Department of Education and Skills

Memorandum

Irish Students' Performance in PISA 2012

1. Background

1.1 . What is PISA?

- The Programme for International Student Assessment (PISA) is a project of the Organisation for Economic Co-operation and Development (OECD) that aims to measure how well students, at age 15, are prepared to meet the challenges they may encounter in future life, including education. PISA takes place every three years and assesses students in the three domains of reading, mathematics and science[1]. The first PISA assessments took place in 2000 and have since been followed by assessments in 2003, 2006, 2009 and 2012.

1.2. Release of PISA 2012 results

- The outcomes of the 2012 cycle and the contents of this information note are under strict embargo until Tuesday, 3 December 2013 at 11.00 a.m. Paris time (i.e. 10.00 a.m. Irish time).
- The OECD will publish the outcomes of PISA 2012 at 11.00am, Paris time on Tuesday 3 December 2013. Simultaneously, the Educational Research Centre, Drumcondra will publish a report on the PISA 2012 outcomes for Ireland.

1.3. How is PISA administered?

- PISA is implemented by the OECD which has a contract with a consortium of research bodies that carry out the research on its behalf. Between 2000 and 2012, the Consortium was led by the Australian Council for Educational Research (ACER). In 2012, the PISA assessments were administered in 65 education systems, representing over 80% of the world's economy (34 OECD member countries and 31 other partner countries/economies).

- Each cycle of PISA focuses on one 'major domain', either reading, mathematics or science, to which the majority of testing time is devoted. The 'minor domains' provide a less detailed account of achievement. Mathematics was the major domain in PISA 2012, while minor domains included reading literacy and science.

- In comparing performance over time, the OECD compares each domain to when it was a major domain. In the report on PISA 2012, the comparisons are made as follows:
    - Outcomes in mathematics in 2012 are compared to those in 2003;
    - Outcomes in reading are compared with outcomes in 2009 and 2000;

[1] Throughout the PISA report, the terms reading, mathematics and science are used as shorthand for reading literacy, mathematical literacy, and scientific literacy

- Outcomes in science are compared with outcomes in 2006

Both the OECD and Irish national reports also draw some comparisons between mathematics and science performance between 2009 and 2012.

- In 2012, countries had the option of participating in computer-based assessments of reading and mathematics in addition to the traditional paper-based assessments of mathematics, reading and science.[2] Ireland participated in both paper based and computer based assessments. This means that outcomes will be published for Irish students in:
  - Print Mathematics
  - Computer-based Mathematics
  - Print Reading
  - Digital (computer-based) Reading
  - Science

- 23 OECD countries and 9 other partner countries/economies participated in the computer-based assessments of reading and mathematics.

- PISA 2012 consisted of a field trial and main study. In Ireland, these were managed by the Educational Research Centre (ERC) on behalf of the Department of Education and Skills (DES). The actual assessments in schools were administered by inspectors from the DES and, in a small number of cases, representatives of the ERC.

- PISA also collects contextual information through questionnaires completed by student and principals, as well as some information from national sources (such as the DES post-primary database).

1.5 Who takes PISA?

- PISA is based on a random sample of 15-year old students in each of the participating countries. In 2012, 182 schools in Ireland took part, giving a weighted school-level response of 99.2%, after replacement. After refusals and absences were taken into account, 5016 students completed the print assessment, giving a weighted student response rate of 84.1%.

- Of the students who participated in Ireland, the majority (60.5%) were in Third year, almost a quarter (24.3%) were in Transition Year, 13.3% were in Fifth Year and 1.9% were in First or Second Year. It should be noted that students in Third Year and in Transition Year in 2012 would not have encountered the new Project Maths syllabus, except those in a small number of Project Maths pilot schools.

- A total of 2,396 students participated in the computer-based assessment which was 67% of students sampled to participate.

- Ireland met all response criteria laid out by the OECD.

[2] Science is the only domain in PISA 2012 that did not have a computer-based component. Only 32 of the 65 countries participating in PISA 2012 opted to take part in the computer-based assessment.

2. Results of Irish students for mathematics in 2012

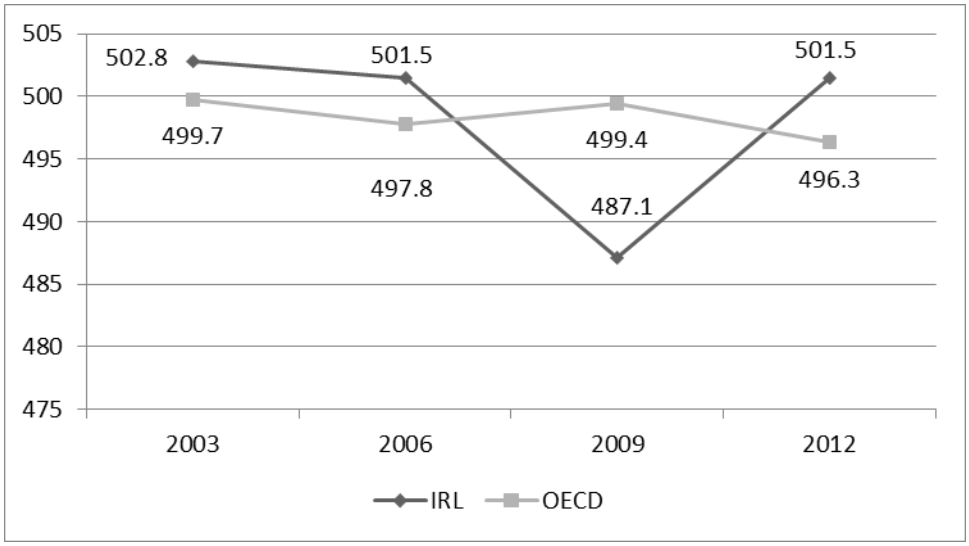
2.1 How well did Irish students perform in Print Mathematics?

- For the first time in PISA, Irish students performed significantly above the OECD average on print mathematics. Ireland was placed 13th of the 34 OECD countries and 20th overall of the 65 countries.

- On print mathematics, Ireland performed significantly below sixteen participating countries including Estonia, Finland, Poland and Germany. Ireland performed significantly above 39 participating countries including Norway, Sweden and the US. Ireland was in a group of ten countries including Australia, New Zealand and the United Kingdom whose average scores in mathematics were not significantly different from one another. The performance of students in Northern Ireland (which was part of the United Kingdom sample) was below the OECD average and that of Ireland. Appendix 1 provides more detail on the performance of Ireland relative to other countries.

- Ireland's performance in 2012 showed a significant improvement on that achieved in 2009 but there was no improvement in the average mathematics score achieved compared to 2003, when mathematics was also the major domain. In 2003 Ireland's mathematics performance was not significantly different from the OECD average[3]. See Figure 1.

Figure 1. Mean scores on the overall mathematics scale for Ireland and the OECD average, 2003 to 2012



- Student performance in Ireland showed no significant change in the content areas of Change and Relationships, Space and Shape or Quantity- between 2003 and 2012. While Uncertainty and Data was the content area where Irish students scored best in both assessments, there was a significant fall in student performance since 2003,

[3] This is explained by a lowering of the OECD average performance over time with an increase in the numbers of participating countries.

particularly among higher achieving students. Irish students also continue to perform poorly on Space and Shape, which has a negative impact on overall achievement.

- The score achieved by the lowest performing students (students at the 10th percentile) on overall mathematics in Ireland was higher than the corresponding OECD average. However, the score showed little change from that achieved by this group of Irish students in 2003.

- The score achieved by the highest performing students on overall paper mathematics (those at the 90th percentile) in Ireland was not significantly different from the average across the OECD and represented a slight drop in performance of this group of Irish students compared to 2003. Given that overall mathematics performance is above the OECD average, this suggests that higher achieving students in Ireland are underachieving.

- The average proportion of students across OECD countries who perform below Level 2[4] on overall print mathematics is 23.1%. Encouragingly, the proportion of Irish students (16.9%) that perform below Level 2 on print mathematics is well below this. With the exception of 2009, there has been little variation in the proportions of Irish students below Level 2 since 2003.

- 11% of Irish students performed at the highest levels of proficiency (at or above Level 5). This is slightly below the OECD average of 13%. With the exception of 2009, there has been little variation in the proportions of Irish students at or above Level 5 since 2003.

- Irish boys outperformed girls in print mathematics both overall and across each of the content and process areas[5]. Gender differences in performance in Ireland in PISA 2012 showed little or no change from 2003. The proportion of boys and girls scoring below Level 2 and at or above Level 5 also showed little change from 2003. The difference between the performance of boys and girls is slightly higher in Ireland compared with the average differences across OECD countries but not significantly so.

2.2 How well did Irish students perform in Computer-based Mathematics?

- Compared to their performance on the print mathematics assessment, Irish students did significantly less well on the computer-based assessment of mathematics. However, it is difficult to draw satisfactory conclusions from the outcomes of this element of the assessment as there were wide differences in the performance of many countries across the two modes of assessment. Of the 32 countries participating in both the print- and computer-based mathematics assessments, 15 scored better on the print mathematics assessment while 17 performed better on

[4] In each domain, Level 2 is considered by the OECD to be the basic level of proficiency needed to participate effectively and productively in society and in future learning.

[5] In addition to four content areas, three mathematics processes were assessed in PISA 2012 - *formulating* situations mathematically; *employing* mathematical concepts, facts, procedures and reasoning; and *interpreting*, applying and evaluating mathematical outcomes.

the computer-based assessment. Appendix 2 provides more detail on the performance of Ireland relative to other countries on computer-based mathematics. The average score for Irish students on the computer-based assessment of mathematics was not significantly different from the corresponding OECD average score.

- Lower-achieving students in Ireland (those scoring at the 10th percentile) performed slightly, but not significantly, above the OECD average on computer based mathematics while our higher-achieving students (those scoring at the 90th percentile) performed significantly below the OECD average.

- Only 7% of Irish students scored at Level 5 or above on computer-based mathematics, compared with 11% on average across OECD countries.

- As with print mathematics, boys outperformed girls on the computer-based assessment. Irish boys performed, on average, at the same level as boys did on average across OECD countries, while girls performed significantly less well. The gap in performance between Irish boys and girls is greater for computer-based mathematics than for print mathematics, with twice as many boys as girls scoring at Level 5 or above on the latter.

2.3 What key conclusions can be drawn in relation to performance in mathematics?

- The results achieved by Ireland in mathematics are welcome, but when compared to 2003 they show little real progress, indicating that a good deal of work is yet to be done. Although performance in 2012 was above the OECD average for the first time, there has not been any substantive improvement in the performance of Irish students in mathematics since 2003, including among the highest and lowest achieving students. This is a concern.

- The strikingly poor performance on Space and Shape is in line with the outcome of TIMSS[6] 2011 and other national and international assessments.

  It should be noted that Ireland is not unique in terms of performing relatively poorly on Space and Shape. Other countries, especially those that might be described as mainly English-speaking (e.g. UK, US, New Zealand and Northern Ireland) also underperform in this area. Students in a number of European countries (e.g. Austria, Belgium, Estonia, Germany, the Netherlands and Poland) perform above the OECD average although none perform as well as the Asian countries.

- The relatively poor performance of Irish 15-year-old girls in mathematics compared to boys is puzzling, especially when the opposite occurs in print and digital reading and there is no significant difference between the performance of boys and girls in science. Neither is underperformance among girls reflected in the Junior Certificate examination where, on average, girls achieve higher grades in mathematics than boys. Also, there was no significant difference in the performance of boys and girls

[6] TIMSS (Trends in International Mathematics and Science Study) is a large, international comparative study that assesses the mathematics and science skills of primary school pupils. In Ireland, the participating students were in 4th class.

at primary level in mathematics as indicated in the National Assessments in 2009 (sixth class pupils) and the TIMSS 2011 study (fourth class pupils).

There is clearly a need to promote mathematics among girls, particularly in post-primary schools.

- The underperformance of higher-achieving students in Ireland in both print and computer-based mathematics is a matter of concern but is not altogether unexpected. The need to challenge the more-able students is a constant theme of inspection reports in mathematics.

  The PISA report (2012) indicates that the use of formative assessment (where teachers provide feedback designed to improve student performance) and engagement by students with extracurricular activities related to mathematics are low compared to the OECD generally. This may have a negative impact on how the more able students, in particular, develop their proficiency in mathematics.

- The limited spread of results, i.e. the relatively narrow gap between lower-achieving and higher-achieving students, in Ireland compared to other OECD countries is very welcome, as are relatively small differences in performance across schools. However, these patterns may be linked to the relatively weak performance of higher-achieving students in Ireland, compared with higher-achievers in other OECD countries, coupled with relatively strong performance among lower-achieving students.

  These patterns suggest a need to raise performance across all achievement levels – among high achieving students because they appear to be under-performing, and among lower-achieving students because they continue to lack key mathematical skills needed for their future lives.

  Given that performance in mathematics was only marginally, albeit significantly, above the OECD average and significantly behind countries such as Estonia and Finland, there is certainly plenty of scope for improvement.

3. Results of Irish students for reading in 2012

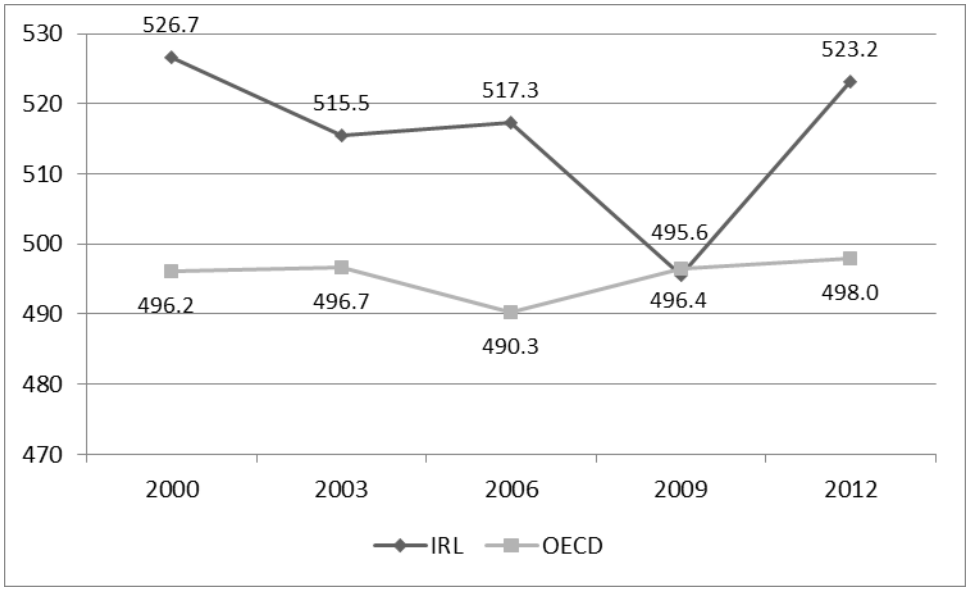
3.1 How well did Irish students perform in Print Reading?

- The mean performance of Irish students was significantly above the OECD average. Ireland ranked 4th out the 34 OECD countries and 7th of all 65 participating countries.

- In print reading, Ireland performed significantly below five participating countries (all Asian) and above 54 countries including New Zealand, Australia, Germany, the UK and the US. Finland, Canada and Poland were among the five countries whose performance in print reading was similar to Ireland. Students in Ireland significantly outperformed their counterparts in Northern Ireland. Appendix 3 provides more detail on the performance of Ireland relative to other countries.

- The average score in Ireland on print reading is significantly above that achieved in 2009 but is not significantly different from the score achieved in 2000 (the last two occasions when reading was the major domain). See Figure 2.

Figure 2. Mean scores on the overall print reading scale for Ireland and the OECD average, all cycles



- Only 9.6% of Irish students performed below proficiency Level 2 compared with 18% across the OECD, while the proportion achieving at or above Level 5 (at 11.4%) is above the OECD average of 8.5%. The proportion of students performing at or above Level 5 in Ireland is below that of a number of other countries with high average performance including Finland (13.5%) and New Zealand (13.9%). There is a need to increase the proportion of students scoring at or above Level 5, while there is a need to ensure that those scoring below Level 2 have adequate skills for their future lives.

- Irish girls significantly outperform boys on print reading, with the difference in performance in 2012 largely similar to that in 2000. On the other hand, the gender difference is significantly smaller in Ireland compared to the OECD average difference.

- The proportion of lower-achieving boys is about the same as it was in 2000, while the proportion of lower-achieving girls has decreased slightly. On the other hand, the proportions of higher-achieving boys and girls have both decreased since 2000.

3.2 How well did Irish students perform on Digital Reading?

- Irish students scored significantly above the OECD average on digital reading, ranking 5th amongst the 23 participating OECD countries and 9th among all 32 participating countries No European country performed significantly better than Ireland. Ireland's performance on digital reading was similar to that of Australia and the United States but significantly better than Germany and Poland. Appendix 4 provides more detail on the performance of Ireland relative to other countries.

- On average, Irish students did equally well on digital and print reading.

- On digital reading, the scores of the highest performing Irish students (i.e. those at the 90th percentile) and the lowest performing Irish students (those at the 10th percentile) are significantly better than the corresponding OECD average scores.

- Only 9% of Irish students perform below Level 2 in digital reading. This is almost half the corresponding average across the participating OECD countries and is to be welcomed.

- As with print reading, Irish girls outperform their male counterparts on digital reading with both Irish boys and girls achieving slightly higher average[7] scores on print reading than on digital reading.

- The performance on digital reading improved for Irish boys and girls in 2012 compared to 2009. This was accompanied by a welcome decrease in the difference in performance by gender between the two years.

3.3 What key conclusions can be made in relation to performance in reading?

- While higher-achieving students in Ireland perform at above-average levels in reading, there is still room for improvement. High achieving students need to be motivated to stretch themselves further.

- The proportions of students performing at or above Level 5 in print reading and digital reading in Ireland are only slightly above the corresponding OECD average proportions, while other high-performing countries such as Finland and New Zealand have higher percentages of students reaching this benchmark. This is consistent with patterns identified in earlier cycles of PISA.

- It should also be noted that the score of top performing students in reading literacy in PISA 2012 (those scoring at the 90th percentile) is below the corresponding score in 2000, though not to a significant degree.

- There is still a significant gap between the performance of girls and boys in reading, though Ireland fares somewhat better in this regard than do students on average across OECD countries.

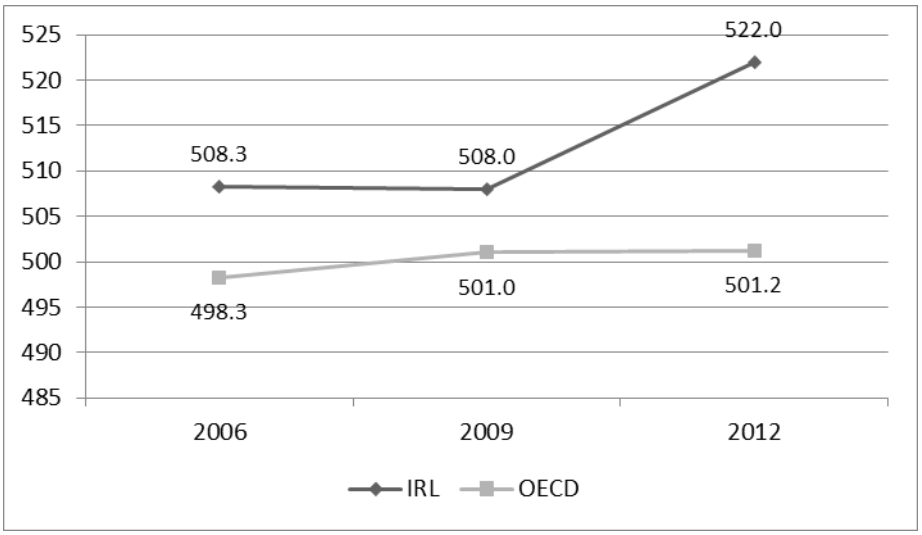
4. Results of Irish students for Science in 2012

4.1 How well did Irish students perform on Science?

- Ireland's mean score in 2012 in science is significantly above the average score for OECD countries and shows a significant increase from 2006 (the last occasion when science was a major domain). Performance in science was also significantly higher than in 2009. See Figure 3.

[7] For the purposes of this memo, *mean* and *average* are used interchangeably.

Figure 3. Mean scores on the overall science scale for Ireland and the OECD average, 2006 to 2012



- Ireland is now ranked 9th among the 34 OECD countries and 15th of the 65 participating countries.

- In science, Ireland performed significantly below seven participating countries including Finland and Estonia. Ireland performed significantly above 45 countries including the US, Norway, Denmark and Sweden. Poland, Canada, Germany, Australia, New Zealand and the UK were among the twelve countries whose performance in science was similar to Ireland. Similar to maths and reading, students in Ireland significantly outperformed their counterparts in Northern Ireland. Appendix 5 provides more detail on the performance of Ireland relative to other countries.

- Encouragingly, Ireland achieved significantly higher scores than on average across OECD countries at both the 10th and 90th percentiles[8] i.e. both low-achieving and high-achieving Irish students scored better than the OECD average, and the performance of Irish students at both ends of the performance scale has shown significant improvement compared to 2006 and 2009.

- 11% of Irish students performed below Level 2 in science compared to an average of 17.8% across OECD countries, while the proportion of students performing at or above Level 5 is only slightly above the OECD average.

- There is no significant difference between the performance of Irish boys and girls in science with the scores of both being above their respective OECD averages and both showing significant improvement from 2006.

- Similar proportions boys and girls in Ireland score below Level 2 in science with a slightly higher proportion of boys scoring at or above Level 5.

[8] The 10th percentile is the score below which the lowest 10% of scores fall, while the 90th percentile is the score above which the top 10% of the scores fall.

4.2 What key conclusions can be drawn in relation to performance in science?

- Ireland's high overall performance and improved international ranking in science in 2012 is very welcome as there was no overall change from 2006 to 2009. It is very good too that the proportion of high-performing students has increased significantly since 2006 while the proportion of low-performing students has decreased considerably.

- The similarities in the scores for boys and girls in science contrasts with the stronger performance among boys in mathematics and girls in reading.

- There is scope for improvement in science, particularly among higher performing students. 10.8% students in Ireland performed at or above level 5 which is slightly higher than Northern Ireland and slightly below the UK. It is, however, well below that achieved in Shanghai-China (27%) and Finland (17%).

- While changes in the primary school curriculum (Department of Education and Science, 1999) and the junior cycle science syllabus (Department of Education and Science, 2003) may have contributed to the increase in science achievement observed in Ireland in 2012, the performance in science points to the need for on-going curricular reform and implementation in this area at primary and post-primary.

  For example, outcomes associated with the description of capabilities at Level 5 of the PISA Framework for science (apply scientific concepts and knowledge about science to complex real-life situations; bring critical insights to situations; construct evidence-based explanations) are more advanced than the objectives of the current junior cycle science syllabus.

  An earlier PISA assessment also indicates that Irish students are better at *identifying scientific issues* than *explaining phenomena scientifically* (i.e. applying knowledge of science concepts, describing or interpreting phenomena or predicting changes). This is supported by findings on science achievement in TIMSS 2011, which indicate that Irish students' scores with regard to reasoning were significantly poorer than overall national performance.

  According to TIMSS 2011, Irish primary pupils spend less time on science than other countries and Irish primary school teachers report a below average confidence in their ability to teach science. Hence, it would also be worthwhile investing further in these aspects of science teaching and learning.

5. Factors influencing student performance in 2012?

Factors influencing student performance in 2012 relate to student and school characteristics, student attitudes and engagement with school and learning, and the interpretation of trends in achievement.

5.1 What student characteristics influence student performance?

A number of student demographic characteristics have been found to relate to achievement in 2012.

- In 2012, student Economic, Social and Cultural Status (ESCS) (the OECD's measure of socio-economic status) is positively related to achievement in mathematics, reading and science. Student ESCS in Ireland and on average across OECD countries has increased significantly since 2003. The overall effect of ESCS on mathematics performance in Ireland is similar to the average across OECD countries.

- Students in one-parent families performed significantly less well than students in other family types in Ireland. There has been a decrease in the percentage of students from one-parent families in Ireland since 2003.

- The percentage of immigrant students in Ireland (9.6%) is about the same as the OECD average (10.5%). This represents a significant increase from 2003 when just 3.4% of Irish students were from immigrant families. There was no difference in performance between immigrant and non-immigrant students in any of the assessed domains, except in reading where those immigrant students who spoke a language other than English or Irish performed significantly less well than non-immigrant students and immigrant students who speak English or Irish. In 2012, immigrant students who speak English or Irish had higher average ESCS (socio-economic status) than native students or immigrant students who speak a language other than English or Irish.

- Slightly more than three-fifths of participating students were from Third year and almost one quarter from Transition year (TY) with the remainder coming, in the main, from Fifth year. TY students performed significantly better than Third-year and Fifth-year students on all domains. There were no significant differences between Third-year and Fifth-year students.

Other aspects of students' background related to achievement in 2012 include the amount of time spent in paid work, preschool attendance, early school leaving risk and skipping school.

- Students who reported engaging in paid work during term time for more than eight hours a week performed significantly less well in the five domains that were tested than students who did not engage in paid work.

- Irish students who never attended pre-school performed significantly less well on all domains than those who attended pre-school, with the exception of computer-based mathematics. However, the enhanced performance may be as a result of students with pre-school attendance coming from families with higher ESCS scores.

- The students who indicated that they did not intend to complete the Leaving Certificate or were unsure performed significantly less well in all domains. The percentage of such students declined from 20.5% in 2003 to 6.5% in 2012.

- The performance of those students who skipped school for a number of days in the two weeks before the PISA assessment was significantly lower across all domains than that of students who did not skip any days.

5.2 What school characteristics influenced student performance?

PISA 2012 shows that a number of school characteristics were also strongly associated with student achievement.

- Students from fee paying schools (8.1% of PISA 2012 students in Ireland; 15 such schools participated) significantly outperformed those from non-fee-paying schools (91.9%) in all print and computer-based assessments.

- On the other hand, students attending DEIS[9] schools (20.7%) performed significantly below their counterparts in non-DEIS schools (79.3%). The performance of students in both DEIS and non-DEIS schools improved significantly on all domains except digital reading between 2009 and 2012. However, the magnitude of the improvement was similar for both school types, meaning that the differences in performance between students in DEIS and non-DEIS schools are about the same in 2009 and 2012.

- In Ireland, the amount of variance in achievement across domains that can be attributed to differences between schools (between-school differences) has decreased between 2009 and 2012, and is at similar levels to 2006.

- Mathematics classes in Ireland have a more positive disciplinary climate and higher levels of support from mathematics teachers than on average across OECD countries, as reported by students. The classroom climate also features higher levels of teacher morale (as reported by principals). However, there is room to improve the level of engagement by Irish students in extracurricular activates related to mathematics and the degree to which formative assessment is used in teaching mathematics. Both of these are related to enhanced performance by students that are more able and should be actively promoted.

- Student in boys' secondary schools obtain the highest scores on print mathematics, computer-based mathematics and science while students in girls' secondary schools perform highest on print reading and digital reading.

5.3 How did student attitudes towards and engagement with school and mathematics impact on performance?

PISA 2012 also assessed aspects of students' behaviour, motivation and confidence and described their associations with students' mathematics performance.

- Irish students' attitudes to school and their dispositions towards mathematics, in terms of motivation and perseverance, are significantly higher than on average

[9] DEIS-Delivering Equality of Opportunity in Schools, focuses on addressing the educational needs of students from disadvantaged backgrounds

across OECD countries. On the other hand, Irish students are significantly more anxious about mathematics than are students on average across OECD countries.

- The disparity in mathematics performance between boys and girls in Ireland is also reflected in their attitudes to mathematics. Irish boys have greater instrumental[10] (though not intrinsic) motivation and perseverance and are less anxious about mathematics than their female peers.

- The mean scores for students' sense of belonging to school are in line with those across the OECD but the scores for Irish students between 2003 and 2012 decreased significantly. Sense of belonging to school was not significantly associated with student achievement.

5.4 Interpreting trends in achievement

A number of factors may have contributed to the increase in results between 2009 and 2012. These relate to:

- Limitations in the way in which PISA establishes and reports trends for reading
- Some differences in the implementation of PISA 2009 and PISA 2012
- Changes in the curriculum and related initiatives.

Limitations in the PISA methodology used to establish and report trends in reading

Limitations in the way in which PISA establishes and reports trends for reading may also have affected achievement results in 2012 and may explain why the results for reading differ so greatly from those in 2009:

- Research conducted after the publication of PISA 2009 results has noted that the model used to scale PISA reading in 2009 was more sensitive for reading than for mathematics and science, which may in part be due to the smaller number of link items used to establish trends in reading in 2009. This means that any change in achievement was likely to be more exaggerated for reading than for mathematics and science in 2009.

- In 2012, there has been an increase in the number of link items used to establish trends for reading and the old link items have been replaced. This provides a more stable and reliable link to PISA 2009. This means that the effect of other factors on achievement scores, such as decreased effort, is less likely to be overestimated, as seems to have been the case for reading in Ireland in 2009.

Differences in the implementation of PISA 2009 and PISA 2012

The implementation of PISA 2012 compared to 2009 may have contributed to the enhanced performance by Irish students between the two cycles:

[10] Instrumental motivation refers to the practical outcomes that one imagines will result from studying mathematics, such as enhanced career prospects etc.

- There was a considerable reduction in the proportion of students skipping items in 2012 compared to the previous cycle in 2009, especially items in the later sections in test booklets. This is indicative of an increased effort being invested by participating students.

- Unlike 2009, Irish schools participated in fewer assessment events at around the time of PISA 2012, and the possibility of assessment fatigue at the system level was, therefore, reduced.

- The administration of the school-based elements of the PISA assessment by inspectors of the DES was a significant change from 2009 and this, along with the enhanced profile attached to the assessments in 2012, may have contributed to more stable performance.

Changes in curriculum and related initiatives

Student performance may also be influenced by changes in the curriculum and related initiatives:

- The introduction of social, environmental and scientific education in the revised primary curriculum in 1999 (Government of Ireland, 1999) and changes in the junior cycle science syllabus (Department of Education and Science, 2003) may have contributed to the significant increase in science achievement observed in Ireland in 2012.

- The positive results for science suggest that policy interventions can have a positive and lasting effect on outcomes for students but require time to bed in. Therefore, we can expect that it will be some time yet before the full impact of interventions such as the National Strategy to Improve Literacy and Numeracy and Project Maths will be seen. It could be argued that, since performance was depressed across all domains except science in 2009, enhanced performance in science may well have manifested itself at that time (i.e., performance in science could have dropped like performance in reading and mathematics in 2009, but an underlying improvement in performance prevented this from happening).

6. Summary

6.1 What were the main strengths of Irish students' performance in 2012?

- Ireland continues to maintain standards in mathematics and reading and has increased achievement in science even though the school going population in Ireland has changed since 2003 (there has been an increase in immigrant students from 3.5% to 9.6%; and increase in SEN students participating in PISA from 2% to 4.7%; and fewer students leaving school early). Ireland's performance in 2009 was atypical and, as noted above, this can be attributed to a number of factors.

- The performance of Irish students in science is to be welcomed. Ireland scored well above the OECD average with very little difference in the performance of boys and girls.

- The results for print and digital reading are very good, with the scores of Irish students at either end of the performance scale exceeding the corresponding OECD averages.

- Ireland scored significantly above the OECD average in mathematics but there was no improvement in the average scores achieved by Irish students when compared to 2003 when mathematics was also the major domain. The enhanced performance relative to the OECD average can be attributed to a decline in the OECD average, rather than an improvement in performance in Ireland since 2003.

- There is good progress in terms of maintaining and improving the performance of lower achieving students. The performance of lower achieving students in Ireland was better than the OECD average for such students across all domains (mathematics, reading and science). There is also a smaller proportion of students performing at below the baseline level of proficiency in Ireland (i.e., below Level 2) than on average across the OECD.

- One important measure of the equity in a country's school system is the between-school differences in average student performance on PISA. The more equitable a school system is, the smaller the between-school differences tend to be. Relative to other OECD countries, between school differences in average student performance are small in Ireland and so we can say that Ireland has a relatively more equitable school system. Compared to PISA 2009, there has been a reduction in the proportions of variance in performance between schools in Ireland, though estimates for 2012 still exceed those for 2000.

- Students in Ireland reported a more positive disciplinary climate in mathematics classes than on average across OECD countries. Classroom climate in Ireland was also characterised by higher levels of teacher morale and support for students from mathematics teachers.

6.2 What are the main areas for development?

- Compared to other EU countries, we are doing well, but internationally we are not in the top group, especially in relation to mathematics. If we are to be competitors in the global arena, we have to look at the performance of Asian economies such as Japan and Korea, and also at the performance of countries closer to home such as Finland, Poland and Germany and other EU countries.

- The overall or long-term pattern of results between 2000 and 2012 has not changed significantly for reading and mathematics– in fact, there have been slight though not significant drops in performance.

- Higher achieving students in Ireland are underperforming relative to their counterparts in other countries, especially in mathematics. While higher-achieving students in Ireland perform at or above average levels in reading and science, there is also room for improvement in these domains.

- Schools must have higher expectations and aspirations for all students across the range of performance. All students need to be challenged and motivated to achieve

to their full potential through better quality learning and teaching and through more formative assessment right through their learning experiences.

- The performance of students attending disadvantaged schools continues to be a challenge, though there is evidence from this and other studies that DEIS is having a positive impact on the performance of these students in primary schools.

- There is an evident need to make mathematics more attractive for girls and to encourage boys to take a greater interest in reading. The high level of anxiety about mathematics among girls in Ireland also needs to be addressed.

- In mathematics, the poor performance of all our students in Space and Shape, when aligned with similar outcomes in other assessments, needs to be addressed at both primary and post-primary levels. The drop in student performance in Uncertainty and Data since 2003 is also a cause for concern and performance in this area needs to be monitored carefully.

- The gaps in performance among students from different school types need to be addressed.

- The mean score for Irish students' sense of belonging to school in 2012 was in line with the OECD average, but lower than in 2003. This is worrying and needs to be addressed.

- Students in Ireland, and girls in particular, may be disadvantaged in PISA 2015 assessments with the move to computer-based modes assessment across all domains, unless computer-usage patterns in schools change.

6.3 What actions will be taken?

- It must be noted that the relatively good performance of Irish students in PISA 2012 cannot be attributed to the impact of the Literacy and Numeracy Strategy and Project Maths. It is evident that it takes time for initiatives to impact on performance as seen in the case of science. However these initiatives are tackling many of the weaknesses in student learning identified through PISA.

- In the next round of PISA in 2015, we can expect to begin to see the impact of the Literacy and Numeracy Strategy and Project Maths. By 2015, all 15-year olds in Ireland will have studied the new Project Maths syllabi since the beginning of their post-primary schooling.

- The DES will ensure that the implementation of the Literacy and Numeracy Strategy, including Project Maths and curricular and assessment reform, remains a priority but in the context of a broad and balanced skills-based curriculum at junior cycle.

Mathematics

- The on-going implementation of Project Maths at second level and the imminent reforms to the junior cycle will help to address shortcomings in the performance of our students in mathematics. A reduced emphasis on teaching content and an increased emphasis on skills development, problem solving in real-life contexts, and formative assessment will help to raise all students' achievement, particularly in relation to areas where Irish students are underperforming such as Space and Shape and Uncertainty and Data. The embedding of changes in these approaches to teaching and assessing mathematics should also help to develop more positive attitudes among students to maths, particularly among girls.

- There will be ongoing monitoring of the implementation of Project Maths to ensure that the types of spatial reasoning and problem solving tasks necessary for greater competence in Shape and Space are not overlooked. The implementation of the National Literacy and Numeracy Strategy, which requires that schools emphasise mathematics across the different subjects on the curriculum should also be beneficial. There might also be value in providing direct instruction in spatial skills, whether in the context of mathematics or as separate modules or short courses.

- There is scope for Transition Year (TY) mathematics programmes designed by schools to more effectively address the needs of more able students and to address any shortcomings in the mathematical knowledge and skills and attitudes to mathematics of particpating students.

- Consideration will be given to how to improve the level of engagement by Irish students in extracurricular activates related to mathematics

Reading

- The revision of the English curriculum at primary level, along with the new English specification in junior cycle (as part of the National Literacy and Numeracy Strategy*)* should support the further reduction of gaps between Ireland and the highest-performing countries in the coming years.

- The National Literacy and Numeracy Strategy includes elements to address the gap in performance between Irish girls and boys in print and in digital reading. In particular, the new English specification for junior cycle requires that students encounter a wider variety of non-literary texts to cater more effectively for boys' reading tastes.

- A number of learning outcomes in the new specifications at junior cycle require the use of digital texts, which also link to boys' interests and should further enhance Irish students' digital literacy skills in the future. In addition, this should advance Ireland's performance compared with the top performing countries in digital reading, though progress in this area may also depend on the increasing digitalisation of assessment here in Ireland.

Science

- There will be on-going curricular reform and implementation in science at primary and post-primary.

- The new syllabus for science currently being developed as part of the new Junior Cycle provides an opportunity to address shortcomings in our current syllabus and to significantly enhance our students' ability in the full range of science skills including their ability to apply their scientific knowledge and interpret scientific phenomena. The NCCA is also currently preparing revised specifications in Physics, Chemistry and Biology at Senior Cycle which will emphasise investigative approaches.

- Consideration will be given to further supporting science teaching and learning at primary level in terms of developing teachers' confidence and competence to teach the subject. The amount of time spent learning science at primary level will also need to be reviewed.

- The DES will continue to support important science events in the educational calendar such as The BT Young Scientist and Sci-Fest.

Appendix 1: Mean country/economy scores, standard deviations and standard errors (SE) for the print mathematics scale and positions relative to the OECD and Irish means, for all participating countries/economies

	Mean	SE	SD	SE	IRL		Mean	SE	SD	SE	IRL
Shanghai-China	612.7	(3.29)	101.0	(2.28)	▲	*Russian Fed.*	482.2	(3.04)	86.4	(1.57)	▼
Singapore	573.5	(1.32)	105.4	(0.92)	▲	Slovak Republic	481.6	(3.43)	100.8	(2.46)	▼
Hong Kong-China	561.2	(3.22)	96.3	(1.92)	▲	United States	481.4	(3.60)	89.9	(1.30)	▼
Chinese Taipei	559.8	(3.30)	115.6	(1.92)	▲	*Lithuania*	478.8	(2.64)	89.1	(1.36)	▼
Korea	553.8	(4.58)	99.1	(2.15)	▲	Sweden	478.3	(2.26)	91.7	(1.28)	▼
Macao-China	538.1	(0.96)	94.5	(0.94)	▲	Hungary	477.0	(3.19)	93.6	(2.40)	▼
Japan	536.4	(3.59)	93.5	(2.19)	▲	*Croatia*	471.1	(3.54)	88.5	(2.55)	▼
Liechtenstein	535.0	(3.95)	95.3	(3.70)	▲	Israel	466.5	(4.68)	104.9	(1.82)	▼
Switzerland	530.9	(3.04)	94.3	(1.45)	▲	Greece	453.0	(2.50)	87.8	(1.34)	▼
Netherlands	523.0	(3.47)	91.6	(2.10)	▲	*Serbia*	448.9	(3.39)	90.7	(2.21)	▼
Estonia	520.5	(2.02)	80.9	(1.17)	▲	Turkey	448.0	(4.83)	91.1	(3.05)	▼
Finland	518.8	(1.94)	85.3	(1.16)	▲	*Romania*	444.6	(3.76)	81.3	(2.21)	▼
Canada	518.1	(1.84)	88.8	(0.80)	▲	*Cyprus*	439.7	(1.07)	93.1	(0.84)	▼
Poland	517.5	(3.62)	90.4	(1.89)	▲	*Bulgaria*	438.7	(3.99)	93.9	(2.19)	▼
Belgium	514.7	(2.08)	102.3	(1.42)	▲	*UAE*	434.0	(2.43)	89.5	(1.19)	▼
Germany	513.5	(2.88)	96.3	(1.64)	▲	*Kazakhstan*	431.8	(3.03)	71.2	(1.76)	▼
Vietnam	511.3	(4.84)	85.8	(2.65)	O	*Thailand*	426.7	(3.45)	82.2	(2.14)	▼
Austria	505.5	(2.67)	92.5	(1.70)	O	Chile	422.6	(3.07)	80.8	(1.46)	▼
Australia	504.2	(1.64)	96.3	(1.19)	O	*Malaysia*	420.5	(3.18)	81.1	(1.62)	▼
Ireland	501.5	(2.25)	84.6	(1.26)		Mexico	413.3	(1.35)	74.3	(0.72)	▼
Slovenia	501.1	(1.23)	91.7	(1.02)	O	*Montenegro*	409.6	(1.05)	82.7	(1.07)	▼
Denmark	500.0	(2.29)	82.1	(1.30)	O	*Uruguay*	409.3	(2.76)	88.7	(1.74)	▼
New Zealand	499.7	(2.21)	99.6	(1.22)	O	*Costa Rica*	407.0	(3.04)	68.4	(1.80)	▼
Czech Republic	499.0	(2.85)	94.9	(1.62)	O	*Albania*	394.3	(2.00)	91.5	(1.40)	▼
France	495.0	(2.45)	97.5	(1.67)	O	*Brazil*	391.5	(2.06)	77.7	(1.63)	▼
United Kingdom	493.9	(3.30)	94.5	(1.75)	O	*Argentina*	388.4	(3.53)	76.7	(1.73)	▼
Iceland	492.8	(1.70)	91.9	(1.31)	▼	*Tunisia*	387.8	(3.91)	78.2	(3.07)	▼
Latvia	490.6	(2.75)	81.9	(1.51)	▼	*Jordan*	385.6	(3.12)	77.6	(2.67)	▼
Luxembourg	489.8	(1.09)	95.4	(0.86)	▼	*Colombia*	376.5	(2.89)	74.3	(1.71)	▼
Norway	489.4	(2.73)	90.5	(1.33)	▼	*Qatar*	376.4	(0.76)	99.9	(0.74)	▼
Portugal	487.1	(3.81)	93.9	(1.37)	▼	*Indonesia*	375.1	(4.04)	71.4	(3.25)	▼
Italy	485.3	(2.03)	92.8	(1.15)	▼	*Peru*	368.1	(3.69)	84.4	(2.20)	▼
Spain	484.3	(1.90)	87.7	(0.73)	▼	OECD average	494.0	(0.49)	91.9	(0.27)	

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

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

Appendix 2: Mean country/economy scores, standard deviations and standard errors (SE) for computer-based mathematics scale and positions relative to the 23-country OECD and Irish means, for all participating countries/economies

	Mean	SE	SD	SE	IRL
Singapore	566.0	1.29	98.3	(1.04)	▲
Shanghai-China	562.3	3.44	93.6	(2.07)	▲
Korea	552.6	4.52	90.1	(2.27)	▲
Hong Kong-China	549.6	3.36	86.7	(2.26)	▲
Macao-China	542.9	1.11	82.8	(0.82)	▲
Japan	539.0	3.32	87.8	(2.43)	▲
Chinese Taipei	537.3	2.76	88.8	(1.85)	▲
Canada	522.8	2.24	91.9	(1.49)	▲
Estonia	516.1	2.20	82.1	(1.41)	▲
Belgium	511.2	2.37	100.0	(1.60)	▲
Germany	509.4	3.34	95.5	(1.96)	▲
France	508.1	3.28	91.9	(4.14)	▲
Australia	507.7	1.64	90.9	(1.24)	▲
Austria	507.3	3.50	88.7	(2.24)	▲
Italy	498.8	4.16	83.1	(2.60)	O
United States	498.0	4.05	88.8	(2.20)	O
Norway	497.6	2.76	87.2	(1.58)	O
Slovak Republic	497.3	3.51	86.1	(2.36)	O
Denmark	496.2	2.68	86.4	(1.45)	O
Ireland	493.1	2.90	80.5	(1.95)	
Sweden	489.9	2.89	86.1	(1.60)	O
Russian Fed.	489.1	2.61	79.8	(1.46)	O
Poland	489.0	3.98	86.0	(1.97)	O
Portugal	489.0	3.09	85.1	(1.57)	O
Slovenia	486.9	1.16	87.8	(0.99)	▼
Spain	475.1	3.17	82.0	(1.54)	▼
Hungary	469.8	3.87	92.6	(2.56)	▼
Israel	446.6	5.62	111.3	(3.53)	▼
UAE	434.1	2.24	84.3	(1.53)	▼
Chile	432.0	3.34	81.5	(1.64)	▼
Brazil	420.7	4.66	83.9	(3.06)	▼
Colombia	396.8	3.16	73.3	(1.76)	▼
OECD Average	497.1	(0.70)	88.8	(0.45)	

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

Appendix 3: Mean country/economy scores, standard deviations and standard errors (SE) for the print reading scale and positions relative to the OECD and Irish means, for all participating countries/economies

	Mean	SE	SD	SE	IRL		Mean	SE	SD	SE	IRL
Shanghai-China	569.6	(2.86)	80.0	(1.84)	▲	Israel	485.8	(5.01)	114.4	(2.45)	▼
Hong Kong-China	544.6	(2.79)	85.2	(1.85)	▲	*Croatia*	484.6	(3.31)	86.1	(2.09)	▼
Singapore	542.2	(1.37)	100.9	(1.17)	▲	Sweden	483.3	(3.00)	106.8	(1.79)	▼
Japan	538.1	(3.67)	98.7	(2.27)	▲	Iceland	482.5	(1.80)	98.0	(1.42)	▼
Korea	535.8	(3.94)	86.5	(1.98)	▲	Slovenia	481.3	(1.22)	92.0	(0.88)	▼
Finland	524.0	(2.38)	94.7	(1.34)	O	*Lithuania*	477.3	(2.48)	86.5	(1.50)	▼
Ireland	523.2	(2.55)	86.1	(1.71)		Greece	477.2	(3.27)	98.8	(2.09)	▼
Chinese Taipei	523.1	(3.03)	91.3	(1.83)	O	Turkey	475.5	(4.21)	85.9	(2.37)	▼
Canada	523.1	(1.93)	92.2	(0.94)	O	*Russian Fed.*	475.1	(2.97)	90.7	(1.54)	▼
Poland	518.2	(3.14)	87.3	(1.61)	O	Slovak Republic	462.8	(4.17)	104.3	(3.25)	▼
Estonia	516.3	(2.03)	80.4	(1.16)	▼	*Cyprus*	449.0	(1.18)	111.2	(1.26)	▼
Liechtenstein	515.5	(4.10)	88.0	(4.15)	O	*Serbia*	446.1	(3.44)	92.6	(2.00)	▼
New Zealand	512.2	(2.40)	105.6	(1.64)	▼	*UAE*	441.7	(2.50)	95.3	(1.07)	▼
Australia	511.8	(1.58)	97.1	(1.01)	▼	Chile	441.4	(2.90)	77.9	(1.45)	▼
Netherlands	511.2	(3.47)	93.0	(3.03)	▼	*Thailand*	441.2	(3.08)	78.1	(1.80)	▼
Belgium	509.1	(2.16)	103.1	(1.67)	▼	*Costa Rica*	440.5	(3.50)	74.4	(1.63)	▼
Switzerland	509.0	(2.57)	90.1	(1.12)	▼	*Romania*	437.6	(3.98)	90.3	(2.00)	▼
Macao-China	508.9	(0.91)	82.3	(0.75)	▼	*Bulgaria*	436.1	(6.02)	118.5	(2.84)	▼
Vietnam	508.2	(4.40)	74.1	(2.58)	▼	Mexico	423.6	(1.51)	80.3	(0.99)	▼
Germany	507.7	(2.82)	91.4	(1.70)	▼	*Montenegro*	422.1	(1.18)	92.2	(1.30)	▼
France	505.5	(2.83)	109.1	(2.33)	▼	*Uruguay*	411.3	(3.16)	95.7	(2.03)	▼
Norway	503.9	(3.22)	100.5	(1.86)	▼	*Brazil*	410.1	(2.11)	85.3	(1.17)	▼
United Kingdom	499.3	(3.50)	97.2	(2.26)	▼	*Tunisia*	404.1	(4.51)	88.0	(2.54)	▼
United States	497.6	(3.74)	92.0	(1.56)	▼	*Colombia*	403.4	(3.45)	83.6	(1.93)	▼
Denmark	496.1	(2.65)	85.6	(2.16)	▼	*Jordan*	399.0	(3.56)	91.4	(2.55)	▼
Czech Republic	492.9	(2.87)	88.7	(1.85)	▼	*Malaysia*	398.2	(3.33)	83.7	(1.48)	▼
Italy	489.8	(1.97)	97.1	(0.94)	▼	*Indonesia*	396.1	(4.21)	75.4	(2.68)	▼
Austria	489.6	(2.76)	91.8	(1.77)	▼	*Argentina*	396.0	(3.70)	96.1	(2.25)	▼
Latvia	488.7	(2.39)	84.9	(1.75)	▼	*Albania*	394.0	(3.20)	115.8	(1.96)	▼
Hungary	488.5	(3.16)	91.8	(1.94)	▼	*Kazakhstan*	392.7	(2.69)	73.8	(1.38)	▼
Spain	487.9	(1.91)	92.1	(1.13)	▼	*Qatar*	387.5	(0.82)	112.8	(0.84)	▼
Luxembourg	487.8	(1.54)	105.0	(1.00)	▼	*Peru*	384.2	(4.34)	93.6	(2.28)	▼
Portugal	487.8	(3.75)	93.5	(1.88)	▼	OECD average	496.5	(0.51)	94.4	(0.31)	

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

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

Appendix 4: Mean country/economy scores, standard deviations and standard errors (SE) for the digital reading scale and positions relative to the OECD and Irish means, for all participating countries/economies

	Mean	SE	SD	SE	IRL
Singapore	567.0	(1.25)	90.2	(0.94)	▲
Korea	555.1	(3.61)	80.6	(2.05)	▲
Hong Kong-China	549.8	(3.55)	94.0	(2.36)	▲
Japan	544.8	(3.30)	78.1	(2.08)	▲
Canada	532.3	(2.34)	88.8	(1.24)	▲
Shanghai-China	531.3	(3.73)	84.0	(2.37)	▲
Estonia	522.8	(2.81)	92.9	(1.90)	O
Australia	520.6	(1.75)	96.9	(1.12)	O
Ireland	520.1	(3.03)	82.4	(1.76)	
Chinese Taipei	519.4	(3.03)	88.9	(1.89)	O
Macao-China	515.3	(0.93)	70.4	(0.78)	O
United States	511.2	(4.50)	89.0	(2.24)	O
France	510.9	(3.61)	97.6	(4.19)	O
Italy	504.1	(4.28)	94.9	(2.82)	▼
Belgium	502.3	(2.53)	99.8	(1.79)	▼
Norway	499.7	(3.49)	100.2	(2.57)	▼
Sweden	498.4	(3.41)	96.0	(1.73)	▼
Denmark	494.7	(2.88)	82.8	(1.45)	▼
Germany	493.6	(3.98)	99.1	(3.40)	▼
Portugal	485.9	(4.36)	89.2	(2.29)	▼
Austria	480.0	(3.89)	103.9	(4.33)	▼
Poland	476.8	(4.47)	96.5	(2.47)	▼
Slovak Republic	474.3	(3.51)	94.6	(2.77)	▼
Slovenia	471.3	(1.25)	98.5	(1.08)	▼
Spain	466.1	(3.89)	98.0	(2.42)	▼
Russian Federation	465.6	(3.86)	86.1	(1.59)	▼
Israel	461.0	(5.09)	116.6	(3.16)	▼
Chile	452.2	(3.57)	81.7	(1.84)	▼
Hungary	450.3	(4.39)	112.2	(3.87)	▼
Brazil	435.6	(4.94)	92.4	(2.72)	▼
United Arab Emirates	406.7	(3.33)	110.5	(1.99)	▼
Colombia	395.8	(3.98)	92.1	(2.86)	▼
OECD Average	496.9	(0.75)	94.4	(0.53)	

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

Appendix 5: Mean country/economy scores, standard deviations and standard errors (SE) for the science scale and positions relative to the OECD and Irish means, for all participating countries/economies

	Mean	SE	SD	SE	IRL		Mean	SE	SD	SE	IRL
Shanghai-China	580.1	(3.03)	82.0	(1.82)	▲	*Croatia*	491.4	(3.10)	85.5	(1.82)	▼
Hong Kong-China	554.9	(2.61)	83.5	(1.83)	▲	Luxembourg	491.2	(1.30)	103.2	(0.95)	▼
Singapore	551.5	(1.51)	104.2	(1.23)	▲	Portugal	489.3	(3.75)	88.8	(1.63)	▼
Japan	546.7	(3.60)	95.5	(2.23)	▲	*Russian Fed.*	486.3	(2.85)	84.9	(1.33)	▼
Finland	545.4	(2.20)	93.0	(1.16)	▲	Sweden	484.8	(3.00)	99.7	(1.54)	▼
Estonia	541.4	(1.95)	80.2	(1.12)	▲	Iceland	478.2	(2.12)	99.3	(1.52)	▼
Korea	537.8	(3.66)	81.9	(1.80)	▲	Slovak Republic	471.2	(3.61)	101.2	(2.83)	▼
Vietnam	528.4	(4.31)	77.4	(2.31)	O	Israel	470.1	(4.96)	107.7	(2.13)	▼
Poland	525.8	(3.12)	86.3	(1.54)	O	Greece	466.7	(3.12)	88.4	(1.45)	▼
Canada	525.5	(1.93)	91.0	(0.87)	O	Turkey	463.4	(3.89)	79.9	(1.85)	▼
Liechtenstein	524.7	(3.55)	85.5	(4.08)	O	*UAE*	448.4	(2.81)	93.8	(1.14)	▼
Germany	524.1	(2.96)	95.2	(1.97)	O	*Bulgaria*	446.5	(4.78)	102.2	(2.45)	▼
Chinese Taipei	523.3	(2.33)	83.0	(1.40)	O	Chile	444.9	(2.86)	80.3	(1.47)	▼
Netherlands	522.1	(3.51)	95.2	(2.18)	O	*Serbia*	444.8	(3.40)	87.2	(1.94)	▼
Ireland	522.0	(2.45)	91.3	(1.58)		*Thailand*	444.0	(2.93)	76.4	(1.67)	▼
Australia	521.5	(1.76)	100.4	(1.01)	O	*Romania*	438.8	(3.25)	78.7	(1.95)	▼
Macao-China	520.6	(0.85)	78.8	(0.70)	O	*Cyprus*	437.7	(1.18)	96.7	(1.07)	▼
New Zealand	515.6	(2.14)	104.9	(1.40)	O	*Costa Rica*	429.4	(2.94)	70.5	(1.59)	▼
Switzerland	515.3	(2.71)	90.9	(1.13)	O	*Kazakhstan*	424.7	(2.97)	74.1	(1.51)	▼
Slovenia	514.1	(1.29)	90.7	(1.15)	▼	*Malaysia*	419.5	(3.00)	78.6	(1.43)	▼
United Kingdom	514.1	(3.38)	99.8	(1.84)	O	*Uruguay*	415.8	(2.77)	95.3	(1.71)	▼
Czech Republic	508.3	(2.96)	90.6	(2.07)	▼	Mexico	414.9	(1.31)	70.7	(0.89)	▼
Austria	505.8	(2.70)	92.2	(1.60)	▼	*Montenegro*	410.1	(1.07)	84.5	(0.98)	▼
Belgium	505.5	(2.09)	101.5	(1.39)	▼	*Jordan*	409.4	(3.12)	82.8	(2.05)	▼
Latvia	502.2	(2.75)	78.7	(1.35)	▼	*Argentina*	405.6	(3.88)	86.0	(2.16)	▼
France	499.0	(2.58)	100.1	(2.21)	▼	*Brazil*	404.7	(2.14)	78.5	(1.37)	▼
Denmark	498.5	(2.74)	92.7	(1.73)	▼	*Colombia*	398.7	(3.05)	76.4	(1.57)	▼
United States	497.4	(3.78)	93.9	(1.48)	▼	*Tunisia*	398.0	(3.46)	78.7	(1.95)	▼
Spain	496.4	(1.83)	86.3	(0.90)	▼	*Albania*	397.4	(2.44)	98.7	(1.80)	▼
Lithuania	495.7	(2.55)	85.8	(1.75)	▼	*Qatar*	383.6	(0.75)	106.5	(0.68)	▼
Norway	494.5	(3.09)	99.7	(1.87)	▼	*Indonesia*	381.9	(3.82)	68.3	(2.33)	▼
Hungary	494.3	(2.95)	90.2	(1.86)	▼	*Peru*	373.1	(3.58)	78.2	(1.88)	▼
Italy	493.5	(1.94)	93.0	(1.08)	▼	OECD Average	501.2	(0.49)	92.8	(0.28)	

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

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