Year. They also concern increases in between-school differences in average achievement, and the emergence of a number of very low-performing schools in PISA 2009. Efforts should be made to ensure that demographic and other changes do not compromise quality or equity in educational provision in post-primary schools in Ireland.

R29. Relevant data (e.g., examination results, results of national and international studies, measures of socioeconomic status) should be carefully analysed over time, and changes in equity of educational outcomes identified with a view to informing policymakers.

PISA Test Design and Scaling

A number of problems have been identified relating to the test design and scaling of the PISA data which can affect the estimation and reporting of trends across PISA cycles. Specific issues include: the use of the Rasch statistical model in estimating student scores; the mixed-domain booklet design where the same students complete items in reading, mathematics and science; the length of the print test and size of positioning effects; variations in aspects of the test design, particularly item formats, across domains and cycles; and the methods used to compute linking errors for trends. The role of non-cognitive factors also emerged as important. Our recommendations reflect a need for the OECD and its contractors to address these issues as a matter of urgency, and to provide more detailed information on the procedures used to produce estimates of achievement and trends.

Recommendations for PISA Test Design and Scaling

R30. Key issues related to the test design and scaling of PISA data identified in this report and elsewhere should be brought to the attention of the OECD and should be addressed in future PISA cycles. These include: the use of the Rasch model in estimating student scores; the mixed-domain booklet design; the length of the print test and size of positioning effects; variations in aspects of the test design, particularly item formats, across domains and cycles; the methods used to compute linking errors; and the role that non-cognitive characteristics may play in their influence on the PISA test scores within and across countries.

R31. The OECD should provide documentation on the methods used to produce achievement trends and compute link errors in PISA that is sufficiently detailed to allow for their independent replication for all cycles of PISA.

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Appendix A: Membership of the PISA 2009 National Advisory Committee

In Ireland, PISA is administered on behalf of the Department of Education and Skills by the Educational Research Centre. These bodies are supported in their work by a National Advisory Committee. The members of the Committee are:

Éamonn Murtagh, Assistant Chief Inspector, Department of Education and Skills, Chair

Aideen Cassidy, Junior Certificate Schools Programme Support Service, Dublin

Jude Cosgrove, Educational Research Centre, Representative on the PISA Governing Board

Conor Galvin, School of Education, University College Dublin

Hugh McManus, State Examinations Commission

Phillip Matthews, School of Education, Trinity College Dublin

Gráinne Moran, Educational Research Centre

Brian Murphy, Education Department, University College Cork

Hal O'Neill, National Council for Curriculum and Assessment

Elizabeth Oldham, Education Department, Trinity College Dublin

Rachel Perkins, Educational Research Centre, PISA 2009 National Project Manager

George Porter, Department of Education and Skills

Emma Pybus, Educational Research Centre (to September 2008)

Gerry Shiel, Educational Research Centre.

Appendix B: Sample Passages and Questions from PISA

Overview

This appendix contains examples of print reading, mathematics, science, and digital reading tasks presented to students in the PISA assessment. The reading tasks are taken from the PISA 2009 assessment, while those for mathematics and science are based on previous cycles (2003 for mathematics and 2006 for science), since no new mathematics or science items were released as part of PISA 2009.

In total, 37 questions are included from 18 passages or stimuli, consisting of 3 print reading passages and 10 print reading questions; 3 digital reading passages and 9 digital reading questions; 5 mathematics stimuli and 9 mathematics questions; and 3 science passages and 9 science questions.

The format of the stimuli is changed slightly from that presented to the students to reduce pagination. In the case of reading questions requiring a written response, sample responses from students in Ireland who participated in PISA 2009 are provided. Responses are transcribed exactly as written by the students. To contextualise each of these responses, students' gender, ESCS (Economic, Social and Cultural Status) level, year level, and whether attending an SSP school or non-SSP school (in the School Support Programme under DEIS) is provided, along with the overall reading score achieved by that student, expressed in terms of PISA proficiency levels. The PISA score-point intervals associated with these levels are shown in Table B1.1.

The OECD (2010a, 2011a) provides further discussion of sample PISA tasks, as does the PISA 2009 Guide for Teachers (Perkins et al., 2011)[74]. The OECD has also published a set of all released print PISA tasks from 2000, 2003, and 2006 (OECD, 2009e).

Online interactive versions of print tasks are available at http://pisa-sq.acer.edu.au/. Online interactive versions of electronic tasks can be accessed at http://erasq.acer.edu.au/. For the electronic tasks, log in with 'public'; the password is 'access'.

Table B1.1: Score-point intervals for PISA 2009 proficiency levels for print reading, digital reading, mathematics and science

Print Reading		Digital Reading		Mathematics		Science	
Level	Interval	Level	Interval	Level	Interval	Level	Interval
Level 6	>6988			Level 6	>669	Level 6	>708
Level 5	626-698	Level 5	>625	Level 5	607-669	Level 5	633-708
Level 4	553-625	Level 4	553-625	Level 4	545-606	Level 4	559-632
Level 3	480-552	Level 3	480-552	Level 3	482-544	Level 3	484-558
Level 2	407-479	Level 2	407-479	Level 2	420-481	Level 2	409-483
Level 1a	335-406	< Level 2	<407	Level 1	358-419	Level 1	335-408
Level 1b	262-334			< Level 1	<358	< Level 1	<335
< Level 1b	<262						

[74] Perkins et al. (2011) include sample tasks for print and digital reading, and not mathematics or science. This report also includes a detailed commentary on the task characteristics.

Print Reading Sample Questions

PRINT READING PASSAGE 1: Telecommuting

The way of the future

Just imagine how wonderful it would be to 'telecommute'[1] to work on the electronic highway, with all your work done on a computer or by phone! No longer would you have to jam your body into crowded buses or trains or waste hours and hours travelling to and from work. You could work wherever you want to – just think of all the job opportunities this would open up! – *Molly*

Disaster in the making

Cutting down on commuting hours and reducing the energy consumption involved is obviously a good idea. But such a goal should be accomplished by improving public transportation or by ensuring that workplaces are located near where people live. The ambitious idea that telecommuting should be part of everyone's way of life will only lead people to become more and more self-absorbed. Do we really want our sense of being part of a community to deteriorate even further? – *Richard*

[1] 'Telecommuting' is a term coined by Jack Nilles in the early 1970s to describe a situation in which workers work on a computer away from a central office (for example, at home) and transmit data and documents to the central office via telephone lines.

Telecommuting – Question 1

What is the relationship between 'The way of the future' and 'Disaster in the making'?

A They use different arguments to reach the same general conclusion.
B They are written in the same style but they are about completely different topics.
C They express the same general point of view, but arrive at different conclusions.
D They express opposing points of view on the same topic.

Response	Ireland	OECD	Item Difficulty
Correct (option D)	52	52	Scale Score: 537 Proficiency Level 3
Incorrect	45	44	
Missing/Not reached	3	4	

Situation: *Occupational*
Text Format: *Multiple*
Text type: *Argumentation*
Aspect: *Integrate and interpret – Develop a broad understanding*
Question format: *Multiple choice*

Telecommuting – Question 2

What is one kind of work for which it would be difficult to telecommute? Give a reason for your answer.

Examples of correct answers (full credit only):

Electrician. It's a practical job and can't be done on a computer.
Teaching, as you could not keep control of the class.
Farming. It is usually done in the countryside. There would be no demand for telecommuting in the countryside.

Examples of incorrect answers:

It would be difficult for people who aren't interested.
Practical work (no example provided).

Response	Ireland	OECD	Item Difficulty
Correct	47	56	Scale Score: 514 Proficiency Level 3
Incorrect	37	29	
Missing/Not reached	16	15	

Situation: *Occupational*
Text Format: *Continuous*
Text type: *Argumentation*
Aspect: *Reflect and evaluate – Reflect on and evaluate the content of a text*
Question format: *Open constructed response*

Examples of responses from students in Ireland:

Gender	ESCS	Year	SSP School	Reading Score	Item Score	Response
Male	Low	Transition	Yes	Level 1 or below	0	Gardener as they will not hear a phone when they are outside.
Male	Low	Third	Yes	Level 1 or below	0	People using different ways in how to telecommute this is bound to create an argument.
Female	Medium	Third	No	Level 1 or below	0	I think building would be a bad telecommute
Male	High	Third	Yes	Level 2	0	teacher: have to teach classes and only telecommute at Break.
Male	High	Third	No	Level 2	1	Pizza man, cant diller by the enter net.
Male	High	Third	No	Level 2	1	A Mechanic as he cant fix a car on a computer
Female	High	Third	No	Level 2	0	Services like a hair dresser
Female	Low	Transition	No	Level 3	1	You cannot telecommute if you are a contractor because you have to do the work, you have to lay the bricks.
Female	Medium	Transition	No	Level 3	0	Cars - because how would you get about from place to place
Female	Medium	Fifth	No	Level 3	1	It would be difficult for a teacher + students because students need personal help + they couldn't get that over a computer.
Male	High	Transition	No	Level 3	1	Law-barrister- you yourself must be present at all times.
Female	Low	Transition	No	Level 4	1	Teaching Because the teachers are getting paid to teach the Students and supervise them.
Female	Low	Fifth	No	Level 4	1	Working on a building site. You actually have to be there to build, you cant do it through a computer.
Female	High	Third	No	Level 4	0	If would be difficult to telecommute if you needed to ask your bosses advice on something
Female	Medium	Transition	No	Levels 5 and 6	1	Building/construction as a building can not be built by a computer they need labourers to lay the bricks
Female	Medium	Transition	No	Levels 5 and 6	1	It would be difficult to telecommute as a surgeon because you would have to obviously have physical contact with your patient
Female	Medium	Third	No	Levels 5 and 6	1	Farming is a type of work taht would be difficult to telecommute because plants and animals need humans.
Female	High	Transition	No	Levels 5 and 6	0	It would be hard to telecommute for a shopkeeper as you cant run a shop from the computer at home.

Telecommuting – Question 3

Which statement would **both** Molly and Richard agree with?

A People should be allowed to work for as many hours as they want to.
B It is not a good idea for people to spend too much time getting to work.
C Telecommuting would not work for everyone.
D Forming social relationships is the most important part of work.

Response	Ireland	OECD	Item Difficulty
Correct (option B)	55	60	Scale Score: 503 Proficiency Level 3
Incorrect	41	36	
Missing/Not reached	4	4	

Situation: *Occupational*
Text Format: *Continuous*
Text type: *Argumentation*
Aspect: *Integrate and Interpret – Develop an interpretation*
Question format: *Multiple Choice*

PRINT READING PASSAGE 2: Mobile Phone Safety

Are mobile phones dangerous?

Key Point

Conflicting reports about the health risks of mobile phones appeared in the late 1990s.

Key Point

Millions of euro have now been invested in scientific research to investigate the effects of mobile phones.

	Yes	No
1.	Radio waves given off by mobile phones can heat up body tissue, having damaging effects.	Radio waves are not powerful enough to cause heat damage to the body.
2.	Magnetic fields created by mobile phones can affect the way that your body cells work.	The magnetic fields are incredibly weak, and so unlikely to affect cells in our body.
3.	People who make long mobile phone calls sometimes complain of fatigue, headaches, and loss of concentration.	These effects have never been observed under laboratory conditions and may be due to other factors in modern lifestyles.
4.	Mobile phone users are 2.5 times more likely to develop cancer in areas of the brain adjacent to their phone ears.	Researchers admit it's unclear this increase is linked to using mobile phones.
5.	The International Agency for Research on Cancer found a link between childhood cancer and power lines. Like mobile phones, power lines also emit radiation.	The radiation produced by power lines is a different kind of radiation, with much more energy than that coming from mobile phones.
6.	Radio frequency waves similar to those in mobile phones altered the gene expression in nematode worms.	Worms are not humans, so there is no guarantee that our brain cells will react in the same way.

If you use a mobile phone …

Key Point

Given the immense numbers of mobile phone users, even small adverse effects on health could have major public health implications.

Key Point

In 2000, the Stewart Report (a British report) found no known health problems caused by mobile phones, but advised caution, especially among the young, until more research was carried out. A further report in 2004 backed this up.

Do	Don't
Keep the calls short.	Don't use your mobile phone when the reception is weak, as the phone needs more power to communicate with the base station, and so the radio-wave emissions are higher.
Carry the mobile phone away from your body when it is on standby.	Don't buy a mobile phone with a high 'SAR' value[1]. This means that it emits more radiation.
Buy a mobile phone with a long 'talk time'. It is more efficient, and has less powerful emissions.	Don't buy protective gadgets unless they have been independently tested.

[1] SAR (specific absorption rate) is a measurement of how much electromagnetic radiation is absorbed by body tissue whilst using a mobile phone.

Mobile Phone Safety – Question 1

What is the purpose of the **Key Points**?

A To describe the dangers of using mobile phones.
B To suggest that debate about mobile phone safety is ongoing.
C To describe the precautions that people who use mobile phones should take.
D To suggest that there are no known health problems caused by mobile phones.

Response	Ireland	OECD	Item Difficulty
Correct (option B)	47	46	Scale Score: 561 Proficiency Level 4
Incorrect	50	49	
Missing/Not reached	3	5	

Situation: *Public*
Text Format: *Non-continuous*
Text type: *Exposition*
Aspect: *Integrate and interpret – Develop a broad understanding*
Question format: *Multiple choice*

Mobile Phone Safety – Question 2

'It is difficult to prove that one thing has definitely caused another.'

What is the relationship of this piece of information to the Point 4 **Yes** and **No** statements in the table **Are mobile phones dangerous?**

A It supports the Yes argument but does not prove it.
B It proves the Yes argument.
C It supports the No argument but does not prove it.
D It shows that the No argument is wrong.

Response	Ireland	OECD	Item Difficulty
Correct (option C)	30	35	Scale Score: 604 Proficiency Level 4
Incorrect	66	59	
Missing/Not reached	4	6	

Situation: *Public*
Text Format: *Non-continuous*
Text type: *Exposition*
Aspect: *Reflect and evaluate – Reflect on and evaluate the content of a text*
Question format: *Multiple choice*

Mobile Phone Safety – Question 3

Look at Point 3 in the **No** column of the table. In this context, what might one of these 'other factors' be? Give a reason for your answer.

Examples of correct answers (full credit only):
Not getting enough sleep.
Being busy.
Stress.
Taking drugs.
Pollution.
Examples of incorrect answers:
Headaches.
Lifestyle.

Response	Ireland	OECD	Item Difficulty
Correct	60	55	Scale Score: 526 Proficiency Level 3
Incorrect	21	21	
Missing/Not reached	19	24	

Situation: *Public*
Text Format: *Non-continuous*
Text type: *Exposition*
Aspect: *Reflect and evaluate – Reflect on and evaluate the content of a text*
Question format: *Open constructed response*

Examples of responses from students in Ireland:

Gender	ESCS Score	Year Level	SSP School	Reading Score	Item Score	Response
Male	Low	Transition	Yes	Level 1 or below	1	Hearing
Female	Low	Third	Yes	Level 1 or below	0	It could be something else causes the problem
Male	Low	Fifth	Yes	Level 2	1	Computers, phone masts
Female	Medium	Third	No	Level 2	0	headaches.
Female	Medium	Transition	Yes	Level 2	1	The chemicals in water, air and food
Male	High	Third	No	Level 2	0	It will damge you when your older
Male	Low	Third	Yes	Level 3	1	Other factors could be binge drinking as more and more people drink too much alcohol
Female	Medium	Transition	No	Level 3	0	It could relate to the heat of the person rather than the radiation
Female	Medium	Transition	No	Level 3	1	Lack of sleep can be one of the other factors because in can cause the other symptoms in the Yes column.
Male	High	Transition	No	Level 3	0	forgetfullness - this is linked to the given factors.
Male	High	Third	No	Level 3	1	Long days at work or if you worked somewhere loud eg. Airport
Male	High	Third	Yes	Level 3	1	stress
Female	Low	Transition	No	Level 4	1	It could be the surroundings that your in could be giving you a headache and make you feel tired eg. the lighting in a room.
Female	Low	Fifth	No	Level 4	1	Using computers. People often complain of headaches after taring at a computer screen for too long.
Female	High	Third	No	Level 4	1	As in standing in front of microwaves or living near a radio transmittion pole
Female	High	Transition	No	Level 4	1	Stress. More and more people are suffering from stress lately in work and at home.
Female	Medium	Transition	No	Levels 5 and 6	1	Use of recreational drugs may be a factor which causes headaches and loss of concentration
Female	Medium	Third	No	Levels 5 and 6	1	Other factors may be a person's job.

Mobile Phone Safety – Question 4

Look at the table with the heading **If you use a mobile phone …** Which of these ideas is the table based on?

A There is no danger involved in using mobile phones.
B There is a proven risk involved in using mobile phones.
C There may or may not be danger involved in using mobile phones, but it is worth taking precautions.
D There may or may not be danger involved in using mobile phones, but they should not be used until we know for sure.
E The **Do** instructions are for those who take the threat seriously, and the **Don't** instructions are for everyone else.

Response	Ireland	OECD	Item Difficulty
Correct (option C)	71	63	Scale Score: 488 Proficiency Level 3
Incorrect	25	30	
Missing/Not reached	4	7	

PRINT READING PASSAGE 3: The Play's the Thing

Takes place in a castle by the beach in Italy.

FIRST ACT

Ornate guest room in a very nice beachside castle. Doors on the right and left. Sitting room set in the middle of the stage: couch, table, and two armchairs. Large windows at the back. Starry night. It is dark on the stage. When the curtain goes up we hear men conversing loudly behind the door on the left. The door opens and three tuxedoed gentlemen enter. One turns the light on immediately. They walk to the centre in silence and stand around the table. They sit down together, Gál in the armchair to the left, Turai in the one on the right, Ádám on the couch in the middle. Very long, almost awkward silence. Comfortable stretches. Silence. Then:

GÁL

Why are you so deep in thought?

TURAI

I'm thinking about how difficult it is to begin a play. To introduce all the principal characters in the beginning, when it all starts.

ÁDÁM

I suppose it must be hard.

TURAI

It is – devilishly hard. The play starts. The audience goes quiet. The actors enter the stage and the torment begins. It's an eternity, sometimes as much as a quarter of an hour before the audience finds out who's who and what they are all up to.

GÁL

Quite a peculiar brain you've got. Can't you forget your profession for a single minute?

TURAI

That cannot be done.

GÁL

Not half an hour passes without you discussing theatre, actors, plays. There are other things in this world.

TURAI

There aren't. I am a dramatist. That is my curse.

GÁL

You shouldn't become such a slave to your profession.

TURAI

If you do not master it, you are its slave. There is no middle ground. Trust me, it's no joke starting a play well. It is one of the toughest problems of stage mechanics. Introducing your characters promptly. Let's look at this scene here, the three of us. Three gentlemen in tuxedoes. Say they enter not this room in this lordly castle, but rather a stage, just when a play begins. They would have to chat about a whole lot of uninteresting topics until it came out who we are. Wouldn't it be much easier to start all this by standing up and introducing ourselves? *Stands up.* Good evening. The three of us are guests in this castle. We have just arrived from the dining room where we had an excellent dinner and drank two bottles of champagne. My name is Sándor Turai, I'm a playwright, I've been writing plays for thirty years, that's my profession. Full stop. Your turn.

GÁL

Stands up. My name is Gál, I'm also a playwright. I write plays as well, all of them in the company of this gentleman here. We are a famous playwright duo. All playbills of good comedies and operettas read: written by Gál and Turai. Naturally, this is my profession as well.

GÁL and TURAI

Together. And this young man …

ÁDÁM

Stands up. This young man is, if you allow me, Albert Ádám, twenty-five years old, composer. I wrote the music for these kind gentlemen for their latest operetta. This is my first work for the stage. These two elderly angels have discovered me and now, with their help, I'd like to become famous. They got me invited to this castle. They got my dress-coat and tuxedo made. In other words, I am poor and unknown, for now. Other than that I'm an orphan and my grandmother raised me. My grandmother has passed away. I am all alone in this world. I have no name, I have no money.

TURAI

But you are young.

GÁL

And gifted.

ÁDÁM

And I am in love with the soloist.

TURAI

You shouldn't have added that. Everyone in the audience would figure that out anyway.

They all sit down.

TURAI

Now wouldn't this be the easiest way to start a play?

GÁL

If we were allowed to do this, it would be easy to write plays.

TURAI

Trust me, it's not that hard. Just think of this whole thing as …

GÁL

All right, all right, all right, just don't start talking about the theatre again. I'm fed up with it. We'll talk tomorrow, if you wish.

Note:

Line numbers were given in the margin of the script to help students find parts that are referred to in the questions and the extract from the play was formatted to two columns per page.

The Play's the Thing – Question 1

What were the characters in the play doing **just before** the curtain went up?

Examples of correct answers:

Eating their dinner.
The characters were behind the door on the left coming back from dinner.

Examples of incorrect answers:

Talking about boring topics
They are in their positions for the play.
They were conversing loudly behind the door to the left.

Response	Ireland	OECD	Item Difficulty
Correct	11	13	Scale Score: 730 Proficiency Level 6
Incorrect	81	75	
Missing/Not reached	8	12	

Situation: *Personal*
Text Format: *Continuous*
Text type: *Narrative*
Aspect: *Integrate and Interpret – Develop an interpretation*
Question Format: *Short response*

Examples of responses from students in Ireland:

Gender	ESCS	Year	SSP School	Reading Score	Item Score	Response
Female	Low	Third	Yes	Level 1 or below	0	introducisin them selfs
Male	Low	Fifth	Yes	Level 1 or below	0	Talking bout a casel
Male	Medium	Third	Yes	Level 1 or below	0	they were chilling on the chairs.
Female	Medium	Third	No	Level 1 or below	0	They were talking about how difficult it is to write a play.
Female	Medium	Transition	Yes	Level 2	0	The men were talking loudly
Male	High	Third	Yes	Level 2	0	Setting up equipment
Male	High	Third	No	Level 2	0	Haven a mintit slicence
Female	Low	Third	No	Level 3	1	They were in the dinning room.
Male	Low	Third	Yes	Level 3	0	They are silently entering a room
Female	Medium	Fifth	No	Level 3	1	They were dining in the dining room + had drank two bottles of champange.
Male	High	Transition	No	Level 3	0	Speaking loadly outside the door
Female	Low	Transition	No	Level 4	1	They had just come back from dinner and they were sitting on the chairs.
Female	High	Third	No	Level 4	0	they were conversing loudly behind the left door
Female	High	Transition	No	Level 4	1	Having dinner
Female	Medium	Transition	No	Levels 5 and 6	0	sitting down together after they enter the room talking
Female	Medium	Transition	No	Levels 5 and 6	0	They were talking behind the door on the left
Female	Medium	Third	No	Levels 5 and 6	1	They were eating in the dining room
Female	High	Transition	No	Levels 5 and 6	1	The characters were behind the door on the left coming back from dinner.

The Play's the Thing – Question 2

'It's an eternity, sometimes as much as a quarter of an hour … ' (lines 29-30)

According to Turai, why is a quarter of an hour 'an eternity'?

A It is a long time to expect an audience to sit still in a crowded theatre.
B It seems to take forever for the situation to be clarified at the beginning of a play.
C It always seems to take a long time for a dramatist to write the beginning of a play.
D It seems that time moves slowly when a significant event is happening in a play.

Response	Ireland	OECD	Item Difficulty
Correct (option B)	62	66	Scale Score: 474 Proficiency Level 2
Incorrect	36	30	
Missing/Not reached	2	4	

Situation: *Personal*
Text Format: *Continuous*
Text type: *Narration*
Aspect: *Integrate and Interpret – Develop an interpretation*

The Play's the Thing – Question 3

Overall, what is the dramatist Molnár doing in this extract?

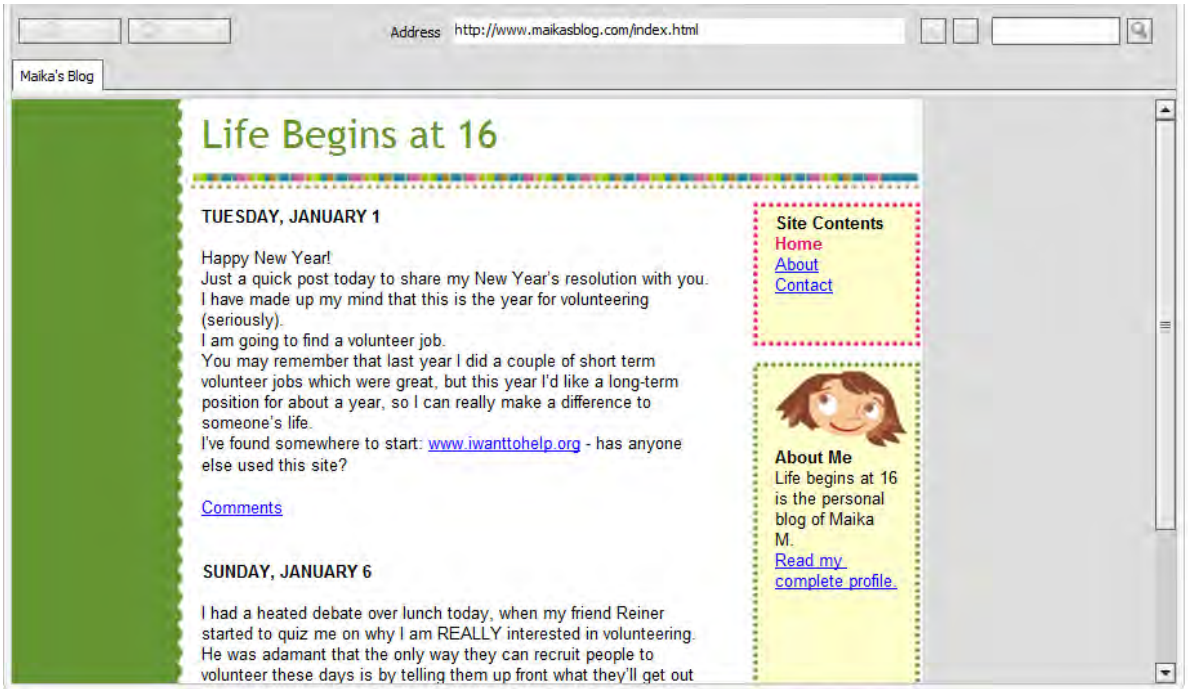
A He is showing the way that each character will solve his own problems.
B He is making his characters demonstrate what an eternity in a play is like.
C He is giving an example of a typical and traditional opening scene for a play.
D He is using the characters to act out one of his own creative problems.

Response	Ireland	OECD	Item Difficulty
Correct (option D)	46	46	Scale Score: 556 Proficiency Level 4
Incorrect	48	48	
Missing/Not reached	6	6	

Situation: *Personal*
Text Format: *Continuous*
Text type: *Narration*
Aspect: *Integrate and interpret – Develop a broad understanding*
Question format: *Multiple choice*

Digital Reading Sample Questions

DIGITAL READING PASSAGE 1: IWANTTOHELP



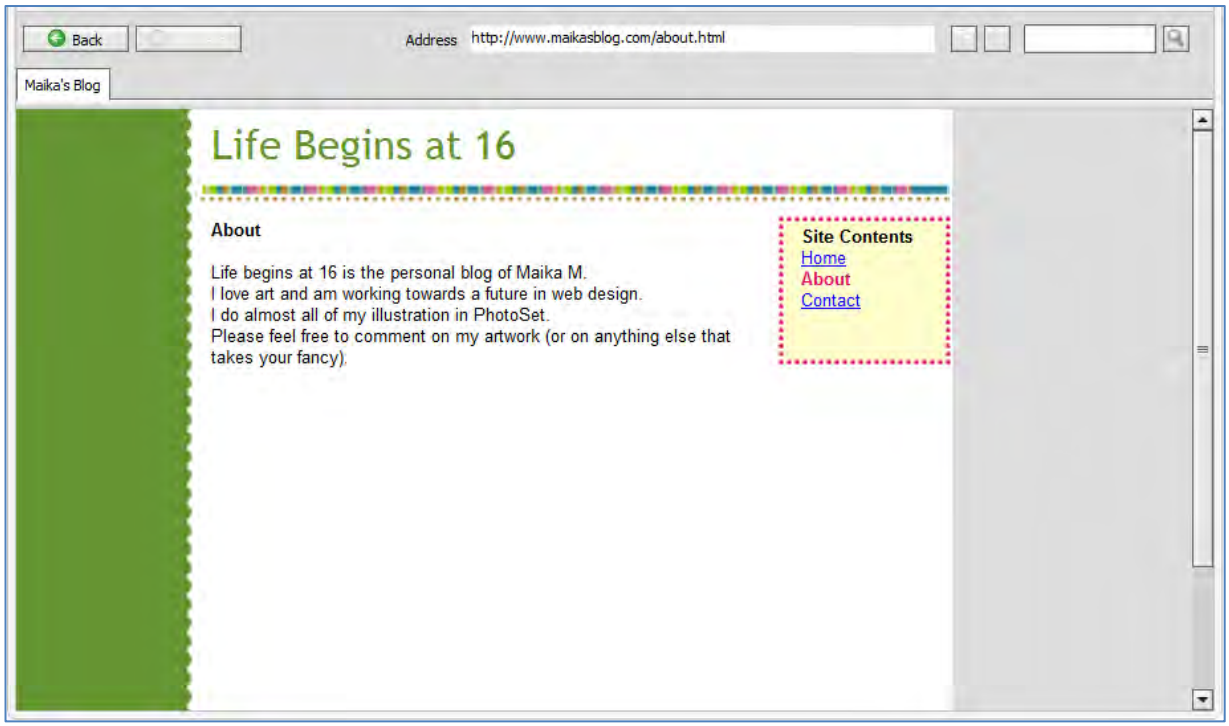
IWANTTOHELP – Question 1

Read Maika's blog entry for January 1. What does the entry say about Maika's experience of volunteering?

A She has been a volunteer for many years.
B She only volunteers in order to be with her friends.
C She has done a little volunteering but would like to do more.
D She has tried volunteering but does not think it is worthwhile.

Response	Ireland	OECD	Item difficulty
Correct (option C)	89	85	Scale score: 362 Below proficiency level 2
Incorrect	10	14	
Missing/Not reached	2	1	

Situation: *Occupational*
Environment: *Message-based*
Text Format: *Continuous*
Text type: *Description*
Aspect: *Access and retrieve – Retrieve information*
Question Format: *Multiple choice*



IWANTTOHELP: Question 2

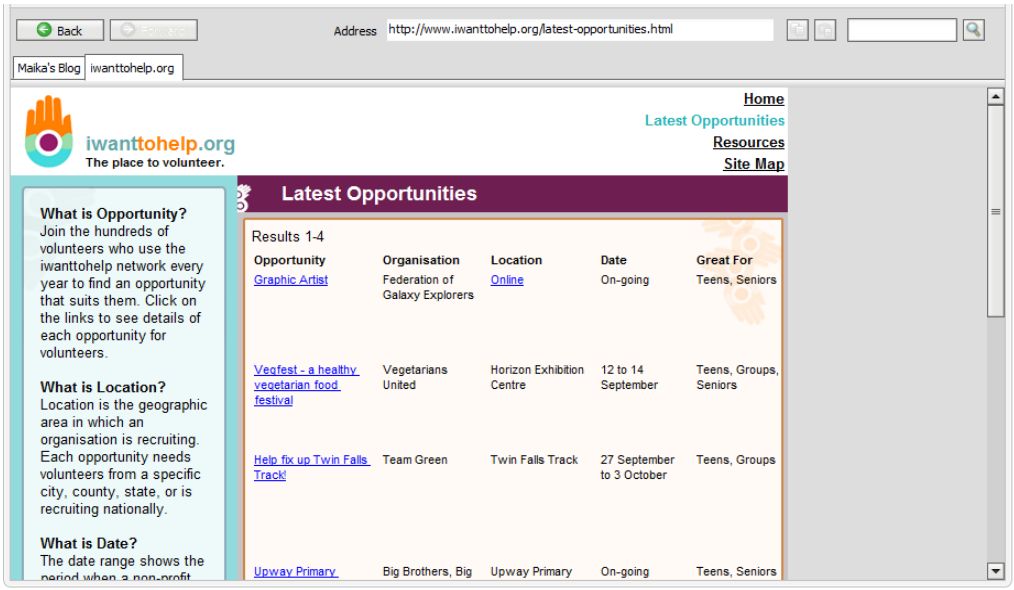
Go to Maika's 'About' page.

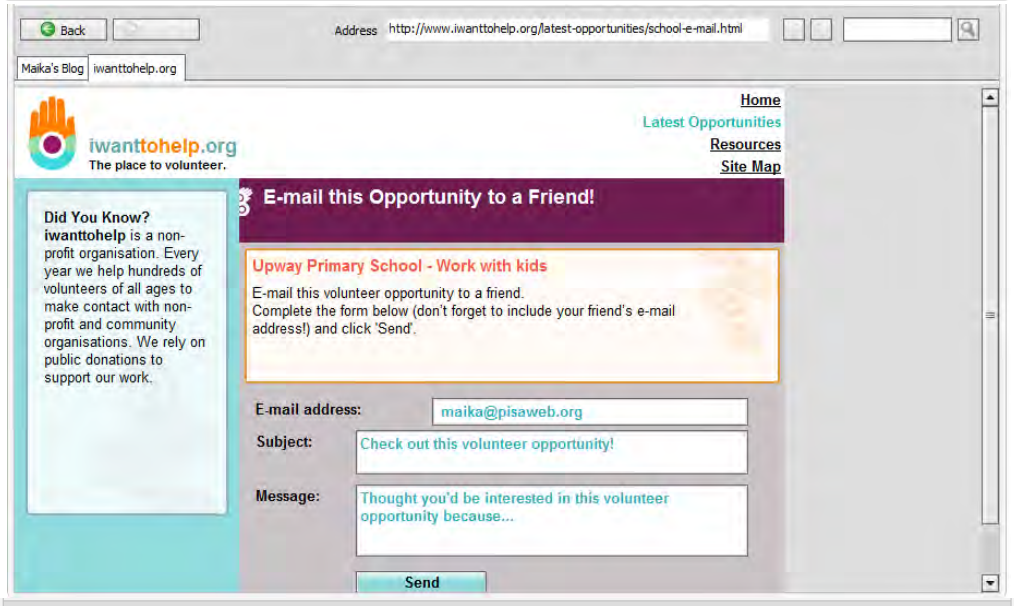
What kind of work does Maika want to do when she leaves school?

A Photography.
B Web design.
C Banking.
D Social work.

Response	Ireland	OECD	Item difficulty
Correct (option B)	76	78	Scale score: 417 Proficiency level 2
Incorrect	22	20	
Missing/Not reached	2	2	

Situation: *Educational*
Environment: *Message-based*
Text Format: *Multiple*
Text type: *Description*
Aspect: *Access and retrieve – Retrieve information*
Question Format: *Multiple choice*


Back
Address http://www.iwanttohelp.org/latest-opportunities.html
Maika's Blog
iwanttohelp.org
iwanttohelp.org
The place to volunteer.
Home
Latest Opportunities
Resources
Site Map
What is Opportunity?
Join the hundreds of volunteers who use the iwanttohelp network every year to find an opportunity that suits them. Click on the links to see details of each opportunity for volunteers.
What is Location?
Location is the geographic area in which an organisation is recruiting. Each opportunity needs volunteers from a specific city, county, state, or is recruiting nationally.
What is Date?
The date range shows the
Latest Opportunities
Results 1-4
Opportunity
Organisation
Location
Date
Great For
Graphic Artist
Federation of Galaxy Explorers
Online
On-going
Teens, Seniors
Vegfest - a healthy vegetarian food festival
Vegetarians United
Horizon Exhibition Centre
12 to 14 September
Teens, Groups, Seniors
Help fix up Twin Falls Track!
Team Green
Twin Falls Track
27 September to 3 October
Teens, Groups
Upway Primary
Big Brothers, Big
Upway Primary
On-going
Teens, Seniors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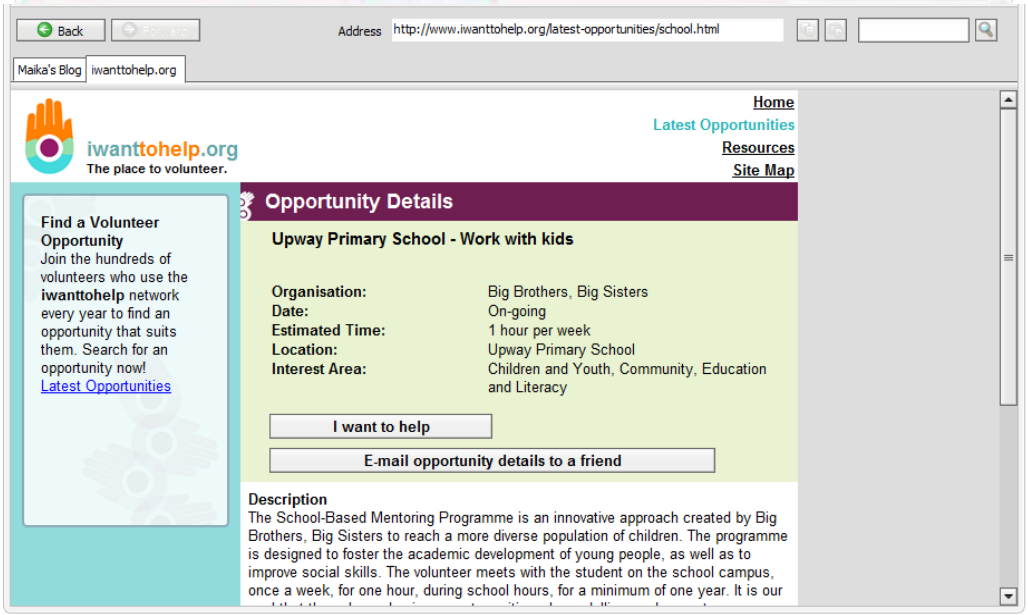
Address http://www.iwanttohelp.org/latest-opportunities/school-e-mail.html
Maika's Blog
iwanttohelp.org
iwanttohelp.org
The place to volunteer.
Home
Latest Opportunities
Resources
Site Map
Did You Know?
iwanttohelp is a non-profit organisation. Every year we help hundreds of volunteers of all ages to make contact with non-profit and community organisations. We rely on public donations to support our work.
E-mail this Opportunity to a Friend!
Upway Primary School - Work with kids
E-mail this volunteer opportunity to a friend.
Complete the form below (don't forget to include your friend's e-mail address!) and click 'Send'.
E-mail address:
maika@pisaweb.org
Subject:
Check out this volunteer opportunity!
Message:
Thought you'd be interested in this volunteer opportunity because...
Send


Back
Address http://www.iwanttohelp.org/latest-opportunities/school.html
Maika's Blog
iwanttohelp.org
iwanttohelp.org
The place to volunteer.
Home
Latest Opportunities
Resources
Site Map
Find a Volunteer Opportunity
Join the hundreds of volunteers who use the iwanttohelp network every year to find an opportunity that suits them. Search for an opportunity now!
Latest Opportunities
Opportunity Details
Upway Primary School - Work with kids
Organisation: Big Brothers, Big Sisters
Date: On-going
Estimated Time: 1 hour per week
Location: Upway Primary School
Interest Area: Children and Youth, Community, Education and Literacy
I want to help
E-mail opportunity details to a friend
Description
The School-Based Mentoring Programme is an innovative approach created by Big Brothers, Big Sisters to reach a more diverse population of children. The programme is designed to foster the academic development of young people, as well as to improve social skills. The volunteer meets with the student on the school campus, once a week, for one hour, during school hours, for a minimum of one year. It is our

IWANTTOHELP – Question 3:

Read Maika's blog for January 1. Go to the iwanttohelp site and find an opportunity for Maika. Use the email button on the 'Opportunity Details' page for this opportunity to tell Maika about it. Explain in the email why the opportunity is suitable for her. Then send your email by clicking on the 'Send' button.

Examples of correct answers (full credit):

Students get credit for locating the place to set up and send the email and refer to ongoing position or future or web design or art, e.g.
You're a great artist and it is ongoing - you said you wanted a longer type of work right?
It's ongoing and it would help you get experience for your future.
You are obviously interested in graphic design, and want to pursue this when you finish school, and you would also love to volunteer. This would be a great opportunity to do both these things, and will look great on your CV too!

Examples of correct answers (partial credit):

Students get credit for locating the place to set up and send the email and the message in the email is vague, incomplete, irrelevant or missing.

Examples of incorrect answers:

Other responses.

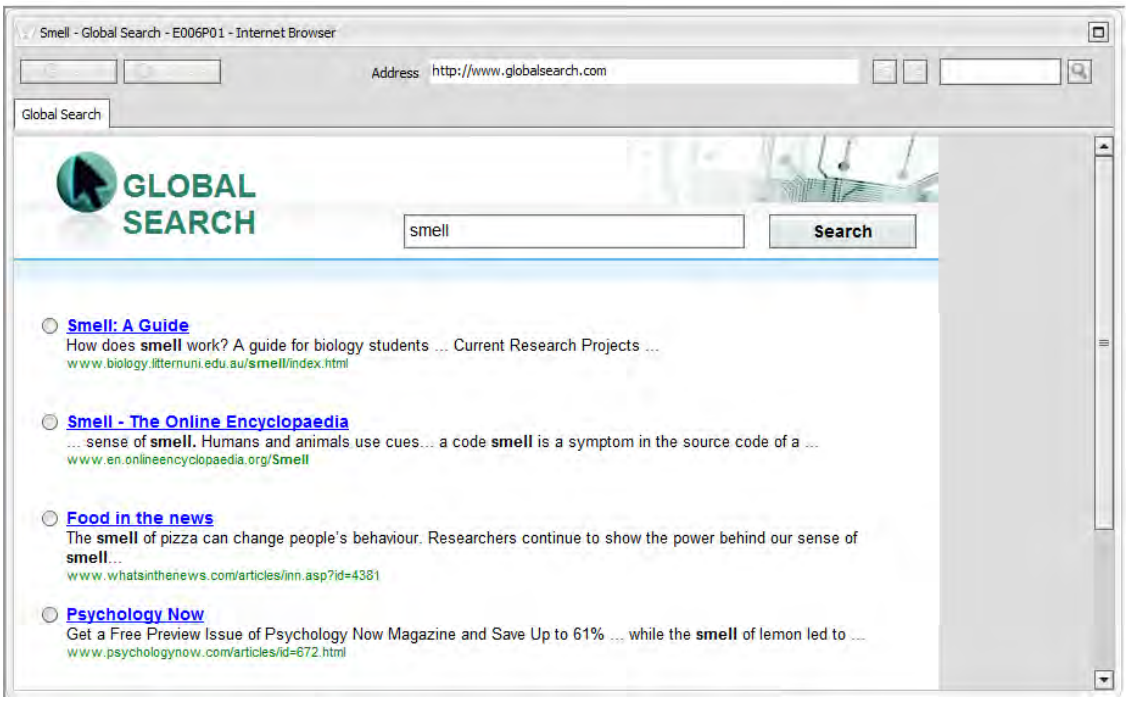
Response	Ireland	OECD	Scale score	Proficiency level
Full credit	49	44	567	4
Partial credit	15	14	525	3
Incorrect	3	5		
Missing/Not reached	33	37		

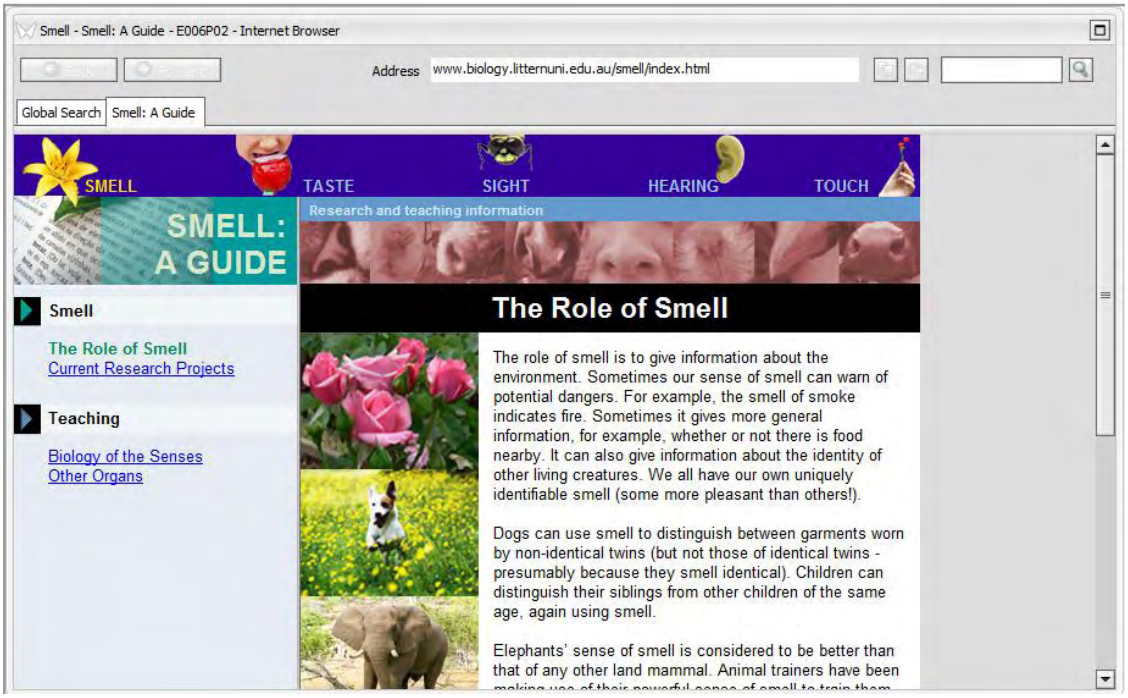
Situation: *Educational*
Environment: *Mixed*
Text Format: *Multiple*
Text type: *Not specified*
Aspect: *Complex*
Question Format: *Open constructed response*

Examples of responses from students in Ireland:

Gender	ESCS Score	Year Level	SSP School	Reading Score	Item Score	Response: *Thought you'd be interested in this volunteer opportunity because…*
Male	Low	Third	Yes	Level 1 or below	2	you like to work with designs
Female	Medium	Third	No	Level 1 or below	2	it's grapic design and you like to to web design taught it might help out :)write back and tell me what ye think love Ya.
Female	Medium	Transition	Yes	Level 2	2	you are looking for something part time and this is just waht you need. you are like a big sister to the children and it is a nice thing to do and a nice way of volunteering. Please get back to me on your thoughtsThank You.
Male	High	Third	No	Level 2	2	you would like to be a graphic designer when you leve sckool and your new year reselotion to be a volunteer so this is the perfect volunteer work for u Meave.
Female	High	Third	No	Level 2	2	its online and its to do with art and design on the wb ! . and as you said on your website thats what you want to do right ? so go ahead and do it (:
Female	Low	Transition	No	Level 3	2	you are in to the whole arts and graphics and i thought this would be great for you. Just what your looking for.
Female	Medium	Transition	No	Level 3	1	it sounds like it would be a great one for you suit you down to the ground.
Female	Medium	Third	No	Level 3	1	[blank]
Male	High	Third	No	Level 3	2	your into art and you want to volunteer so i tought this would be perfect
Male	High	Third	Yes	Level 3	2	Hi Meave,Thought you'd be interested in this volunteer opportunity because you are good at art and you enjoy it! The skills needed in this project are computer skills and you can use it in your art project. Just thought you'd like to know, Adam.
Female	Low	Transition	No	Level 4	2	you are intrested in art so this might be the right choice for you.
Female	Low	Fifth	No	Level 4	2	it involves 2 of your most loved past times, volunteer work and graphic design! I just seen it and thought it would be a perfect opportunity for you. Check it out and let me know what you think. There are also other great opportunities on this website if this one doesn't take your fancy!Anyway Maeve let me know!Johnnio.
Female	Medium	Transition	No	Levels 5 and 6	2	you say you love art and would like to pursue a career in web design after you leave school so this would be good experience for the future. you would also be supporting many good causes by supplying your artistic skills and it would be great fun.
Female	High	Transition	No	Levels 5 and 6	2	you would like to something arty in the future and this would be good experience for you and you would also be doing volunteer work at the same time so its the best of both worlds.

DIGITAL READING PASSAGE 2: Smell





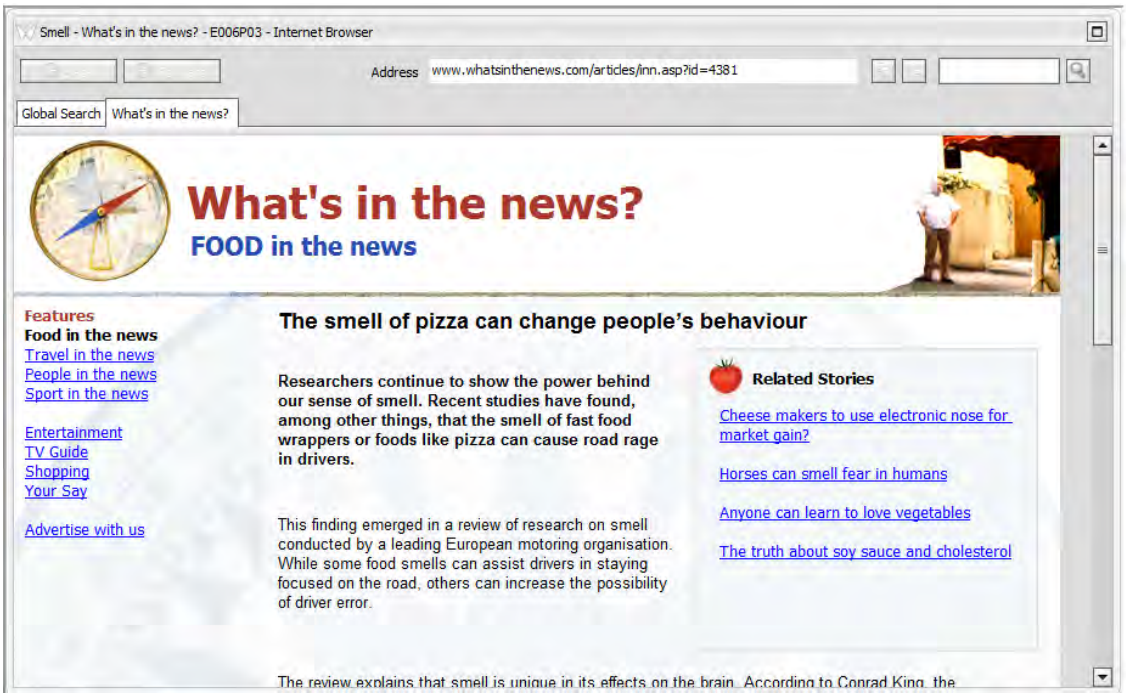
Smell – Question 1:

Go to the 'Smell: A Guide' web page. Which of these statements best expresses the main idea on this page?

A Smell can interfere with normal patterns of behaviour.
B Smell warns humans and animals of danger.
C The primary purpose of smell is to help animals to find food.
D The development of smell takes place early in life.
E The basic function of smell is recognition.

Response	Ireland	OECD	Item difficulty
Correct (option E)	37	42	Scale score: 572 Proficiency level 4
Incorrect	59	54	
Missing/Not reached	4	4	

Situation: *Educational*
Environment: *Authored*
Text Format: *Multiple*
Text type: *Exposition*
Aspect: *Integrate and Interpret – Form a broad understanding*
Question Format: *Multiple choice*



Smell – Question 2:

Go to the 'Food in the news' web page. Would this web page be a suitable source for you to refer to in a school science assignment about smell? Answer Yes or No and refer to the content of the 'Food in the news' web page to give a reason for your answer.

Examples of correct responses (full credit only):

Answers (or implies) **No** and gives a plausible supporting explanation, referring to the trivial or sensational nature of the website content, or the popularisation of the issues by journalists or the site's failure to explicitly give its sources of information; or answers (or implies) **Yes** and indicates that the site would be helpful as a secondary source, leading to more reputable sources; or answers (or implies) Yes and gives a plausible supporting explanation, referring to the article's sources of information or the level of detail provided.

Examples of incorrect responses:

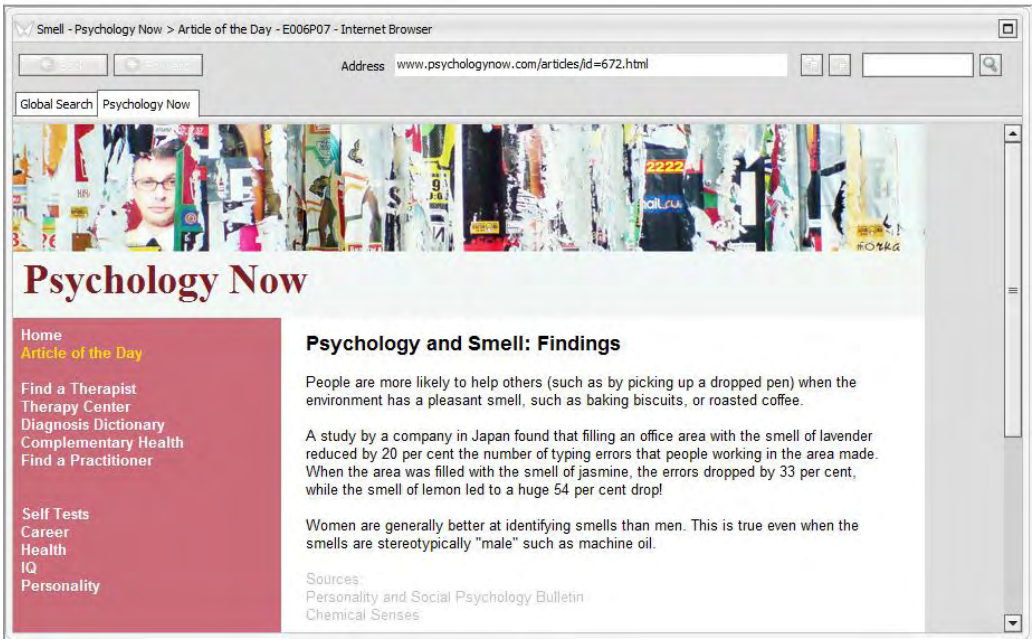
Other irrelevant, vague or incorrect responses.

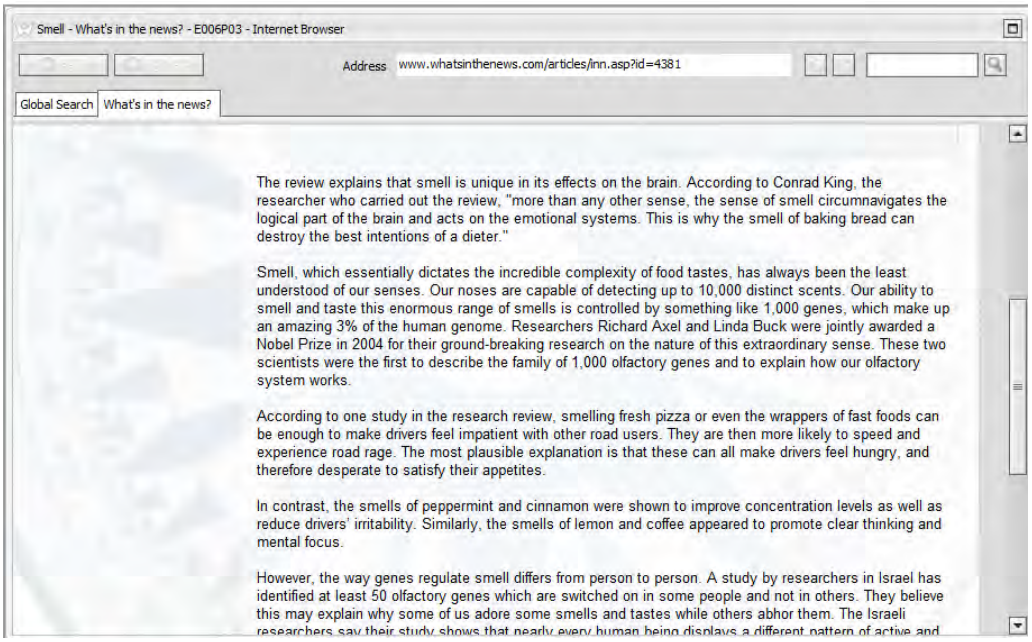
Response	Ireland	OECD	Item difficulty
Correct	23	27	Scale score: 657 Proficiency level 5
Incorrect	69	64	
Missing/Not reached	8	9	

Situation: *Public*
Environment: *Authored*
Text format: *Multiple*
Text type: *Exposition*
Aspect: *Reflect and evaluate – Reflect on and evaluate content of text*
Question format: *Open constructed response*

Examples of responses from students in Ireland:

Gender	ESCS Score	Year Level	SSP School	Reading Score	Item Score	Response
Male	Low	Transition	Yes	Level 1 or below	1	yes as research has been carried out on this topic
Female	Low	Third	Yes	Level 1 or below	0	yes because it is gud
Male	Low	Third	Yes	Level 1 or below	0	it would help you to help students espically with a science project.
Female	Medium	Third	No	Level 1 or below	0	Yes, it would be a good assignment in my science classs because people would want to know about fast food causing road rage.
Female	Medium	Third	No	Level 2	0	no because its telling us that drivers get road rage from smelling pizza wrappers
Male	High	Third	Yes	Level 2	1	yes because you can try different foods to check out the different smells involved in this science assignment and might be a fun experiment
Male	High	Third	No	Level 2	0	Yes as it gives information about how smell reacts with the brian as quoted above
Female	Low	Third	No	Level 3	0	Yes it would be a suitable source because it shows how people's mood is changed by the smell of food and the way they act to get to the food or away it.
Female	Low	Transition	No	Level 3	1	No. I dont think that this web page would be suitable because it isnt taking the issue serious it isnt really what you would call a sceintific answer. It does not give enough detail.
Female	Medium	Fifth	No	Level 3	0	Yes because the article is saying that the smell of food can make us want it more e.g., a lorry drivrer smelling it will increase his speed and experience road rage.
Male	High	Transition	No	Level 3	0	I do not think that this website would be useful for a school assignment -- it is quite in depth in terms of detail. Most of the things mentioned in the article aren't relevant to school children. Therefore I do not think it would be a useful website for a school assignment.
Male	High	Third	No	Level 3	0	Yes I would refer to this in a school asignment about smell because it has many facts about smell
Female	High	Third	No	Level 3	1	Yes i do think that this web page would be a suitable source for students to refer to for a school science assignment because it gives interesting information and it also has statistics in the article .
Female	High	Transition	No	Level 4	0	yes, because this is about how smells can cause driving errors
Female	High	Third	No	Level 4	1	this would not be suitable as it is not a college and it doesnt have a qualified persons name on the screen which means anybody could have written it and it might not be real information
Female	Medium	Transition	No	Levels 5 and 6	0	yes as it tells the reader how certain smells can affect the brain, for example the smell of coffee promotes clear thinking and mental focus. the web page also tells the reader about some of the science behind the sense of smell. all this links in with science and would be suitable for the assignment
Female	High	Transition	No	Levels 5 and 6	1	yes i think it would be a suitable source the information in the second website backs up what the other source says about smell: that gives us information about the environment we live in.





Smell – Question 3:

There is information about the smell of lemon on the pages 'Food in the news' and 'Psychology Now'.

Which statement summarises the conclusions of the two studies about the smell of lemon?

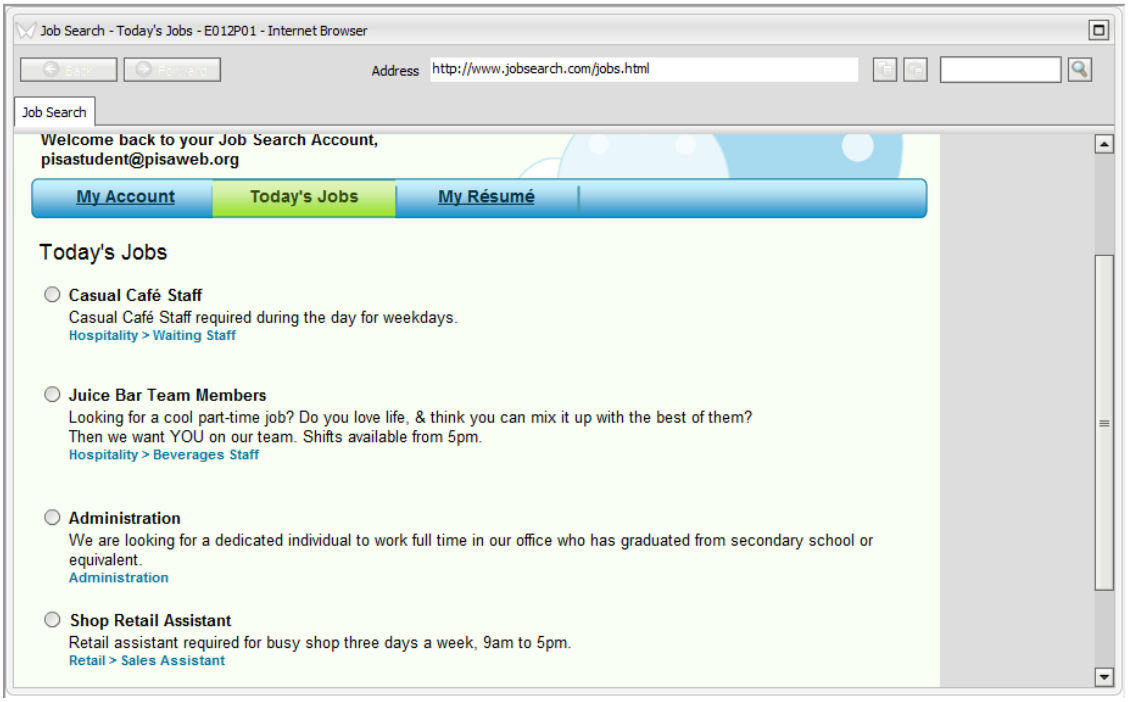
A Both studies suggested that the smell of lemon helps you work quickly.
B Both studies suggested that most people like the smell of lemon.
C Both studies suggested that the smell of lemon helps you to concentrate.
D Both studies suggested that females are better at detecting the smell of lemon than males.

Response	Ireland	OECD	Item difficulty
Correct (option C)	61	64	Scale score: 485 Proficiency level 3
Incorrect	34	31	
Missing/Not reached	5	5	

Situation: *Educational*
Environment: *Authored*
Text Format: *Multiple*
Text type: *Exposition*
Aspect: *Integrate and Interpret – Develop an interpretation*
Question Format: *Multiple choice*

DIGITAL READING PASSAGE 3: Job Search

Job Search – Question 1



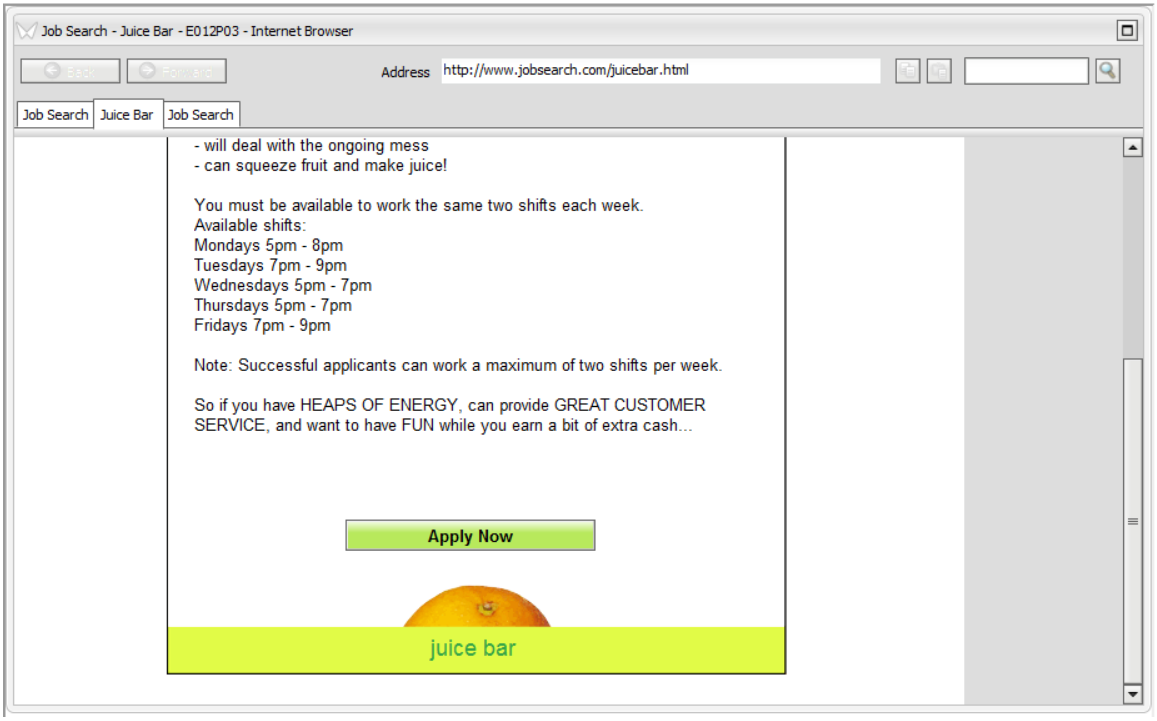
This is a page from a job search website. Which job in this list is most suitable for school students?

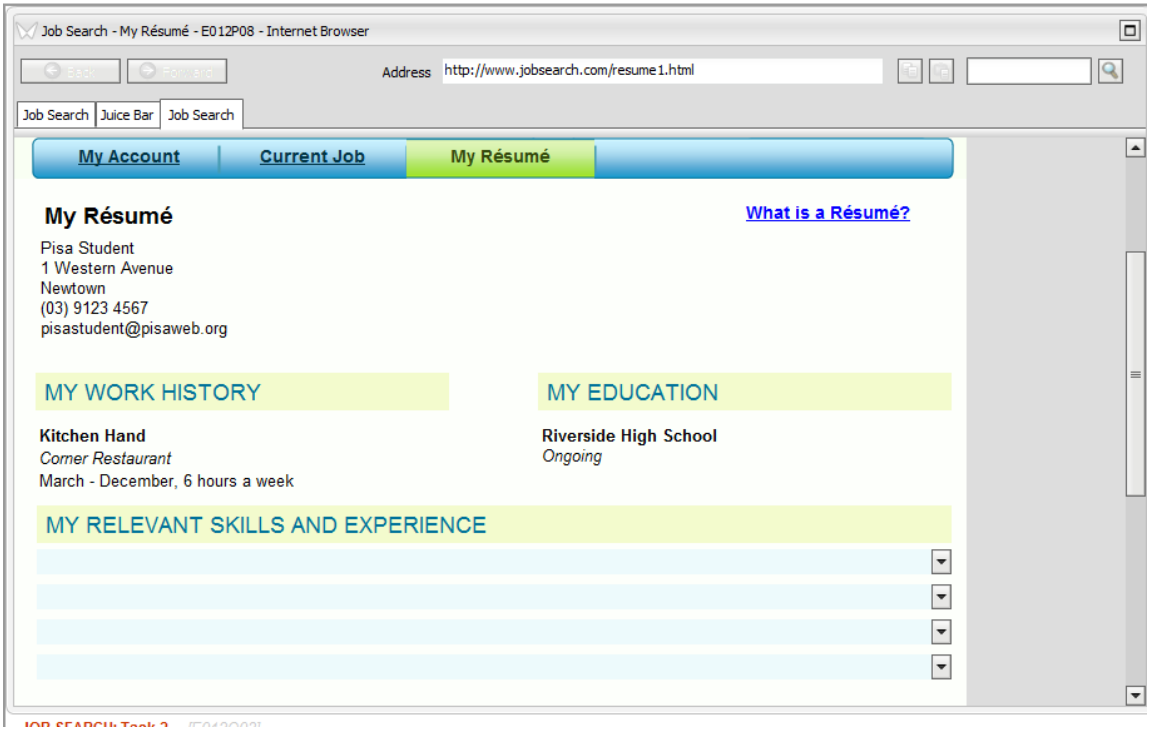
Click on the button next to the job.

Response	Ireland	OECD	Item difficulty
Correct (option B)	77	67	Scale score: 463 Proficiency level 2
Incorrect	21	30	
Missing/Not reached	2	3	

Situation: *Occupational*
Environment: *Authored*
Text format: *Non-continuous*
Text type: *Description*
Aspect: *Reflect and evaluate – Reflect on and evaluate content of text*
Question format: *Multiple choice*

Job Search – Question 2





You have decided to apply for the Juice Bar job. Click on the link and read the requirements for this job. Click on 'Apply Now' at the bottom of the Juice Bar job details to open your résumé page. Complete the 'Relevant Skills and Experience' section of the 'My Résumé' page by choosing four experiences from the drop down lists that match the requirements of the Juice Bar job.

Examples of correct responses (full credit): Selects the following four experiences (in any order):
Efficient at cleaning dishes: working at Corner Restaurant
Good at following instructions: followed kitchen safety regulations daily
Knowledge of food handling and preparation experience: work at Corner Restaurant
Work well with team: won the 2007 sports team player award

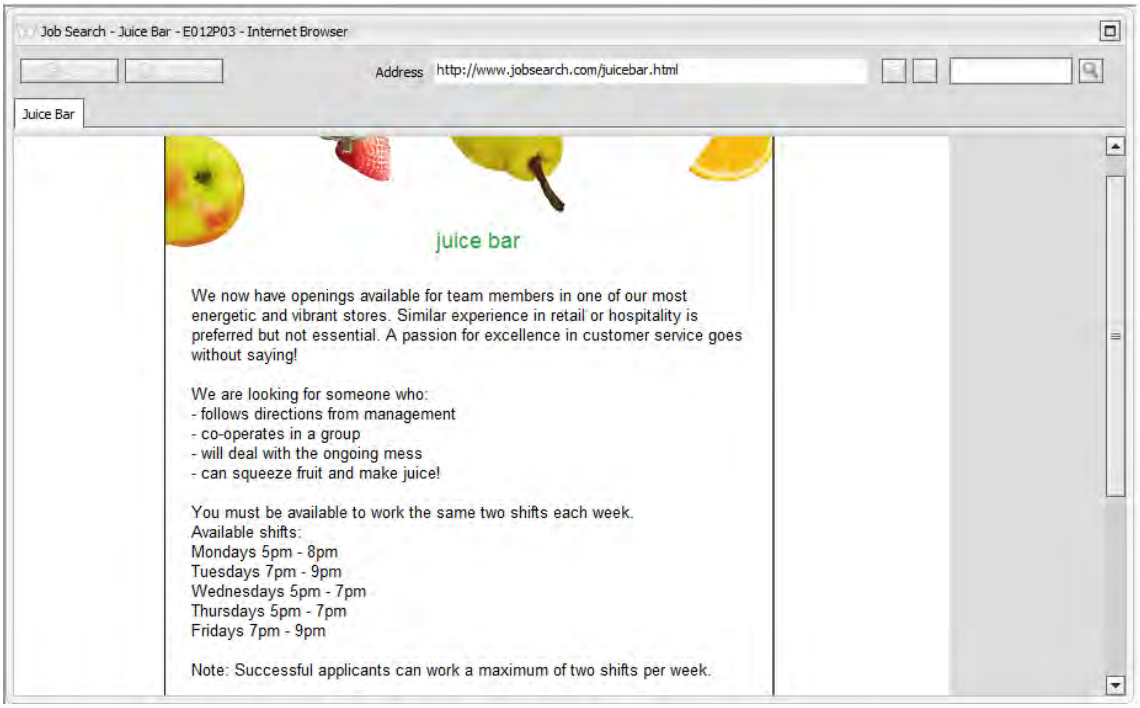
Examples of correct responses (partial credit): Selects any three of the following four experiences (in any order):
Efficient at cleaning dishes: working at Corner Restaurant
Good at following instructions: followed kitchen safety regulations daily
Knowledge of food handling and preparation experience: work at Corner Restaurant
Work well with team: won the 2007 sports team player award

Examples of incorrect responses: Selects two or fewer experiences, correct or otherwise.

Response	Ireland	OECD	Scale score	Proficiency level
Full credit	9	11	624	4
Partial credit	34	29	462	2
Incorrect	23	31		
Missing/Not reached	34	29		

Situation: *Occupational*
Environment: *Message-based*
Text format: *Multiple*
Text type: *Description*
Aspect: *Integrate and interpret – Develop an interpretation*
Question format: *Complex multiple choice*

Job Search – Question 3



'Note: Successful applicants can work a maximum of two shifts per week.'

Why do you think the employer has made this rule?

Examples of correct answers (full credit only):

Refers to a benefit or protection for the employer or employee that is consistent with the stipulation of not working more than two shifts and with working a fixed two shifts. May refer to flexibility, reliability or effectiveness of employees or to the employer's concerns about employee welfare.

Examples of incorrect answers:

Refers to gaining work experience, earning money, or other irrelevant or incorrect reasons.

Response	Ireland	OECD	Item difficulty
Correct	46	49	Scale score: 558 Proficiency level 4
Incorrect	42	35	
Missing/Not reached	12	16	

Situation: *Occupational*
Environment: *Authored*
Text format: *Mixed*
Text type: *Description*
Aspect: *Reflect and evaluate – Reflect on and evaluate content of text*
Question format: *Open constructed response*

Examples of responses from students in Ireland:

Gender	ESCS Score	Year Level	SSP School	Reading Score	Item Score	Response
Male	Low	Transition	Yes	Level 1 or below	0	this is because of the employee trade union
Male	Medium	Third	Yes	Level 1 or below	1	so u dont work to hard and stress urself out
Female	Medium	Third	No	Level 1 or below	0	So the people training can get eought experience.
Female	Medium	Third	No	Level 2	1	if students...so they would have time to study and do homework
Female	Medium	Transition	Yes	Level 2	1	He can't let school pupils work more than the maximum weekly work hours
Male	High	Third	Yes	Level 2	0	to earn extra money for college and another job they might prefer
Female	Low	Third	No	Level 3	1	So that other people can still work at the juice bar and you only have to work two shifts each week
Male	Low	Third	Yes	Level 3	0	the employer made this rule because he needs someone who will be usefull and realiable
Female	Medium	Third	No	Level 3	1	so students will also have time to study and for themselfs.
Male	High	Transition	No	Level 3	0	To allow other students the chance to work in his shop. To make it fair for other applicants.
Male	High	Third	Yes	Level 3	0	Other workers need their jobs too.
Female	Low	Transition	No	Level 4	1	because he wants his staff to work well so they can get extra shifts
Female	Low	Fifth	No	Level 4	0	Because lots of people have been applying for the job, and this way more people get work, which is what they need in times of recession..
Female	High	Transition	No	Level 4	1	Because it is a part-time job and the employer probably knows a lot of school students will apply and have to focus on schoolwork also.
Female	Medium	Transition	No	Levels 5 and 6	1	I think the employer has made this rule because students would be unable to come to work for much longer than this while at school so it saves them having to change shifts by working short hours twice a week.
Female	Medium	Third	No	Levels 5 and 6	1	the employer may have made this rule so that students wont be too tired from working.
Female	High	Transition	No	Levels 5 and 6	0	so that no one works too much and somebody else doesnt get payed more than they should.

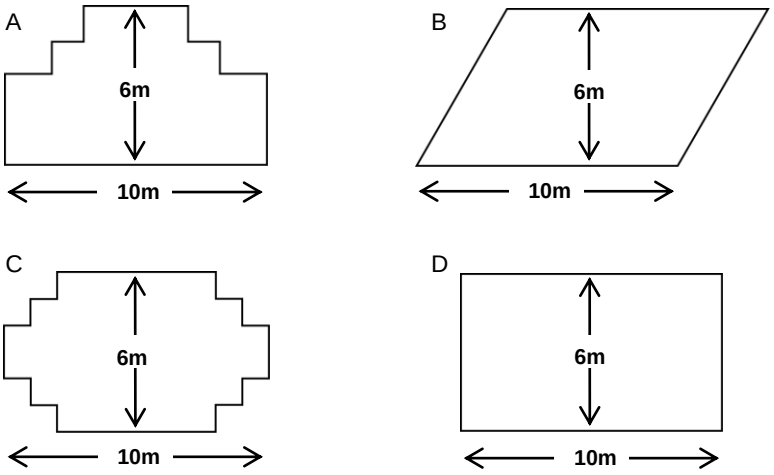
Mathematics Sample Questions

MATHEMATICS PASSAGE 1: Carpenter

A carpenter has 32 metres of timber and wants to make a border around a vegetable patch. He is considering the following designs for the vegetable patch.

Carpenter – Question 1

Circle either 'Yes' or 'No' for each design to indicate whether the vegetable patch can be made with 32 metres of timber.



Vegetable patch design	Using this design, can the vegetable patch be made with 32 metres of timber?
Design A	Yes / No
Design B	Yes / No
Design C	Yes / No
Design D	Yes / No

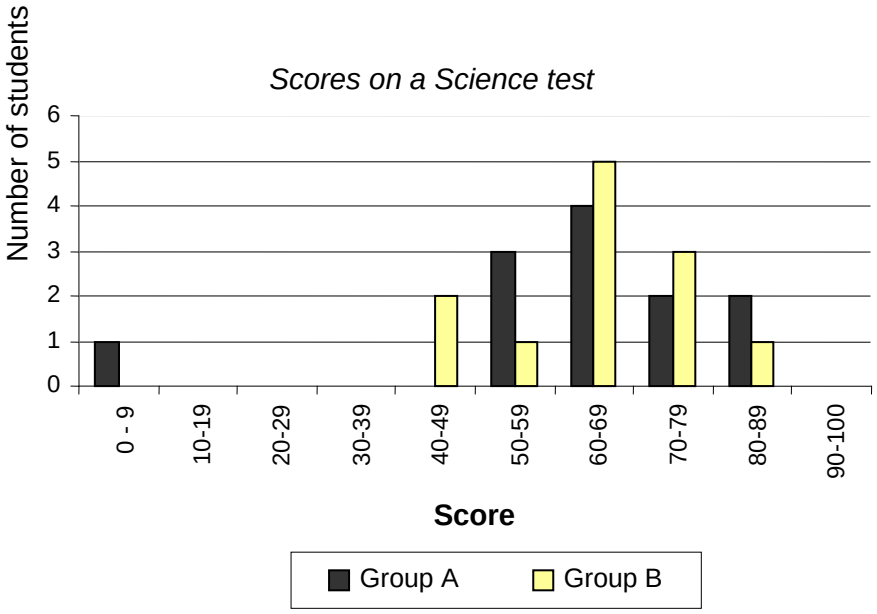
Response	Ireland	OECD	Item Difficulty
Correct (yes, no, yes, yes)	13	20	Scale Score: 687 Proficiency Level: 6
Incorrect	85	77	
Missing/Not reached	2	3	

Situation: *Educational*
Aspect: *Space and Shape*
Question format: *Complex multiple choice*

MATHEMATICS PASSAGE 2: Test Scores

The diagram below shows the results on a Science test for two groups, labelled as Group A and Group B.

The mean score for Group A is 62.0 and the mean for Group B is 64.5. Students pass this test when their score is 50 or above.



Test Scores – Question 1

Looking at the diagram, the teacher claims that Group B did better than Group A in this test. The students in Group A don't agree with their teacher. They try to convince the teacher that Group B may not necessarily have done better.
Give one mathematical argument, using the graph that the students in Group A could use.

Examples of correct answers (full credit only):

Arguments relating to number of students passing, influence of the outlier, or number of students with scores in the highest level.

Examples of incorrect answers:

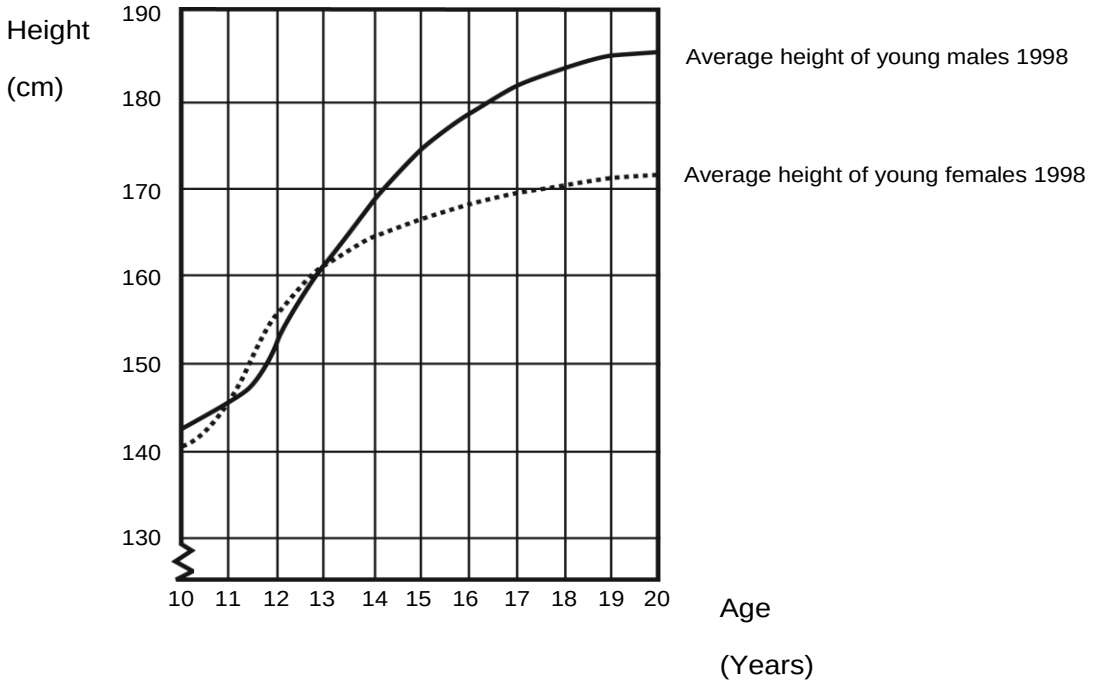
Responses showing incorrect mathematical reasoning or that simply describe differences.

Response	Ireland	OECD	Item Difficulty
Correct	41	32	Scale Score: 620 Proficiency Level: 5
Incorrect	39	33	
Missing/Not reached	20	35	

Situation: *Educational*
Aspect: *Uncertainty*
Question format: *Open constructed response*

MATHEMATICS PASSAGE 3: Growing Up

Young population grows taller



The average height of both young males and young females in the Netherlands in 1998 is represented in this graph.

Growing Up – Question 1

Since 1980 the average height of 20-year-old females has increased by 2.3 cm, to 170.6 cm. What was the average height of a 20-year-old female in 1980?

Answer: _____ cm.

Response	Ireland	OECD	Item Difficulty
Correct (168.3 [cm])	66	67	Scale Score: 478 Proficiency Level: 2
Incorrect	28	25	
Missing/Not reached	6	8	

Situation: *Scientific*
Aspect: *Change and Relationships*
Question format: *Closed constructed response*

Growing Up – Question 2

According to this graph, on average, during which period in their life are females taller than males of the same age?

Examples of correct answers (full credit only):

Gives the correct interval, from 11-13 years (using mathematical or daily-life language).

Examples of incorrect answers:

Other subsets of 11, 12, 13 years; other responses.

Response	Ireland	OECD	Item Difficulty
Correct	52	55	Scale Score: 525 Proficiency Level: 3
Incorrect	45	37	
Missing/Not reached	3	8	

Growing Up – Question 3

Explain how the graph shows that on average the growth rate for girls slows down after 12 years of age.

Examples of correct answers (full credit only):

Response refers to the change of the gradient of the graph for female (explicitly or implicitly, in mathematical language or using daily-life language).

Examples of incorrect answers:

Response indicates that female height drops below male height, but does not mention the steepness of the female graph or makes a comparison of the female growth rate before and after 12 years; other responses.

Response	Ireland	OECD	Item Difficulty
Correct	56	45	Scale Score: 574 Proficiency Level: 4
Incorrect	33	34	
Missing/Not reached	11	21	

Situation: *Scientific*
Aspect: *Change and Relationships*
Question format: *Open constructed response*

MATHEMATICS PASSAGE 4: Exchange Rate

Mei-Ling from Singapore was preparing to go to South Africa for 3 months as an exchange student. She needed to change some Singapore dollars (SGD) into South African rand (ZAR).

Exchange Rate – Question 1

Mei-Ling found out that the exchange rate between Singapore dollars and South African rand was:

1 SGD = 4.2 ZAR.

Mei-Ling changed 3000 Singapore dollars into South African rand at this exchange rate. How much money in South African rand did Mei-Ling get?

Response	Ireland	OECD	Item Difficulty
Correct (12 600 [ZAR])	83	80	Scale Score: 406 Proficiency Level: 1
Incorrect	13	14	
Missing/Not reached	4	7	

Situation: *Public*
Aspect: *Quantity*
Question format: *Short constructed response*

Exchange Rate – Question 2

On returning to Singapore after 3 months, Mei-Ling had 3 900 ZAR left. She changed this back to Singapore dollars, noting that the exchange rate had changed to: 1 SGD = 4.0 ZAR. How much money in Singapore dollars did Mei-Ling get?

Response	Ireland	OECD	Item Difficulty
Correct (975 [SGD])	76	74	Scale Score: 439 Proficiency Level: 2
Incorrect	18	17	
Missing/Not reached	6	9	

Situation: *Public*
Aspect: *Quantity*
Question format: *Short constructed response*

Exchange Rate – Question 3

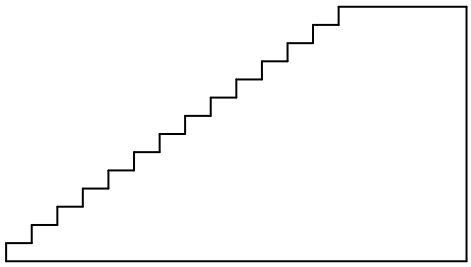
During these 3 months the exchange rate had changed from 4.2 to 4.0 ZAR per SGD. Was it in Mei-Ling's favour that the exchange rate now was 4.0 ZAR instead of 4.2 ZAR, when she changed her South African rand back to Singapore dollars? Give an explanation to support your answer.

Response	Ireland	OECD	Item Difficulty
Correct (Yes, with valid explanation)	41	40	Scale Score: 585 Proficiency Level: 4
Incorrect	46	42	
Missing/Not reached	13	18	

Situation: *Public*
Aspect: *Quantity*
Question format: *Open constructed response*

MATHEMATICS PASSAGE 5: Staircase

The diagram below illustrates a staircase with 14 steps and a total height of 252 cm:



Staircase – Question 1

What is the height of each of the 14 steps?

Height: _____ cm.

Response	Ireland	OECD	Item Difficulty
Correct (18 [cm])	80	78	Scale Score: 421 Proficiency Level: 2
Incorrect	11	12	
Missing/Not reached	9	10	

Situation: *Occupational*
Aspect: *Space and Shape*
Question format: *Short constructed response*

Science Sample Questions

SCIENCE PASSAGE 1: Greenhouse

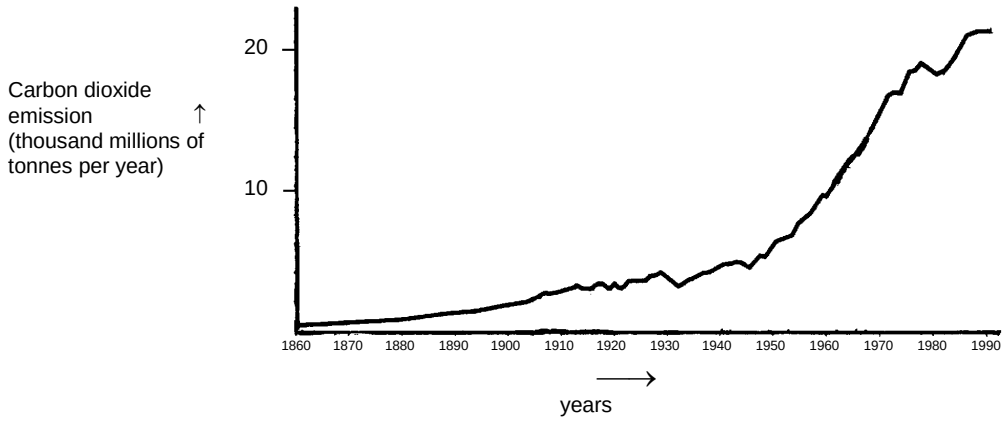
The Greenhouse Effect: Fact or Fiction?

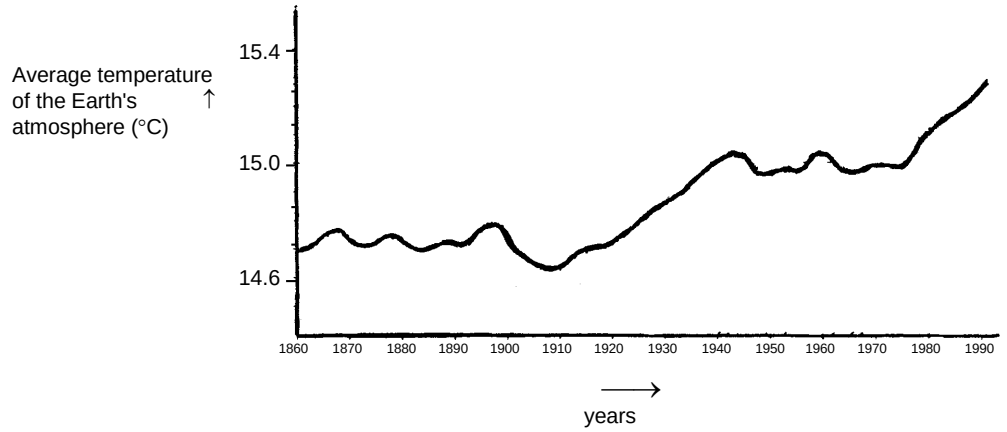
Living things need energy to survive. The energy that sustains life on the Earth comes from the Sun, which radiates energy into space because it is so hot. A tiny proportion of this energy reaches the Earth. The Earth's atmosphere acts like a protective blanket over the surface of our planet, preventing the variations in temperature that would exist in an airless world.

Most of the radiated energy coming from the Sun passes through the Earth's atmosphere. The Earth absorbs some of this energy, and some is reflected back from the Earth's surface. Part of this reflected energy is absorbed by the atmosphere.

As a result of this the average temperature above the Earth's surface is higher than it would be if there were no atmosphere. The Earth's atmosphere has the same effect as a greenhouse, hence the term *greenhouse effect.* The greenhouse effect is said to have become more pronounced during the twentieth century.

It is a fact that the average temperature of the Earth's atmosphere has increased. In newspapers and periodicals the increased carbon dioxide emission is often stated as the main source of the temperature rise in the twentieth century. A student named André becomes interested in the possible relationship between the average temperature of the Earth's atmosphere and the carbon dioxide emission on the Earth. In a library he comes across the following two graphs.





André concludes from these two graphs that it is certain that the increase in the average temperature of the Earth's atmosphere is due to the increase in the carbon dioxide emission.

Greenhouse – Question 1

What is it about the graphs that supports André's conclusion?

Examples of correct answers (full credit only):

Response refers to the increase of both (average) temperature and carbon dioxide emission, or refers (in general terms) to a positive relationship between temperature and carbon dioxide emission.

Examples of incorrect answers:

Refers to the increase of either the (average) temperature or the carbon dioxide emission; refers to temperature and carbon dioxide emission without being clear about the nature of the relationship.

Response	Ireland	OECD	Item Difficulty
Correct	60	54	Scale Score: 529 Proficiency Level: 3
Incorrect	31	32	
Missing/Not reached	9	14	

Situation: *Global*
Aspect: *Using scientific evidence; Scientific explanations*
Question format: *Short constructed response*

Greenhouse – Question 2

Jeanne disagrees with André's conclusion. She compares the two graphs and says that some parts of the graphs do not support his conclusion. Give an example of a part of the graphs that supports Jeanne's conclusion.

Examples of correct answers (full credit only):

Refers to one particular part of the graphs in which the curves are not both descending or both climbing and gives the corresponding explanation.

Examples of incorrect answers:

Mentions a correct period, without any explanation; mentions only one particular year (not a period of time), with an acceptable explanation.

Response	Ireland	OECD	Item Difficulty
Correct	23	22	Scale Score: 659 Proficiency Level: 5
Incorrect	58	42	
Missing/Not reached	19	26	

Situation: *Global*
Aspect: *Using scientific evidence; Scientific explanations*
Question format: *Short constructed response*

Greenhouse – Question 3

André persists in his conclusion that the average temperature rise of the Earth's atmosphere is caused by the increase in the carbon dioxide emission. But Jeanne thinks that his conclusion is premature. She says: 'Before accepting this conclusion you must be sure that other factors that could influence the greenhouse effect are constant'. Name one of the factors that Jeanne means.

Examples of correct answers (full credit only):

Gives a factor referring to the energy/radiation coming from the Sun, or to a natural component or a potential pollutant.

Examples of incorrect answers:

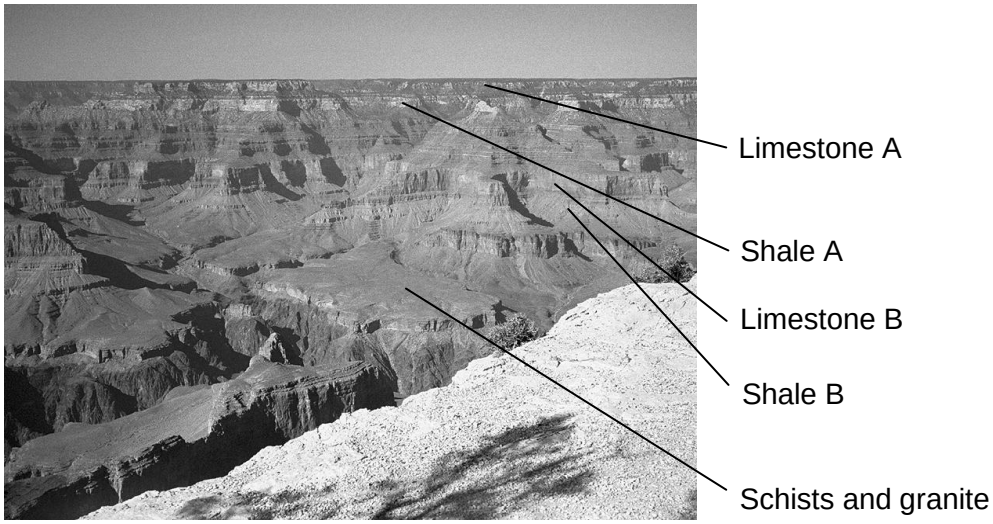
Refers to a cause that influences the carbon dioxide concentration, or a non-specific factor.

Response	Ireland	OECD	Item Difficulty
Correct	19	19	Scale Score: 709 Proficiency Level: 6
Incorrect	50	46	
Missing/Not reached	31	35	

Situation: *Global*
Aspect: *Explaining phenomena scientifically; Earth and space systems*
Question format: *Short constructed response*

SCIENCE PASSAGE 2: The Grand Canyon

The Grand Canyon is located in a desert in the USA. It is a very large and deep canyon containing many layers of rock. Sometime in the past, movements in the Earth's crust lifted these layers up. The Grand Canyon is now 1.6 km deep in parts. The Colorado River runs through the bottom of the canyon. See the picture below of the Grand Canyon taken from its south rim. Several different layers of rock can be seen in the walls of the canyon.



The Grand Canyon – Question 1

About five million people visit the Grand Canyon national park every year. There is concern about the damage that is being caused to the park by so many visitors. Can the following questions be answered by scientific investigation? Circle 'Yes' or 'No' for each question.

Can this question be answered by scientific investigation?	*Yes or No?*
How much erosion is caused by use of the walking tracks?	Yes / No
Is the park area as beautiful as it was 100 years ago?	Yes / No

Response	Ireland	OECD	Item Difficulty
Correct (Yes, No)	74	61	Scale Score: 485 Proficiency Level: 3
Incorrect	25	37	
Missing/Not reached	1	2	

Situation: *Social*
Aspect: *Identifying scientific issues; Scientific enquiry*
Question format: *Complex multiple choice*

The Grand Canyon – Question 2

The temperature in the Grand Canyon ranges from below 0 ^{o}C to over 40 ^{o}C. Although it is a desert area, cracks in the rocks sometimes contain water. How do these temperature changes and the water in rock cracks help to speed up the breakdown of rocks?

A Freezing water dissolves warm rocks.
B Water cements rocks together.
C Ice smoothes the surface of rocks.
D Freezing water expands in the rock cracks.

Response	Ireland	OECD	Item Difficulty
Correct (option D)	87	68	Scale Score: 451 Proficiency Level: 2
Incorrect	11	29	
Missing/Not reached	2	3	

Situation: *Social*
Aspect: *Explaining phenomena scientifically; Earth and space systems*
Question format: *Multiple choice*

The Grand Canyon – Question 3

There are many fossils of marine animals, such as clams, fish and corals, in the Limestone A layer of the Grand Canyon. What happened millions of years ago that explains why such fossils are found there?

A In ancient times, people brought seafood to the area from the ocean.
B Oceans were once much rougher and sea life washed inland on giant waves.
C An ocean covered this area at that time and then receded later.
D Some sea animals once lived on land before migrating to the sea.

Response	Ireland	OECD	Item Difficulty
Correct (option C)	70	76	Scale Score: 411 Proficiency Level: 2
Incorrect	26	20	
Missing/Not reached	4	4	

Situation: *Social*
Aspect: *Explaining phenomena scientifically; Earth and space systems*
Question format: *Multiple choice*

SCIENCE PASSAGE 3: Acid Rain

Below is a photo of statues called Caryatids that were built on the Acropolis in Athens more than 2500 years ago. The statues are made of a type of rock called marble. Marble is composed of calcium carbonate. In 1980, the original statues were transferred inside the museum of the Acropolis and were replaced by replicas. The original statues were being eaten away by acid rain.

Acid Rain – Question 1

Normal rain is slightly acidic because it has absorbed some carbon dioxide from the air. Acid rain is more acidic than normal rain because it has absorbed gases like sulfur oxides and nitrogen oxides as well. Where do these sulphur oxides and nitrogen oxides in the air come from?

Examples of correct answers (full credit only):

Gives any one of car exhausts, factory emissions, burning fossil fuels, or similar, or just refers to pollution.

Examples of incorrect answers:

Responses that do not mention 'pollution' and do not give a significant cause of acid rain.

Response	Ireland	OECD	Item Difficulty
Correct	70	58	Scale Score: 506 Proficiency Level: 3
Incorrect	21	26	
Missing/Not reached	9	16	

Situation: *Social*
Aspect: *Explaining phenomena scientifically; Physical systems*
Question format: *Short constructed response*

Acid Rain – Question 2

The effect of acid rain on marble can be modelled by placing chips of marble in vinegar overnight. Vinegar and acid rain have about the same acidity level. When a marble chip is placed in vinegar, bubbles of gas form. The mass of the dry marble chip can be found before and after the experiment.

A marble chip has a mass of 2.0 grams before being immersed in vinegar overnight. The chip is removed and dried the next day. What will the mass of the dried marble chip be?

A Less than 2.0 grams
B Exactly 2.0 grams
C Between 2.0 and 2.4 grams
D More than 2.4 grams

Response	Ireland	OECD	Item Difficulty
Correct (option A)	68	67	Scale Score: 460 Proficiency Level: 2
Incorrect	30	31	
Missing/Not reached	2	2	

Situation: *Personal*
Aspect: *Using scientific evidence; Physical systems*
Question format: *Multiple choice*

Acid Rain – Question 3

Students who did this experiment also placed marble chips in pure (distilled) water overnight.

Explain why the students include this step in their experiment.

Examples of correct answers (full credit only):

Response explains that the students used water to show that acid (vinegar) is necessary for the reaction.

Examples of incorrect answers:

Refers to a comparison with the vinegar and marble test, without clarifying that vinegar is necessary for the reaction; other insufficient, vague, or irrelevant responses.

Response	Ireland	OECD	Item Difficulty
Correct	23	14	Scale Score: 717 Proficiency Level: 6
Incorrect	67	69	
Missing/Not reached	10	17	

Situation: *Personal*
Aspect: *Identifying scientific issues; Scientific enquiry*
Question format: *Open constructed response*

Appendix C: Additional Tables for Chapter 8

Table C8.1: Comparison of parameter estimates for PISA 2009 print reading: models with and without missing indicators

		With missing indicators						*Without missing indicators*					
Variable	*Level/Comparison*	*PE*	*SE*	*Stat*	*Test Stat*	*df*	*p*	*PE*	*SE*	*Stat*	*Test Stat*	*df*	*p*
	Intercept	509.17	4.726	t	107.740	141	<.001	508.43	4.647	t	109.389	138	<.001
	School Level												
SSP	In SSP-Not in SSP	-24.64	5.743	t	-4.289	141	<.001	-20.27	5.710	t	-3.551	138	.001
Outlier School	Outlier-Not Outlier	-38.63	15.323	t	-2.521	141	.013	-37.16	22.412	t	-1.658	117	.100
	Student Level												
Gender	Gender (female-male)	15.29	4.138	t	3.696	33	.001	12.39	3.886	t	3.187	28	.004
Immigrant/Language status	Immigrant other language-Native same language	-29.48	10.274	Ddiff	57.717	3	<.001	-27.64	10.392	Ddiff	20.203	2	<.001
	Immigrant same language-Native same language	-8.13	6.135					-8.23	6.446				
	Missing immigrant/language	-31.39	7.744										
Number of siblings	No siblings-one or two siblings	6.80	4.996	Ddiff	19.000	4	<.001	7.35	5.746	Ddiff	24.811	3	<.001
	Three siblings-one or two siblings	-6.27	3.518					-10.81	3.717				
	Four or more siblings-one or two siblings	-9.80	4.514					-10.45	3.717				
	Missing siblings	-11.99	13.299										
Parental occupation	Parental occupation (HISEI)	8.36	1.421	Ddiff	53.354	2	<.001	7.72	1.517	t	5.089	54	<.001
	Missing parental occupation	-23.09	14.483										
Parental education	Lower second level or below-upper second level	-17.18	4.168	Ddiff	28.376	3	<.001	-17.87	4.230	Ddiff	30.453	2	<.001
	Third level-upper second level	-0.66	2.953					3.12	3.231				
	Missing parental education	-10.60	10.940										
Books in the home	25 books or fewer-26-200 books	-16.37	4.210	Ddiff	60.733	3	<.001	-17.13	4.188	Ddiff	53.872	2	<.001
	More than 200 books-26-100 books	10.08	3.665					9.40	3.701				
	Missing books in the home	-7.88	12.909										
In part-time work	Works up to 8 hours-does not work	-10.66	3.936	Ddiff	42.244	3	<.001	-5.33	3.749	Ddiff	18.450	2	<.001
	Works more than 8 hours-does not work	-24.00	5.353					-18.94	5.935				
	Missing in part-time work	-12.92	8.336										
Grade	Grade 9-Grade 8	-39.60	9.687	Ddiff	137.227	3	<.001	-40.10	13.210	Ddiff	108.124	3	<.001
	Grade 9-Grade 10 (TYP)	20.45	3.181					19.46	3.236				
	Grade 9-Grade 11	19.55	4.002					20.96	4.579				
Metacognitive summarising strategies	Metacognitive summarising strategies	14.87	1.201	Ddiff	189.467	2	<.001	15.46	1.416	t	10.919	1796	<.001
	Missing metacognitive summarising strategies	-45.38	10.405										
Understanding and remembering strategies	Understanding and remembering strategies	10.92	1.501	Ddiff	120.512	2	<.001	10.89	1.679	t	6.486	71	<.001
	Missing understanding and remembering strategies	-37.53	8.480										
Reading for enjoyment	Does not read-reads up to 30 minutes	7.99	3.290	Ddiff	29.446	4	<.001	6.48	3.907	Ddiff	20.893	3	<.001
	Does not read-read up to 60 minutes	15.93	4.270					13.85	4.718				
	Does not read-reads more than 60 minutes	21.50	5.097					19.83	5.929				
	Missing reading for enjoyment	2.05	15.017										
Attitude to reading	Attitude to reading	24.33	2.337	Ddiff	235.407	2	<.001	26.90	2.295	t	11.722	147	<.001
	Missing attitude to reading	11.81	10.254										
Library usage	Library usage	-16.58	1.508	Ddiff	228.064	2	<.001	-16.64	1.514	t	-10.988	64	<.001
	Missing library usage	30.67	21.700										
Online reading	Online reading	5.52	1.177	Ddiff	31.211	2	<.001	1.64	1.270	t	1.290	3022	.198
	Missing online reading	30.84	27.145										
Early school leaving risk	Early school leaving risk (no-yes)	-20.03	4.478	Ddiff	29.855	2	<.001	-16.39	4.985	t	-3.289	3022	.011
	Missing early school leaving risk	-7.45	15.542										
Absences past two weeks	No absences-absent one to four days	-2.08	2.982	Ddiff	20.037	3	<.001	-1.92	3.034	Ddiff	12.707	2	.002
	No absences-absent five days or more	-13.46	5.515					-14.78	5.653				
	Missing absences past two weeks	-29.33	14.110										

Table C8.2: Comparison of parameter estimates for PISA 2009 digital reading: models with and without missing indicators

		With missing indicators						Without missing indicators					
Variable	*Level/Comparison*	*PE*	*SE*	*Stat*	*Test Stat*	*df*	*p*	*PE*	*SE*	*Stat*	*Test Stat*	*df*	*p*
	Intercept	492.52	6.406	t	78.880	85	<.001	494.50	6.690	t	73.917	112	<.001
Gender	Gender (female-male)	9.92	3.761	t	2.637	158	.010	9.72	3.772	t	2.577	321	.011
Immigrant/Language status	Immigrant other language-Native same language	-36.63	11.392	Ddiff	50.809	3	<.001	-39.91	10.997	Ddiff	41.606	2	
	Immigrant same language-Native same language	-18.77	6.700					-18.89	7.424				
	Missing immigrant/language	-17.00	8.028										
Number of siblings	No siblings-one or two siblings	15.51	5.463	Ddiff	52.492	4	<.001	13.64	6.353	Ddiff	51.540	3	<.001
	Three siblings-one or two siblings	-10.81	3.698					-14.66	4.009				
	Four or more siblings-one or two siblings	-16.26	4.819					-17.83	4.970				
	Missing siblings	-8.59	16.106										
Parental occupation	Parental occupation (HISEI)	8.81	1.510	Ddiff	57.768	2	<.001	8.16	1.651	t	4.942	126	<.001
	Missing parental occupation	-31.32	14.143										
Parental education	Lower second level or below-upper second level	-15.36	4.708	Ddiff	19.286	3	<.001	-17.21	5.169	Ddiff	21.130	2	<.001
	Third level-upper second level	-2.44	3.084					0.74	3.271				
	Missing parental education	-1.86	12.265										
Books in the home	25 books or fewer-26-200 books	-11.01	4.714	Ddiff	39.454	3	<.001	-12.77	5.055	Ddiff	39.509	2	<.001
	More than 200 books-26-100 books	12.10	3.621					12.30	3.979				
	Missing books in the home	6.56	12.868										
In part-time work	Works up to 8 hours-does not work	-10.05	3.859	Ddiff	29.856	3	<.001	-5.93	4.118	Ddiff	16.114	2	<.001
	Works more than 8 hours-does not work	-21.01	5.202					-18.91	6.095				
	Missing in part-time work	-11.93	8.844										
Grade	Grade 9-Grade 8	-52.10	10.341	Ddiff	177.930	3	<.001	-46.56	15.887	Ddiff	130.024	3	<.001
	Grade 9-Grade 10 (TYP)	22.92	3.456					21.67	3.577				
	Grade 9-Grade 11	24.42	4.863					27.09	5.024				
Attended preschool	Attended preschool (yes-no)	8.86	4.100	Ddiff	16.186	2	<.001	7.43	4.753	t	1.562	24	.131
	Missing attended preschool	24.06	20.284										
Metacognitive summarising strategies	Metacognitive summarising strategies	13.28	1.429	Ddiff	137.400	2	<.001	12.65	1.696	t	7.459	522	<.001
	Missing metacognitive summarising strategies	-43.00	11.365										
Understanding and remembering strategies	Understanding and remembering strategies	13.51	1.703	Ddiff	130.990	2	<.001	13.70	1.991	t	6.882	51	<.001
	Missing understanding and remembering strategies	-25.31	8.546										
Reading for enjoyment	Does not read-reads up to 30 minutes	3.83	3.412	Ddiff	20.233	4	<.001	3.12	4.466	Ddiff	11.300	3	.010
	Does not read-read up to 60 minutes	12.81	4.673					11.71	4.891				
	Does not read-reads more than 60 minutes	13.68	5.243					13.08	6.511				
	Missing reading for enjoyment	35.02	19.722										
Attitude to reading	Attitude to reading	21.45	2.155	Ddiff	170.761	2	<.001	22.66	2.402	t	9.434	117	<.001
	Missing attitude to reading	20.84	11.356										
Library usage	Library usage	-17.38	1.411	Ddiff	215.004	2	<.001	-17.80	1.512	t	-11.772	908	<.001
	Missing library usage	-26.91	19.130										
Online reading	Online reading	15.32	1.378	Ddiff	191.201	2	<.001	12.52	1.635	t	7.654	736	<.001
	Missing online reading	7.00	30.835										
Early school leaving risk	Early school leaving risk (no-yes)	-14.75	5.116	Ddiff	17.497	2	<.001	-14.28	5.982	t	-2.386	212	.018
	Missing early school leaving risk	-17.44	14.622										

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