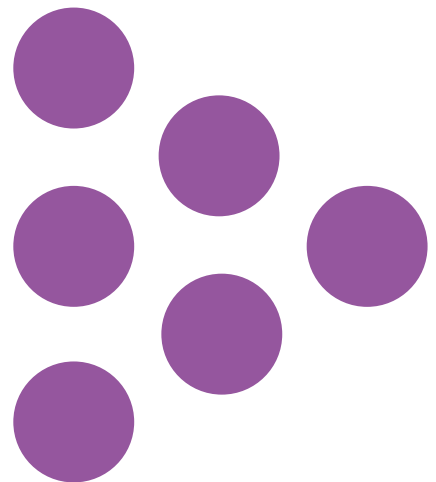![Welsh Government logo](Llywodraeth Cymru / Welsh Government)

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Welsh Government

Report

Achievement of 15-Year Olds in Wales: PISA 2018 National Report

National Foundation for Educational Research (NFER)
Juliet Sizmur, Robert Ager, Jenny Bradshaw, Rachel Classick, Maria Galvis, Joanna Packer, David Thomas and Rebecca Wheater

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Executive summary

Introduction

The Programme for International Student Assessment (PISA) is a study of educational achievement organised by the Organisation for Economic Co-operation and Development (OECD). PISA assesses the knowledge and skills of pupils aged 15. Pupils are assessed on their competence to address real-life challenges involving reading, mathematics and science. Each round of PISA focuses on one of the three areas in which knowledge and skills are assessed: mathematics, science and reading. The major domain for PISA 2018 was reading, with science and mathematics as minor subject domains.

PISA enables governments to benchmark education policy and performance, to make evidence-based decisions and to learn from one another. The data collected enables us to learn from policies and practices in other countries, and to make evidence-based decisions. It is also of great value to academic and research communities and to participating schools.

Nearly 80 countries participated in PISA 2018, including all members of the OECD and all 4 countries within the United Kingdom. In Wales, PISA 2018 was conducted in October to December 2018, with a sample of 3165 15-year-old pupils in 107 schools.

Highlights

The average science and reading scores of pupils in Wales have not changed significantly since PISA 2009 and 2006, respectively. In mathematics, however, there has been a statistically significant increase in the mean score compared with PISA 2009 and PISA 2012. The mathematics score was also higher than in PISA 2015, and while this difference was not statistically significant, it is a continuation of an upward trend. Wales' performance was, for the first time, not significantly different from the OECD average in all 3 subjects.

As with previous cycles of PISA, east Asian countries were the highest-performing, with Singapore, Macao (China) and the combined regions of Beijing, Shanghai, Jiangsu and Zhejiang in China (B-S-J-Z (China), dominating the top positions in all 3 subject areas.

England, Scotland and Northern Ireland had mean scores significantly higher than Wales for reading, but in both science and mathematics Wales, Scotland and Northern Ireland showed no significant differences, while the mean score for both subjects in England was significantly higher than the other UK countries.

Achievement in reading

The mean reading score in Wales has remained consistent since 2006 and was higher than the mean score of 15-year-olds in 42 countries. There were 22 countries where the mean reading score was statistically significantly higher than that in Wales. The top performers in reading were in east Asian countries (B-S-J-Z (China), Singapore, Macao (China) and Hong Kong (China)), with pupils in Estonia, Canada and Finland also scoring highly.

Although the mean reading score for Wales has not shown a statistically significant change since PISA 2006, the relationship of this score to that of other countries has changed and, for the first time, in 2018 there was no statistically significant difference to the OECD average. Portugal, the Czech Republic, the Netherlands, Switzerland, the Russian Federation, Croatia and Latvia, which had all previously outperformed Wales, showed no significant difference in PISA 2018. Wales is also now significantly higher than Iceland, Israel, Luxembourg and Greece, all of which did not differ from Wales in reading in PISA 2015. The mean reading score also fell in Japan, Norway and Slovenia, although they continued to outperform Wales.

There has been a significant increase in the scores of higher achieving pupils in Wales since 2015 but the scores of lower achieving pupils have not changed significantly in that time. The 2018 attainment gap (the difference between the highest and lowest achievers) in Wales was similar to that across the OECD on average.

Pupils in Wales showed relative strengths in the reading skills of 'locating information' and 'evaluating and reflecting' but were less strong in 'understanding'.

Achievement in science

The mean score for Wales in science was not significantly different from the OECD average. The 2018 score was also not significantly different from the scores for Wales since 2009 to 2015 but was significantly lower than in PISA 2006. The top performers in science were again from east Asian countries (B-S-J-Z (China), Singapore and Macao (China)). Estonia and Finland were the highest-scoring European countries.

Nineteen countries had mean scores in science that were significantly higher than that of Wales. This is an improvement on the relative performance for Wales since PISA 2015 when 28 countries scored significantly higher than Wales in science. Twelve countries had mean scores that were not statistically different and Wales significantly outperformed the 45 remaining participating countries.

The 2018 attainment gap in Wales was significantly smaller than the OECD average. The scores of the highest and lowest achievers in science had not significantly changed since 2015.

Achievement in mathematics

Wales has made encouraging progress in mathematics. The mean score for mathematics in Wales was significantly better in 2018 than in PISA 2009 and PISA 2012. It was also higher than in 2015, although in this case the difference was not statistically significant. In 2018, the mean score for mathematics in Wales was not statistically different from the OECD average for the first time, having been significantly below the OECD average in previous PISA cycles, and the number of countries outperforming Wales decreased from 30 in 2015 to 23 in 2018.

The 7 highest-performing countries in mathematics were all from east Asia (B-S-J-Z (China), Singapore, Macao (China), Hong Kong (China), Chinese Taipei, Japan and Korea). The highest scoring European countries were Estonia and the Netherlands and, in contrast to reading and science, Finland was not among the highest performers.

Wales also had a significantly smaller attainment gap between the highest and lowest achievers than the OECD average.

Variation in reading scores by pupil characteristics

In common with all other countries, pupils from the most advantaged backgrounds in Wales had higher achievement in reading than those from less socio-economically advantaged homes. This gap in achievement was statistically smaller in Wales than the average across the OECD countries, which may be partly accounted for by a narrower gap in the socio-economic status of its most and least disadvantaged pupils, compared with the OECD average.

The reading performance of pupils in Wales with an immigrant background was not significantly different from non-immigrant pupils, which differs from the international trend. There was also no significant difference in performance in reading amongst pupils who spoke English or Welsh at home, compared with pupils who spoke another language at home.

In common with all other participating countries, girls in Wales outperformed boys in reading. The gender gap in Wales was similar to that across the OECD on average. There was no statistically significant gap between performance of boys and girls in science, which was also the case in Wales in PISA 2015. There was also no statistically significant gender gap between boys' and girls' performance in mathematics in PISA

2018 in Wales. This was in contrast to PISA 2015, when boys significantly outperformed girls in mathematics. Girls showed a significant improvement in mathematics and reading whereas the score for boys remained stable between 2015 and 2018.

Pupils' attitudes and wellbeing

Pupils in Wales were more confident in their reading ability than the OECD average, but were less likely to read books and had more negative attitudes towards reading. Pupils reported reading online materials far more frequently than printed materials. The most popular online reading activity was chatting online, a frequent activity for 91% of pupils.

Pupils in Wales were, overall, slightly less satisfied with their lives than pupils across the OECD. They were more likely to feel miserable and worried than pupils across the OECD and less likely to feel joyful, cheerful and proud.

Schools

In Wales there were larger differences in reading achievement between pupils attending the same schools than there were between pupils in different schools, compared with the OECD average. Reading achievement ranged less from school to school in Wales than across the OECD on average. This is to be expected in a comprehensive system, compared with selective systems that generally show a much larger difference in achievement between schools.

It was more common in Wales than the OECD average to group pupils by ability within schools, either by grouping them into different classes or by grouping within classes. This, again, is more likely to be the case in a comprehensive system.

Headteachers in Wales reported fewer discipline problems or problems with either teacher or pupil behaviour than the OECD average, although the amount of disruptive behaviour in lessons reported by pupils was similar to the OECD average. Generally, pupils also reported a similar incidence of bullying to the OECD average, but showed a higher rate of disapproval of bullying behaviour.

Headteachers in Wales were more likely than those in the OECD countries on average to report that teaching was hindered by insufficient school equipment and infrastructure, particularly shortages of textbooks and ICT resources.

PISA across the UK

The mean score for reading in Wales (483) was significantly lower than that of the other countries of the UK, but not significantly different from the OECD average (487). There

were no significant differences between mean scores for reading in England (505), Northern Ireland (501) and Scotland (504) and all 3 were significantly above the OECD average. In science and mathematics, the mean score in Wales was significantly lower than in England but not significantly different from those in Scotland and Northern Ireland, or the OECD average.

In common with Wales, there was no statistically significant change in the mean score for reading in Northern Ireland and England since PISA 2015. However, there was a significant improvement in the mean score for reading in Scotland compared with PISA 2015. In science, Wales, Scotland and Northern Ireland have shown a decline in performance over successive cycles of PISA, with mean scores in PISA 2018 that were significantly lower than those in PISA 2006, while the science score in England has remained stable. In mathematics, both Wales and England have shown an improving trend, while Scotland has declined significantly since PISA 2006 and Northern Ireland has remained broadly stable.

In all countries in the UK, girls significantly outperformed boys in reading, as was the case across the OECD. In science, girls significantly outperformed boys in Northern Ireland but there were no significant gender differences in Wales, England or Scotland. In mathematics, there was no significant gender gap in Wales or Northern Ireland, but boys significantly outperformed girls in England and Scotland.

The gap in reading attainment between the most and least disadvantaged pupils was significantly smaller than the OECD average in Northern Ireland, Scotland and Wales, but the difference between England and the OECD average was not statistically significant.

Pupils in all countries of the UK had more negative attitudes towards reading than the OECD average, but pupils in England reported that they read more than those in the rest of the UK. Pupils in all UK countries were less satisfied with their lives than the OECD average, and had lower expectations of their highest level of qualification than pupils across the OECD.

Headteachers in Scotland reported more problems with pupil truancy and teacher absenteeism than those in the rest of the UK, while those in Wales reported greater shortages or inadequacies of educational materials (for example textbooks, IT equipment etc.). Principals in Northern Ireland reported more inadequacies with the physical infrastructure of their schools than headteachers in England, Wales and Scotland.

1 Introduction

This report presents the reading, mathematics and science results of the international comparison study PISA 2018 for 15-year-olds in Wales. The results for the United Kingdom as a whole are reported in the OECD's international reports.

Comparisons are made with other countries of the UK and some selected countries identified as of particular interest, for example, because of high achievement.

Chapter 1 gives background on the PISA study and its implementation in the UK. It also outlines the structure of the rest of the report.

1.1 What is PISA?

1.1.1 Background to PISA

The Programme for International Student Assessment (PISA) is a study of educational achievement organised by the Organisation for Economic Co-operation and Development (OECD). In England, Wales, Northern Ireland and Scotland, PISA 2018 was carried out on behalf of the respective governments by the National Foundation for Educational Research (NFER), which acted as the National Centre for PISA.

PISA assesses the knowledge and skills of pupils aged 15, who are assessed on their competence to address real-life challenges involving reading, mathematics and science. PISA is carried out on a 3-year cycle. The first PISA study was in 2000 (supplemented in 2002) and was undertaken in 43 countries (32 in 2000 and another 11 in 2002). Since then, the number of participating countries has increased, with 79 countries participating in PISA 2018. Each round of PISA focuses on one of the three areas in which knowledge and skills are assessed: mathematics, science and reading. The major domain for PISA 2018 was reading, with science and mathematics as minor subject domains.

The data collected through PISA enables governments to benchmark education policy and performance, to make evidence-based decisions and to learn from policies and practices in other countries. It is also of great value to academic and research communities and to participating schools.

1.1.2 Participating countries

Countries, regions and jurisdictions

The entities that participated in PISA were, in most cases, whole countries while in others they were regions of countries or separate jurisdictions. However, for ease of reference, throughout this report we refer to all participating entities as 'countries'.

Table 1.1   List of 79 countries that took part in PISA 2018

In PISA 2018, 79 countries took part. Of these, 37 were members of the OECD (highlighted in bold on the following table). These countries were:

Countries A – G	Countries H – N	Countries P – V
Albania	Hong Kong (China)	Panama
Argentina	**Hungary**	Peru
Australia	**Iceland**	Philippines
Austria	Indonesia	**Poland**
Baku (Azerbaijan)	**Republic of Ireland**	**Portugal**
Belarus	**Israel**	Qatar
Belgium	**Italy**	Romania
Bosnia and Herzegovina	**Japan**	Russian Federation
Brazil	Jordan	Saudi Arabia
Brunei Darussalam	Kazakhstan	Serbia
B-S-J-Z (China)[1]	**Korea**	Singapore
Bulgaria	Kosovo	**Slovak Republic**
Canada	**Latvia**	**Slovenia**
Chile	Lebanon	**Spain**[3]
Colombia	**Lithuania**	**Sweden**
Costa Rica	**Luxembourg**	**Switzerland**
Croatia	Macao (China)	Chinese Taipei
Cyprus[2]	Macedonia	Thailand
Czech Republic	Malaysia	**Turkey**
Denmark	Malta	Ukraine

Countries A – G	Countries H – N	Countries P – V
Dominican Republic	**Mexico**	United Arab Emirates
Estonia	Moldova	**United Kingdom**
Finland	Montenegro	**United States**
France	Morocco	Uruguay
Georgia	**Netherlands**	Vietnam[4]
Germany	**New Zealand**	
Greece	**Norway**	

Notes:

[1] B-S-J-Z (China) refers to the four Chinese provinces that participated (Beijing, Shanghai, Jiangsu and Zhejiang).

[2] Data for Cyprus was not available for analysis at the time of writing the national reports. However, Cyprus is included in the appendix tables and in the international reports.

[3] Reading data for Spain is not included in the international database or reports due to technical issues.

[4] Data for Vietnam is not fully included in the international database or reports due to technical issues.

1.2 What does PISA measure?

Each round of PISA assesses pupils in reading, mathematics and science. The major domain for PISA 2018 was reading.

1.2.1 The PISA 2018 assessment framework

In each round of PISA, the OECD develops a new assessment framework for the major domain (reading in PISA 2018). This outlines the particular skills to be assessed and also the way in which they will be measured. The PISA 2018 framework is available on the OECD website[1]. The framework for reading is also outlined in Chapter 2 of this report and described in more detail in Appendix A2, which also includes sample reading questions.

1.2.2 The PISA questionnaires

In addition to the PISA assessments in reading, mathematics and science, schools and pupils complete questionnaires, the content of which is also specified in the PISA 2018 framework.

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[1] https://www.oecd-ilibrary.org/education/pisa-2018-assessment-and-analytical-framework_5c07e4f1-en

The PISA pupil questionnaire[2], completed by all participating pupils, asks them about their background, their attitudes and feelings, their educational experiences and their future aspirations. In PISA 2018, pupils were asked in detail about their experiences of and attitudes towards reading, both inside and outside school.

The PISA school questionnaire is completed by the headteacher or a senior teacher and collects information on various aspects of school management and organisation and, for PISA 2018, focused in particular on the teaching of reading in schools.

1.3   How does PISA measure attainment?

In Wales, 3165 15-year-old pupils in 107 schools completed a two-hour computer-based assessment and pupil questionnaire. The majority of pupils who took part in the study were due to complete their GCSEs in 2019 while others were in the year below. While GCSEs tend to focus on assessing a pupil's learning based on the curriculum, PISA is designed to assess the application of the pupil's learning to real-life situations. In this section, we outline how PISA assesses pupils, and the steps taken to collect high quality data that is comparable across countries.

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[2] Referred to as the student questionnaire in international reports and databases.

Differences between PISA and GCSEs

While both PISA and GCSEs assess pupils in reading, mathematics and science, there are several differences between the two assessments.

What is assessed: GCSE (General Certificate of Secondary Education) assess pupils on content and skills defined by the national curriculum. PISA is not based on specific curriculum content in participating countries. Rather, it measures pupils' ability to apply their knowledge to solve problems in real-world situations.

The time of assessment: In Wales, the PISA tests were sat in October to December 2018 by pupils around age 15 at the beginning of the academic year. This is six months before GCSE exams, which were taken in May/June 2019.

Mode of assessment: Pupils complete the PISA tests on computer, while GCSEs are paper-based examinations.

Importance of the assessment for pupils: Pupils do not receive individual results or feedback about their performance in PISA. In contrast, GCSEs are 'high stakes' exams, with pupils receiving a grade for each subject they enter.

Because of the low-stakes nature of PISA, pupils may make less effort than in examinations such as GCSEs. For this reason, pupils participating in PISA were asked to complete an 'effort thermometer' to indicate how much effort they had invested in the PISA assessment, and how much they would have invested if the scores were going to be counted in their school marks. The results are presented in Appendix F.

1.3.1 How PISA samples are chosen

Countries participating in PISA must follow strict international sampling procedures to ensure comparability between their samples. NFER worked closely with the international sampling contractor to ensure that Wales' sample was representative of its 15-year-old population.

NFER provided the international sampling contractor with a sampling frame (a list of all schools with eligible pupils), from which they selected a sample of schools, chosen at random to be representative of all schools in Wales, for example by school type and region. The aim of this is to achieve a sample of pupils which is representative of the population of 15-year-olds in schools.

The schools which had been selected in the sample were then invited to participate in the study. Software supplied by the international PISA contractor was used by NFER to randomly select 40 pupils who met the PISA age definition within each school, for all

schools that agreed to take part. In Wales, the majority of pupils were in Year 11. The aim of the PISA sampling is to obtain a nationally representative sample of pupils in the age group, rather than a pupil sample that is representative at school level.

PISA 2018 response rates

The final school response rate for the UK was 87%. This was slightly below the OECD's target participation rate and NFER was asked to submit a non-response bias analysis, analysing differences between responding and non-responding schools, and between originally sampled schools and replacement schools. The OECD's Technical Advisory Group was satisfied that this analysis demonstrated that no notable bias would result from the non-response. The OECD therefore agreed that the UK data should be included as fully comparable to other countries' data in the international reports.

The minimum pupil response rate required was 80% and the final UK rate of 83% fully met this target.

Full details of sampling procedures and the numbers of participating schools and pupils are in Appendix A.

1.3.2 How PISA assesses pupils

PISA uses a common set of assessments and questionnaires in all participating countries. Each country was responsible for adapting and translating these materials and the international contractors then verified the adapted and translated materials. All procedures affecting assessment conditions were standardised across countries and carefully monitored.

The OECD's international contractors led the development of new questions for assessing reading, the major domain in PISA 2018. Participating PISA countries were invited to submit questions that were then added to those developed by the OECD's experts and contractors. The international contractors and participating countries reviewed these questions and checked them for cultural bias. Those deemed suitable were then trialled as part of a field trial conducted during 2017 in all participating countries. If any questions proved to have been too easy or too hard in certain countries, they were dropped from the main study in all countries.

For mathematics and science, which were minor domains in PISA 2018, questions from previous cycles were used. A set of reading questions used in previous cycles was also included so that trends in performance could be measured across PISA cycles.

The PISA assessments are computer-based and each pupil sits a two-hour assessment. The OECD introduced computer-based assessment in PISA 2015, so PISA 2018 was the first cycle of electronic delivery with reading as the major domain. Pupils were presented with a variety of question formats in the assessment. Some questions were multiple choice, some required more detailed written responses and, since the introduction of computer delivery, some interactive simulations have been included. Examples of PISA 2018 questions are in Appendix A.

PISA is designed with the aim of providing an assessment of performance at the system (or country) level. It uses a design in which the full set of assessment materials are distributed among different units, and participating pupils are presented with different sets of these units. This approach enables the OECD to obtain a much greater coverage of the content than if all pupils completed the same version of the assessment. PISA is not designed to produce individual pupil scores, so it is not necessary for each pupil to receive exactly the same set of assessment questions.

An innovation in PISA 2018 was the introduction of an approach referred to as multi-stage adaptive testing (MSAT) for the assessment of reading. This type of adaptive testing is particularly well suited for assessments that consist of units that, in turn, are composed of multiple questions, some of which may require human coding (marking). The computer bases decisions about which unit to present to a pupil next, based on performance on a set of questions. This gives a better assessment of a pupil's ability, since the flow of assessment questions is adapted to the pupil's ability so that questions are neither too easy nor too difficult.

1.4   Organisation of this report

Chapters 2, 4 and 5 describe PISA results for reading, science and mathematics in Wales. Chapter 3 discusses pupils' responses to the pupil questionnaire, in particular, responses on attitudes towards reading and performance by pupil characteristics, such as socio-economic status. Chapter 6 presents responses by headteachers to the school questionnaire and also describes aspects of the school environment, such as bullying and school discipline. In Chapter 7 we compare and discuss the PISA results in all four countries of the United Kingdom.

The international tables and figures presented in the appendices of this report include the results for the United Kingdom since these are reported in all international tables. In most cases, tables and figures in the appendices also include results for England, Wales, Northern Ireland and Scotland.

In each chapter of this report, we make comparisons between the results for Wales and the OECD average. This is the average of the 37 members of the OECD. This is more useful than a comparison with all participating countries as it enables comparison with

similarly developed countries. We also include comparisons with specific individual countries where such comparisons help to illustrate and interpret the results in Wales.

The OECD average

Since 2010, 7 countries have joined the OECD (Chile, Colombia, Estonia, Israel, Latvia, Lithuania, Slovenia) meaning there are now 37 OECD members. Where applicable within this report, we will make comparisons to the average of these 37 members (referred to as the 'OECD average'). When making comparisons with previous PISA cycles, where possible, the current OECD member countries will be used as the 'OECD average', to ensure consistent comparisons over time. However, for some of the trend information, data is not available for all 37 countries, so the OECD average will be based on the countries with available data. This means the OECD averages used in this report for PISA 2015 and earlier cycles may be different from those used in previous PISA reports. The national reports for previous cycles will include a different number of countries within the OECD average, since they were based on OECD membership at the time.

More detailed analyses of international results can be found in the OECD report on PISA 2018, which also includes results for the United Kingdom (OECD, 2019b, OECD 2019c, OECD 2019d). The results from the separate countries of the UK are reported in an Annex to the international report.

The OECD and its international contractors analyse and report on the data collected in each country. This analysis includes mean scores for reading, mathematics and science, distribution of pupils' performance, and changes in performance in countries over time. The OECD also analyses and reports on a range of variables such as the effects of socio-economic background, school management and pupil attitudes.

The OECD publishes full details of how this analysis is done in the Technical Report (OECD, 2019). The full international results are available on the OECD website.

Interpreting differences between countries

It is important to know what can reasonably be concluded from the PISA data and which interpretations would be going beyond what can be reliably supported by the results. Some important points need to be kept in mind while reading this report.

Sources of uncertainty

There are two sources of uncertainty which have to be taken into account in the statistical analysis and interpretation of any test results. These are described as **sampling error** and **measurement error**. The use of the term 'error' does not imply that a mistake has been made; it simply highlights the necessary uncertainty.

Sampling error stems from the inherent variation of human populations which can never be summarised with absolute accuracy. It affects virtually all research and data collection that makes use of sampling. Only if every 15-year-old in each participating country had taken part in PISA could it be stated with certainty that the results are totally representative of the attainment of the entire population of pupils in those countries. In reality, the data was collected from a sample of 15-year-olds. Therefore, the results are a best estimation of how the total population of 15-year-olds could be expected to perform in these tests. There are statistical methods to measure how good the estimation is. It is important to recognise that all data on human performance or attitudes which is based on a sample carries a margin of error.

Measurement error relates to the results obtained by each individual pupil. It takes account of variations in their score which are not directly due to underlying ability in the subject, but which are influenced by other factors related to individuals or to the nature of the tests or testing conditions.

Interpreting rank order: the importance of statistical significance

Because of the areas of uncertainty described above, interpretations of very small differences between two sets of results are often meaningless. Were they to be

measured again it could well be that the differences would turn out the other way round. For this reason, this report focuses mainly on **statistically significant** differences between mean scores rather than the simple rank order of countries. Statistically significant differences are unlikely to have been caused by random fluctuations due to sampling or measurement error.

When statistical significance is reported, it indicates that the compared mean scores are significantly different at the 5% level.

Where statistically significant differences between countries are found, these may be the result of a great number of factors. The data for some of these factors were not collected in the PISA survey. Therefore, the PISA survey is only able to explain the reasons for differences between countries to a limited extent. For example, differences in school systems and educational experiences in different countries could play a part, as could a wide range of different out-of-school experiences, details of which are not included in the data collection. It is important to bear this in mind while reading this report.

It is also important to remember that changes in ranking over time may be because of changes in which countries participate in each cycle.

2 Reading

Chapter outline

This chapter reports the reading attainment of pupils in Wales. It draws on findings outlined in the PISA International report (OECD, 2019b) and places outcomes for Wales in the context of those findings. Throughout the chapter, comparisons are made between the findings for PISA 2018 and previous cycles.

Key findings

Overall reading performance

- In 2018, pupils in Wales achieved a mean score of 483 in reading. This was similar to the OECD average (487) for the first time. The 2018 reading mean score was an increase of 6 score points since 2015, but the difference was not statistically significant.
- Wales and the OECD have each maintained their average levels of performance in reading, with 2018 reading scores that were not significantly different from previous PISA cycles.

Gender gap

- Girls significantly outperformed boys in all participating countries.
- The gender gap in Wales (26 score points) was slightly smaller, but not significantly different from the OECD average (30 score points).

Attainment gap between highest and lowest achievers

- The attainment gap in Wales was lower than, but not significantly different than, the OECD average.
- There has been a significant increase in the scores of higher achieving pupils since 2015, but the scores of lower achieving pupils have not significantly changed in that time.

Reading subscales

- In Wales, pupils showed relative strengths in the reading skills of 'locating information' and 'evaluating and reflecting' but were less strong in 'understanding'.
- Pupils had higher scores for multiple-source texts than single-source text; this was also seen internationally.

Reading performance in relation to other countries

- Compared with the other participating countries, 22 scored significantly higher than in Wales. This compares with 30 in 2015. Eleven countries performed at a level that was not significantly different from that of Wales, while the remaining 42 countries performed significantly less well.
- Since 2009, the last time reading was the major domain, Wales significantly improved its position in relation to 9 other participating countries worldwide. This is evidence of Wales' relative improvement over time in reading, even though the difference in mean scores over time was not statistically significant.

2.1 Wales' performance in reading

In 2018, pupils in Wales achieved a mean score of 483 in reading which was not statistically different from the OECD average (487)[3] for the first time. There was an increase of 6 score points since 2015, but the difference was not statistically significant[4]. The Welsh score was closer to the OECD average for reading in 2018 than in any previous cycle, but Wales and the OECD have each maintained their average levels of performance in reading, with no significant change since 2006. As seen in Figure 2.1, since 2015, as reading performance in Wales has improved, the OECD average has declined, narrowing the score difference between them.

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[3] The 2018 OECD average is based upon the 'AVR' results published in the OECD International results Table 1.B1.10.

[4] When statistical significance is reported, it indicates that the compared means are significantly different at the 5% level.

Figure 2.1   Trends over time in reading scores in Wales and the OECD[5]
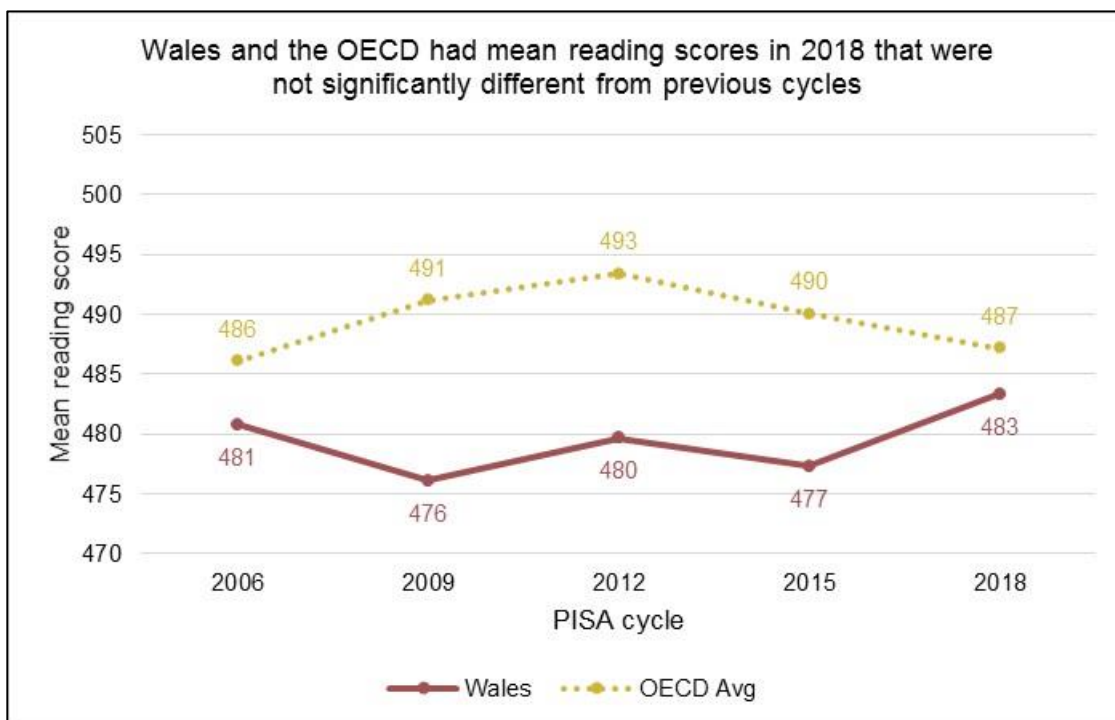
Wales and the OECD had mean reading scores in 2018 that were not significantly different from previous cycles

Source: PISA 2018 database; Bradshaw *et al*., 2007; Bradshaw *et al*., 2010; Wheater *et al*., 2014; Jerrim *et al.,* 2016.

Key point

For the first time, Wales' mean score for reading was not statistically different from the OECD average.

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[5] Note: The OECD average for 2012, 2015 and 2018 is based upon 'AVR' results presented in the OECD International results Table 1.B1.10, made up of 36 OECD countries (not including Spain, see OECD International report for more details). See Chapter 1 for further information on the countries included in the 2018 OECD average. The OECD average for 2009 is based upon 'AV35' results (excluding Austria and Spain) while the OECD average for 2006 is based on 'AV35R' results (excluding the United States and Spain), both also presented in the OECD International results Table 1.B1.10.

2.2 Reading in PISA 2018

'Reading literacy is understanding, using, evaluating, reflecting on and engaging with texts in order to achieve one's goals, to develop one's knowledge and potential, and to participate in society' (OECD, 2019b).

Reading was the major domain of the OECD PISA study in 2018. Full details of how PISA assesses reading, including how PISA defined and measured reading literacy, and differences between the PISA 2018 reading test and that of previous PISA assessments are provided in Chapter 1 of the OECD international report (OECD, 2019b). A brief summary of key points[6] is provided below.

PISA conceives reading as a broad set of competencies that allows readers to engage with written information, presented in one or more texts, for a specific purpose. To engage with what they read, readers must understand what is written and integrate this with their pre-existing knowledge. They must examine the author's (or authors') intention and decide whether the text is reliable and truthful, and whether it is relevant to their goals or purpose. PISA also recognises that reading is a daily activity for most people, and that education systems need to prepare pupils to be able to adapt to the variety of scenarios in which they will need to read as adults, and be motivated and able to read for a variety of purposes.

Reading was the major domain in 2000, the first year PISA was conducted, and again in 2009 and in 2018. The nature of reading has evolved significantly over the past decade, due to changes in technology, the use of electronic devices and the increasing need for readers to engage in a greater variety of reading tasks, such as triangulating different sources, navigating through ambiguity, distinguishing between fact and opinion, and constructing knowledge. As a result, the ways PISA measures competency in reading, or reading literacy, have had to adapt to these changes.

In 2009, about 85% of pupils in OECD countries reported that they had access to the internet at home. By 2018, that proportion had risen to over 95%. The rapid digitalisation of communication impacts on the kind of information literacy skills that young adults need, and has changed the ways people read and exchange information. Reading today requires the use of complex information-processing strategies, including the analysis, synthesis, integration and interpretation of relevant information from multiple sources.

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[6] Adapted from the PISA 2018 International report (OECD, 2019b).

The nature of texts and the type of problems included in the PISA 2018 assessment of reading reflect the evolving nature of reading in increasingly digital societies.

2.2.1 Changes between 2009 and 2018 in the PISA assessment of reading

The PISA 2018 reading literacy framework was similar in many respects to the PISA 2009 reading literacy framework, which was also used in PISA 2012 and 2015. There were, however, some changes in how the reading assessment was implemented. The major differences between the 2009 and 2018 assessments were:

- a greater emphasis, in 2018, on multiple-source texts, i.e. texts composed of several units of text, created separately by different authors. These types of text are more prevalent in the information-rich digital world and the digital delivery of the PISA 2018 reading assessment made it possible to present them to pupils, helping to expand the range of higher-level reading processes and strategies measured. The assessments included searching for information across multiple documents, integrating across texts to generate inferences, assessing the quality and credibility of sources, and handling conflicts across sources
- the explicit assessment, in 2018, of reading fluency, defined as the ease and efficiency with which pupils can read text
- the use of adaptive testing, whereby the electronic test form that a pupil saw depended on his or her answers to earlier questions
- the digital, on-screen delivery of text, which facilitated the first and third changes listed above. The 2009 assessment was conducted on paper while the 2018 assessment was conducted on computer. Pupils had to use navigational tools to move between passages of text, as there was often too much text to fit onto one screen.

The PISA assessment covers different types of texts and tasks over a range of difficulty levels. It also requires pupils to use a variety of processes, or different ways in which they cognitively interact with the text. Full details of the PISA reading literacy framework, and the research that underlies it, are available in Chapter 1 of the OECD International report (OECD, 2019b).

In this chapter, we present performance in the PISA reading assessment and compare it with the OECD average. This will include examining mean scores, the distribution of scores, performance on the PISA reading processes, gender differences and an overview of how average reading performance has changed over time. Additionally, where relevant, a range of other countries are drawn on for comparison to Wales.

Outcomes for the United Kingdom as a whole are presented in the International report (OECD, 2019b) and in the appendices that accompany this chapter (Appendix B).

Outcomes for Wales (and the 3 other UK countries) are derived from the 'sub-national' level analysis carried out by the international consortium, as well as from additional analysis carried out by NFER using the international dataset. Comparisons between the 4 UK countries are provided in Chapter 7.

2.3 International results

Of the 75 other reported[7] participating countries, 22 scored significantly higher than in Wales. This compares with 30 in 2015. Eleven countries performed at a level that was not significantly different from that of Wales, while the remaining 42 countries performed significantly less well. These are shown in Tables 2.1 to 2.3[8]. Only 4 participating countries had reading scores significantly higher than they had in 2015; these were Singapore, Macao (China), Turkey and the Republic of North Macedonia, with increases of 14, 16, 37 and 41 score points respectively.

Among OECD countries, 17 outperformed Wales, 9 performed similarly and 9 performed less well. This indicates that in terms of reading achievement, Wales is not among the highest-achieving group of countries internationally, but is in the mid-range among other OECD countries. Only one OECD country, Turkey, showed significant improvement in reading since 2015, but scores declined significantly in 7 OECD countries (Japan, Norway, Slovenia, Netherlands, Latvia, Luxembourg and Colombia).

In 2018, Wales' mean reading score was not significantly different from the mean scores of 7 countries that had previously outperformed them in 2015 (Portugal, Czech Republic, Netherlands, Switzerland, Russian Federation, Croatia and Latvia) (Jerrim *et al*., 2016). Additionally, Wales outperformed 4 countries that had had scores that were not significantly different from Wales in 2015 (Iceland, Israel, Luxembourg and Greece).

> **Key point**
>
> In 2018, 22 countries significantly outperformed Wales in reading, but this number has decreased from 30 in 2015

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[7] Whilst Vietnam and Cyprus did participate in PISA 2018, their results are not included in this report. Additionally, reading results are not available for Spain. See Chapter 1 for further details of the countries included in this report.
[8] Note: Please refer to section 1.4 in Chapter 1 when interpreting these results.

Key point

Wales' mean reading score was not significantly different from the mean scores of 7 countries that had previously significantly outperformed them in 2015.

Table 2.1   PISA International results for reading: participants with significantly HIGHER reading scores than Wales

Country	Scale score		Country	Scale score	
*B-S-J-Z (China)**	555		New Zealand	506	
Singapore	549	∧	United States	505	
Macao (China)	525	∧	Japan	504	∨
Hong Kong (China)	524		Australia	503	
Estonia	523		*Chinese Taipei*	503	
Canada	520		Denmark	501	
Finland	520		Norway	499	∨
Republic of Ireland	518		Germany	498	
Korea	514		Slovenia	495	∨
Poland	512		Belgium	493	
Sweden	506		France	493	

∧∨ Indicates a statistically significant change in reading since PISA 2015
OECD countries (not italicised)
Countries not in OECD (italicised)
*B-S-J-Z (China) different provinces from 2015

Source: PISA 2018 database

Table 2.2   PISA International results for reading: participants with SIMILAR reading scores to Wales (not statistically significantly different)

Country	Scale score		Country	Scale score	
Portugal	492		*Croatia*	*479*	
Czech Republic	490		Latvia	479	˅
OECD Average	**487**		*Russian Federation*	*479*	˅
Netherlands	485	˅	Italy	476	
Austria	484		Hungary	476	
Switzerland	484		Lithuania	476	
Wales	**483**				

˄˅ Indicates a statistically significant change in reading since PISA 2015
OECD countries (not italicised)
Countries not in OECD (italicised)

Source: PISA 2018 database

Table 2.3   PISA International results for reading: participants with significantly LOWER reading scores than Wales

Country	Scale score		Country	Scale score	
Iceland	474		Slovak Republic	458	
Belarus	*474*		Greece	457	
Israel	470		Chile	452	
Luxembourg	470	˅	Mexico	420	
Ukraine	*466*		Colombia	412	˅
Turkey	466	˄	plus 31 other countries scoring <450		

˄˅ Indicates a statistically significant change in reading since PISA 2015
OECD countries (not italicised)
Countries not in OECD (italicised)

Source: PISA 2018 database

The last time reading was the major domain in PISA was 2009. It is useful therefore to look at longer term trends from 2009, and other cycles where relevant.

Although the overall mean score for reading has not changed significantly over time, there are signs of relative improvement in Wales. For example, since 2009, Wales' position relative to other countries has improved. In 2018, 22 countries had significantly higher mean scores than Wales. This compares with 30 countries outperforming Wales in

2015 (Jerrim *et al.*, 2016), 31 in 2012 (Wheater *et al.,* 2013) and 29 in 2009 (Bradshaw *et al.,* 2010).

In 2018, 5 countries that had significantly higher scores in 2009 now performed similarly to Wales (Portugal, Netherlands, Switzerland, Italy and Hungary) and one (Iceland) was significantly lower.

In 2009, there were 9 countries that performed similarly to Wales (Bradshaw *et al.,* 2010). In 2018, Wales performed significantly better than 4 of these countries (Greece, Slovak Republic, Israel and Luxembourg), while the remaining 5 were still performing at a similar level to Wales (Latvia, Czech Republic, Croatia, Austria and Lithuania). None had significantly higher scores in 2018.

Figure 2.2 shows the trends in performance for 3 of these countries: Luxembourg, Czech Republic and Croatia, all of which have seen different patterns of performance to Wales.

Figure 2.2   Trends in reading scores for a selection of countries that performed similarly to Wales in 2009
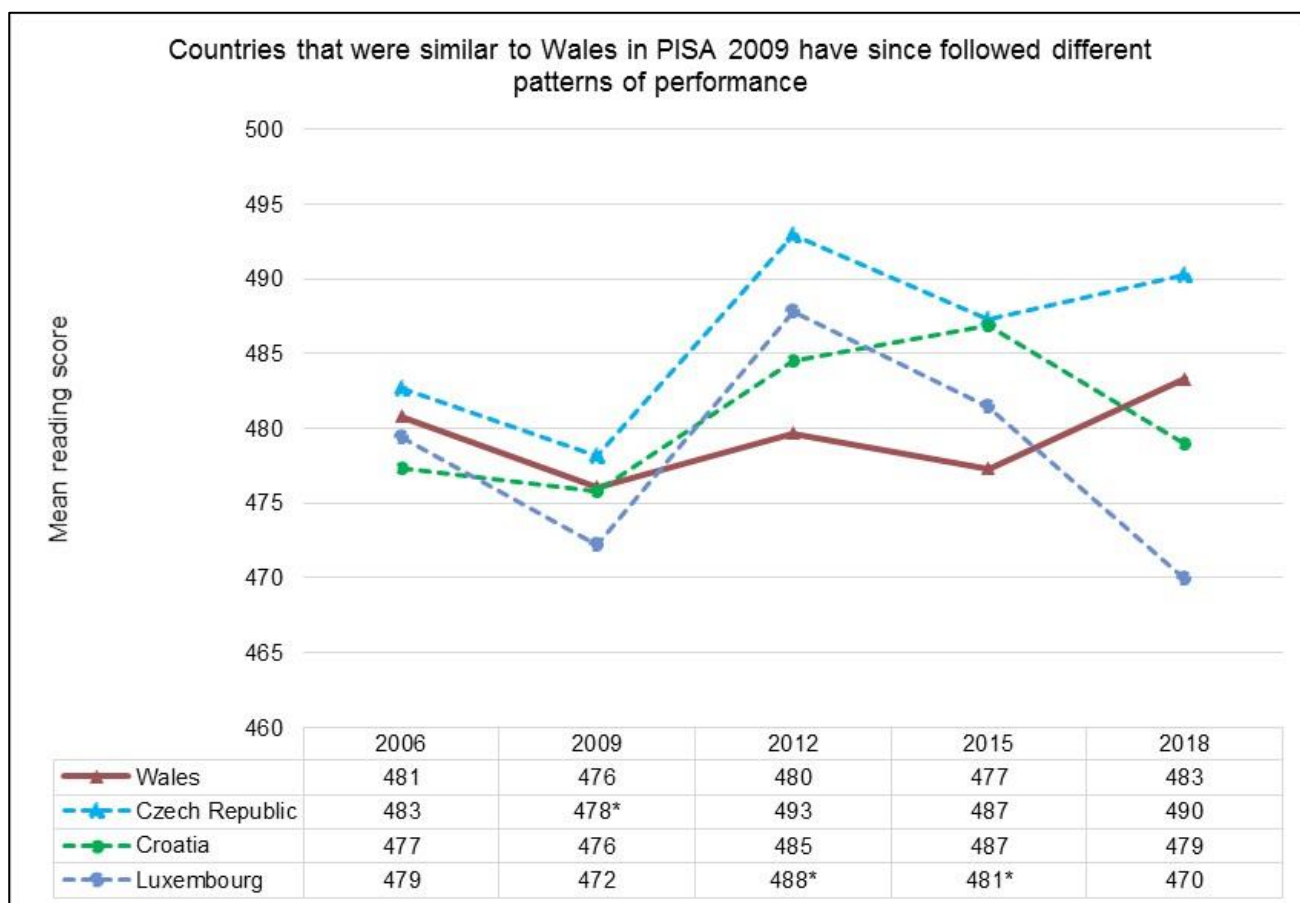
	2006	2009	2012	2015	2018
Wales	481	476	480	477	483
Czech Republic	483	478*	493	487	490
Croatia	477	476	485	487	479
Luxembourg	479	472	488*	481*	470

* Indicates a score that is significantly different from the given country's 2018 score

Source: PISA 2018 database; Bradshaw *et al.*, 2007; Bradshaw *et al.*, 2010; Wheater *et al.*, 2014; Jerrim *et al.*, 2016.

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Whilst Wales' performance in reading has remained stable over time, Luxembourg has followed a different pattern. Their increase in mean reading score in 2012 put Luxembourg significantly above Wales but since then, a decline across 2 cycles has resulted in scores significantly below Wales in 2018.

The Czech Republic had a mean reading score in PISA 2018 which was significantly higher than in 2009. Although they significantly outperformed Wales in 2012 and 2015, the increase in Wales' mean score (although not statistically significant) has meant that Wales now performs similarly to the Czech Republic.

Like Wales, Croatia's 2009 mean score (and subsequent cycles' mean scores) in reading was not significantly different from their 2018 mean score. In 2015, Croatia scored significantly higher than Wales, but due to their (non-significant) decline and Wales' (non-significant) increase in reading score, they scored similarly in PISA 2018.

> **Key point**
>
> Wales' stable pattern of performance in reading is not seen amongst some other countries that performed similarly to Wales in 2009, such as the Czech Republic and Croatia.

2.4   Reading subscale scores

As reading was the major domain in 2018, pupils' scores were analysed separately by the different processes required for reading, as well as by their overall performance. The overall mean score for reading in Wales was 483 score points.

The PISA 2018 reading literacy framework[9] identifies 4 processes that readers use when engaging with a text. These are 'locating information', 'understanding', 'evaluating and reflecting' and 'reading fluency'. The first 3 processes were included, in some way, in previous PISA frameworks. The latter process, 'reading fluency' underpins the other 3 processes and is included for the first time in the 2018 PISA framework.

2.4.1 Locating information

The first cognitive reading process is 'locating information'. This was referred to as 'accessing and retrieving' in the 2009 PISA reading literacy framework. Readers need to

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[9] Explanations of each of the subscales in this report are adapted from the PISA 2018 International report (OECD, 2019b).

assess the relevance, accuracy and truthfulness of passages in order to find information as efficiently as possible. PISA 2018 breaks locating information into 2 cognitive processes:

- accessing and retrieving information within a piece of text, where readers need to scan a single text, retrieving a few words, phrases or numerical values. Overall comprehension of the whole text is not necessary as the target information usually appears verbatim.
- searching for and selecting relevant text, where readers need to consider several pieces of text. This has a particular place in digital reading, where the total amount of text available exceeds the quantity that readers can or need to process.

Figure 2.3   Reading process subscale scores across countries: locating information
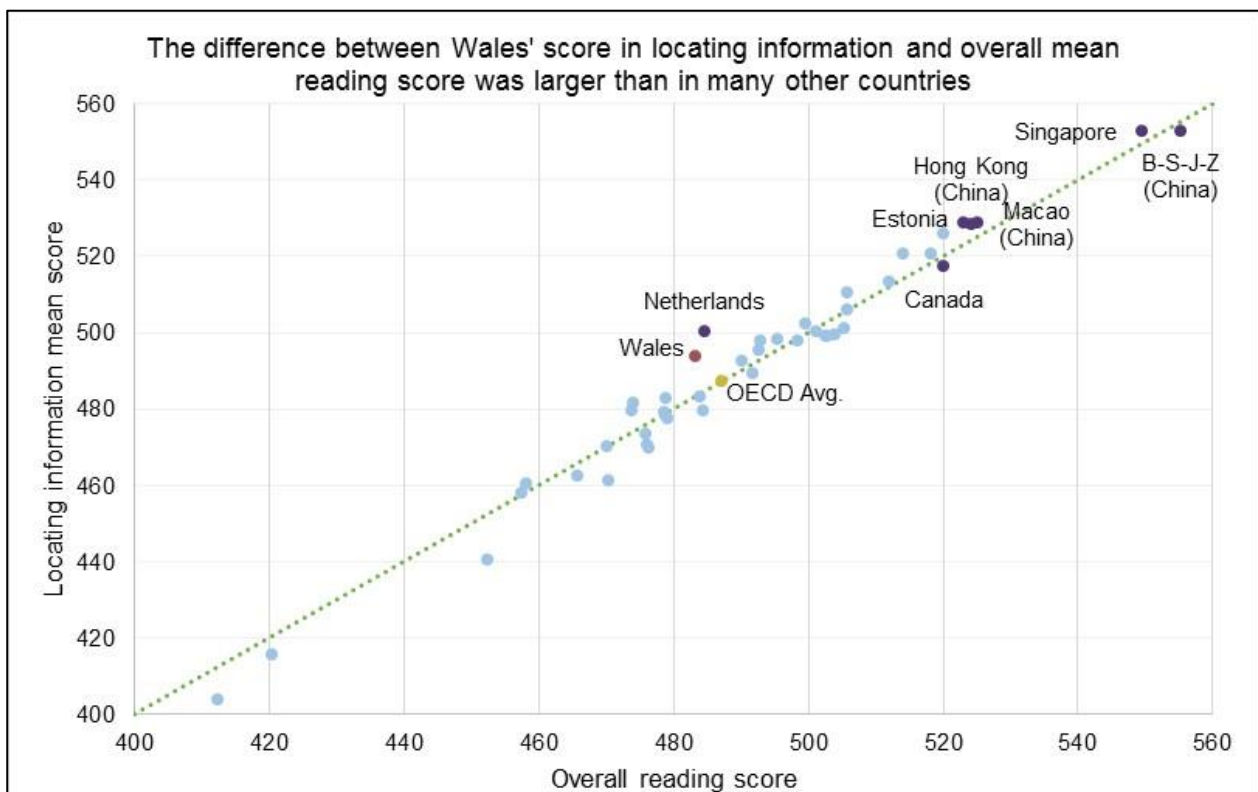
Note: This scatterplot includes all OECD countries and those with a mean score above 450

Source: PISA 2018 database

Wales' pupils' highest score for reading processes was in locating information (494), with a 10 score point[10] difference from their overall mean. This difference was larger than in many other countries. As Figure 2.3 shows, most countries did not have a large

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[10] after taking into account the rounding of figures

difference in mean scores and there was no obvious pattern as to which score was higher. The Netherlands had a mean score for locating information that was 15 points larger than their overall mean score. Canada and B-S-J-Z (China) had scores for locating information that were slightly lower than their overall mean reading score, but this was not the pattern seen across some of the other highest-performing countries, such as Singapore, Macao (China), Hong Kong (China) and Estonia.

This cognitive process appears to be a strength for Wales as well as the Republic of Ireland and Finland, which both had higher mean scores (521 and 526 respectively) than were seen in understanding, and evaluating and reflecting.

Since 2009, when reading was last the major domain, Wales' mean score for locating information (previously known as accessing and retrieving) has increased by 17 score points. 'Evaluating and reflecting' was the strongest cognitive process in Wales in PISA 2009 (Bradshaw *et al.,* 2010).

2.4.2 Understanding

The second process assessed in PISA is 'understanding', more commonly referred to as 'reading comprehension'. In previous PISA frameworks this has been called 'integrating and interpreting'. This is the ability to recognise the meaning conveyed in a passage. In the 2018 PISA reading literacy framework, 2 specific cognitive processes make up understanding:

- acquiring a representation of the literal meaning of a piece of text, where readers must paraphrase sentences or short paragraphs so that they match the target information desired by the task.
- constructing an integrated text representation, where readers work with longer passages to establish their overall meaning. Readers need to connect the information across various passages. This may also require readers to resolve conflicts between different texts.

Figure 2.4   Reading process subscale across countries: understanding
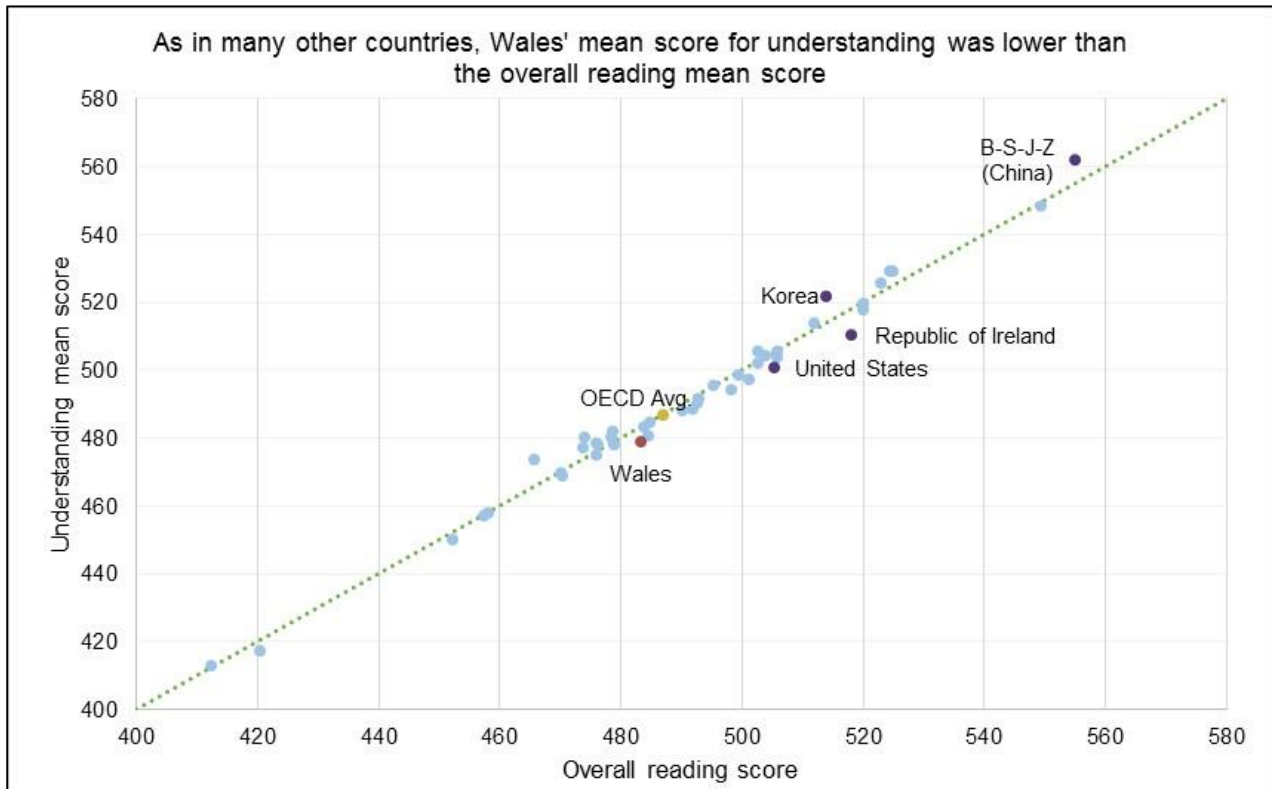
As in many other countries, Wales' mean score for understanding was lower than the overall reading mean score

Note: This scatterplot includes all OECD countries and those with a mean score above 450

Source: PISA 2018 database

Wales' pupils were weaker in understanding (479) than in locating information, with a mean score 5 score points[11] lower than their average reading score. As Figure 2.4 shows, lower mean scores for understanding were seen in other countries such as the Republic of Ireland and the United States, and with the OECD average. However, high-performing countries such as Korea and B-S-J-Z (China) had mean scores in understanding that were higher than their overall mean scores, with differences of 8 and 7 score points respectively.

In 2009, Wales had a similar difference (4 score points) in the mean score for understanding (previously known as integrating and interpreting) compared with the overall mean (Bradshaw *et al.,* 2010).

2.4.3 Evaluating and reflecting

The highest level process assessed in PISA is 'evaluating and reflecting'. Readers need to go beyond understanding the literal or inferred meaning of a piece of text to assess the

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[11] after taking into account the rounding of figures

quality and validity of its content and form. This process has always been part of reading literacy but its importance has strengthened with the growth of digital reading.

There are 3 cognitive processes involved in evaluating and reflecting:

- assessing quality and credibility, where readers judge the validity of content, considering if it is accurate and / or unbiased
- reflecting on content and form, where readers evaluate the quality and style of the text. This may require drawing on real-world knowledge and experience in order to consider different perspectives
- detecting and handling conflict, where readers compare information across texts, recognising contradictions between pieces of text and managing such contradictions. This process is more commonly used when examining multiple-source text.

Figure 2.5 **Reading process subscale scores across countries: evaluating and reflecting**
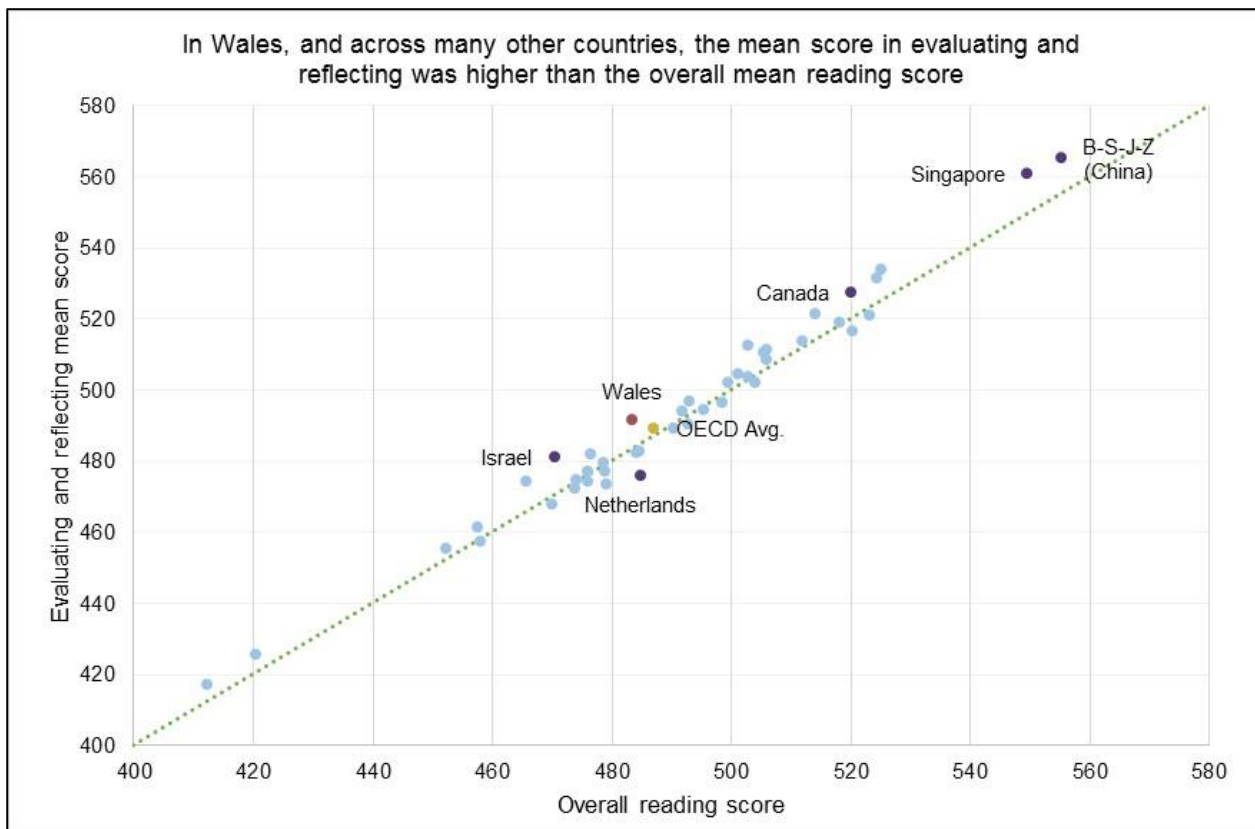
Note: This scatterplot includes all countries in the OECD and those with a mean score above 450

Source: PISA 2018 database

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Wales had an 8 score point[12] difference between their mean score in evaluating and reflecting (492) and the overall reading mean score (483). This pattern was seen across many high-performing countries, such as Canada, Singapore, and B-S-J-Z (China), and with the OECD average. Israel and Singapore both had the largest difference between mean scores (11 score points).

In the previous 2 processes, the Netherlands had a similar pattern to Wales (higher locating information mean score, lower understanding mean score in comparison to overall score). However, for evaluating and reflecting they saw the opposite pattern to Wales, with a mean score in this process that was 9 score points lower than their overall mean score.

In 2009, Wales was strongest in evaluating, with a difference of 7 score points above the overall reading mean (Bradshaw *et al.,* 2010). Although the size of this difference is similar in 2018 to 2009, mean scores for locating information are now higher, making it Wales' strongest reading process.

> **Key point**
>
> Wales had mean scores for locating information and evaluating and reflecting that were higher than their overall mean scores. Their mean score in understanding was lower.

2.4.4 Reading fluency

The final process, 'reading fluency' was assessed for the first time in 2018. At the beginning of the reading assessment, pupils were presented with a variety of sentences, one at a time, and asked to determine if they made sense. Pupils had a short window in which to respond 'Yes' or 'No' before the next sentence was shown. The sentences were relatively simple and it was unambiguous whether they made sense or not. This section included sentences such as:

Six birds flew over the trees.

The window sang the song loudly.

The man drove the car to the store[13].

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[12] after taking into account the rounding of figures

[13] 'Store' was adapted to 'shop' in Wales' version of the assessment.

Reading fluency was considered in pupils' overall scores but not included in the computation of subscale scores. For more information on reading fluency, see Chapter 1 of the OECD International report (OECD, 2019b).

2.4.5 Text classification

In 2009, reading texts were classified by 4 dimensions:

- medium: is the text delivered in print or electronic format?
- environment: was it composed by one author, a group of authors or disjointedly by multiple authors?
- text format: is it continuous prose, a non-continuous matrix of writing or a mixture?
- text type: why was it written and how was it organised?

In the PISA 2018 computer-based assessment of reading, all texts were read on screen and therefore the 'medium' dimension was no longer relevant. The 2018 reading literacy framework was updated and classified texts by:

- source (similar to the previous classification of 'environment'): is the text composed of a single unit or multiple units?
- organisational and navigational structure: how readers move through all of the text when the screen can only display so much on the screen
- text format (as it was in the 2009 framework)
- text type (as it was in the 2009 framework).

2.4.6 Source

This section focuses on the source classification: how countries performed on single and multiple-source texts.

Figure 2.6   Reading source subscale scores across countries: single-source text vs. multiple-source texts
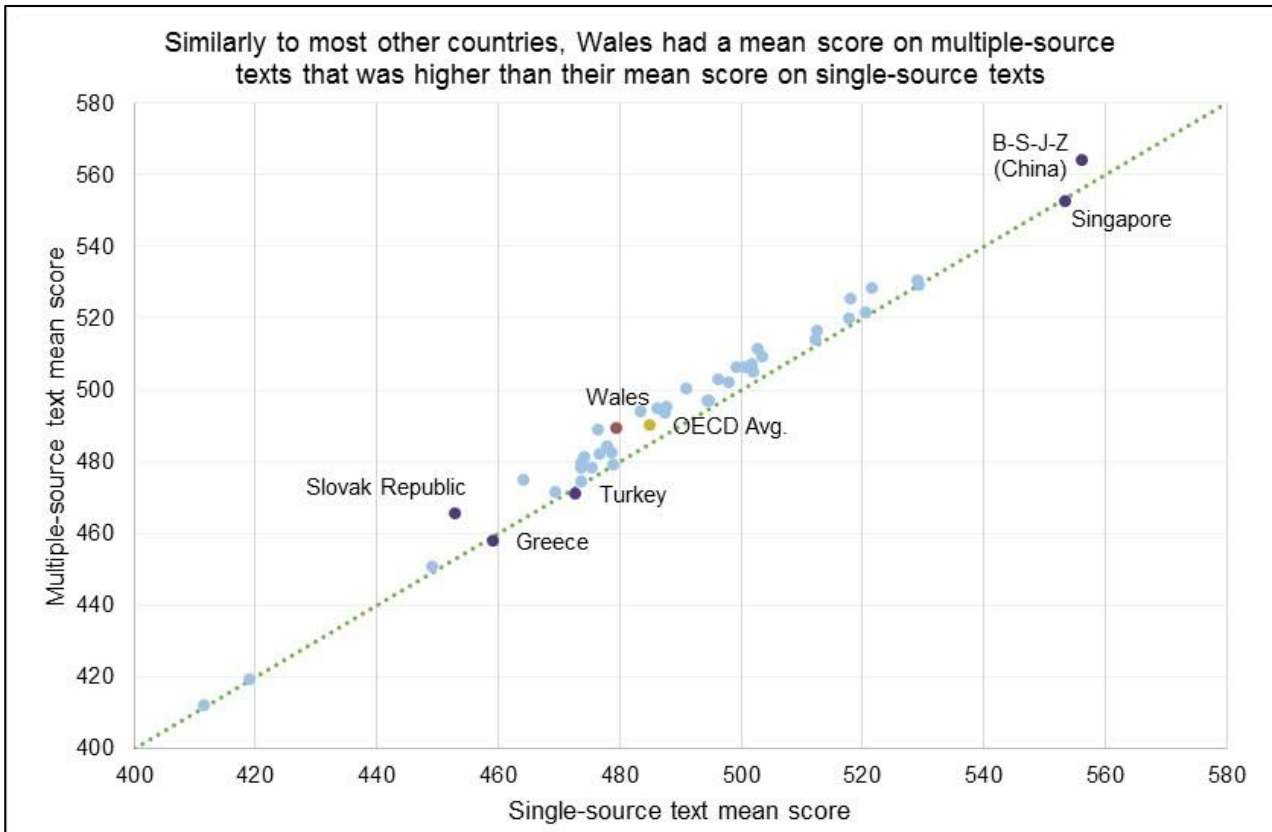
Note: This scatterplot includes all countries in the OECD and those with a mean score above 450

Source: PISA 2018 database

As Figure 2.6 shows, Wales' mean score on multiple-source texts (489) was 10 score points[14] higher than their mean score on single-source texts (480). This pattern was seen across many other countries, with Slovak Republic and Switzerland having the largest gap of 12 score points and highest-performer B-S-J-Z (China) having a gap of 8 score points. Singapore had a higher mean score on single-source texts, as did Greece and Turkey.

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[14] after taking into account the rounding of figures

2.5 Differences between highest and lowest achievers

In addition to knowing how well pupils in Wales performed overall and across the different subscales assessed, it is also important to examine the spread in performance between the highest and lowest achievers. Amongst countries with similar mean scores, there may be differences in the numbers of high- and low-scoring pupils (the highest and lowest achievers). A country with a wide spread of attainment may have large numbers of pupils who are underachieving, as well as pupils performing at the highest levels. A country with a lower spread of attainment may have fewer very high achievers but may also have fewer low achievers.

2.5.1 Distribution of scores

The first way in which the spread of performance in each country can be examined is by looking at the distribution of scores. Appendix B shows the scores achieved by pupils at different percentiles. The 10th percentile is the score below which the lowest performing 10% of pupils lay, while the 90th percentile is the score above which the highest performing 10% lay. The difference between the highest and lowest achievers at the 10th and 90th percentiles is a better measure of the spread of scores for comparing countries than using the very lowest- and highest-scoring pupils. The latter comparison may be affected by a small number of pupils in a country with unusually high or low scores. Comparison of the 10th and the 90th percentiles gives a better indication of the typical spread of attainment.

Figure 2.7   Attainment gap in reading scores in Wales and the OECD

The attainment gap in Wales was smaller than, but not significantly different from, the OECD average
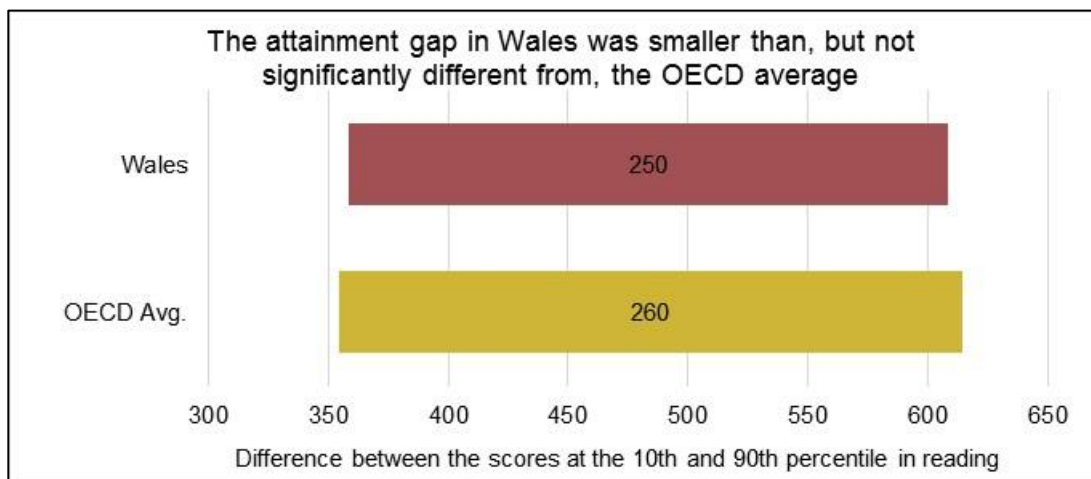
Source: PISA 2018 database

The gap between the highest- and lowest-achieving pupils in Wales was 250 score points[15], smaller than, but not significantly different from, the OECD average gap of 260 score points. Lower-achieving pupils in Wales, i.e. those at the 10th percentile, had a score of 359, while the score of those at the 90th percentile was 608. The OECD score at the 10th percentile was slightly lower than Wales (354) and that at the 90th percentile was just above (614), resulting in the wider attainment gap.

Since 2015 pupils' scores at the 90th percentile have significantly increased (from 588 in 2015 to 608 in 2018). However, scores at the 10th percentile have remained stable (368 in 2015 and 359 in 2018).

Key point

Wales' attainment gap was 10 score points lower than, but not significantly different from, the OECD average.

Figure 2.8 compares countries' mean reading scores with the size of their attainment gap. Countries can be separated into 4 categories in relation to the OECD average: lower-performing countries with a larger gap, lower-performing countries with a smaller gap, higher-performing countries with a larger gap, and higher-performing countries with a smaller gap. Like Wales, most countries clustered around the OECD average, although some differed quite noticeably. For example, high-performer B-S-J-Z (China) had a lower attainment gap than many other countries, including Wales, whereas another high-

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[15] after taking into account the rounding of figures

performing country, Singapore, had a much wider gap. Israel, which scored significantly below Wales in reading had an attainment gap of 332 points, noticeably wider than any other country.

Figure 2.8   Attainment gap in reading scores across PISA 2018 countries
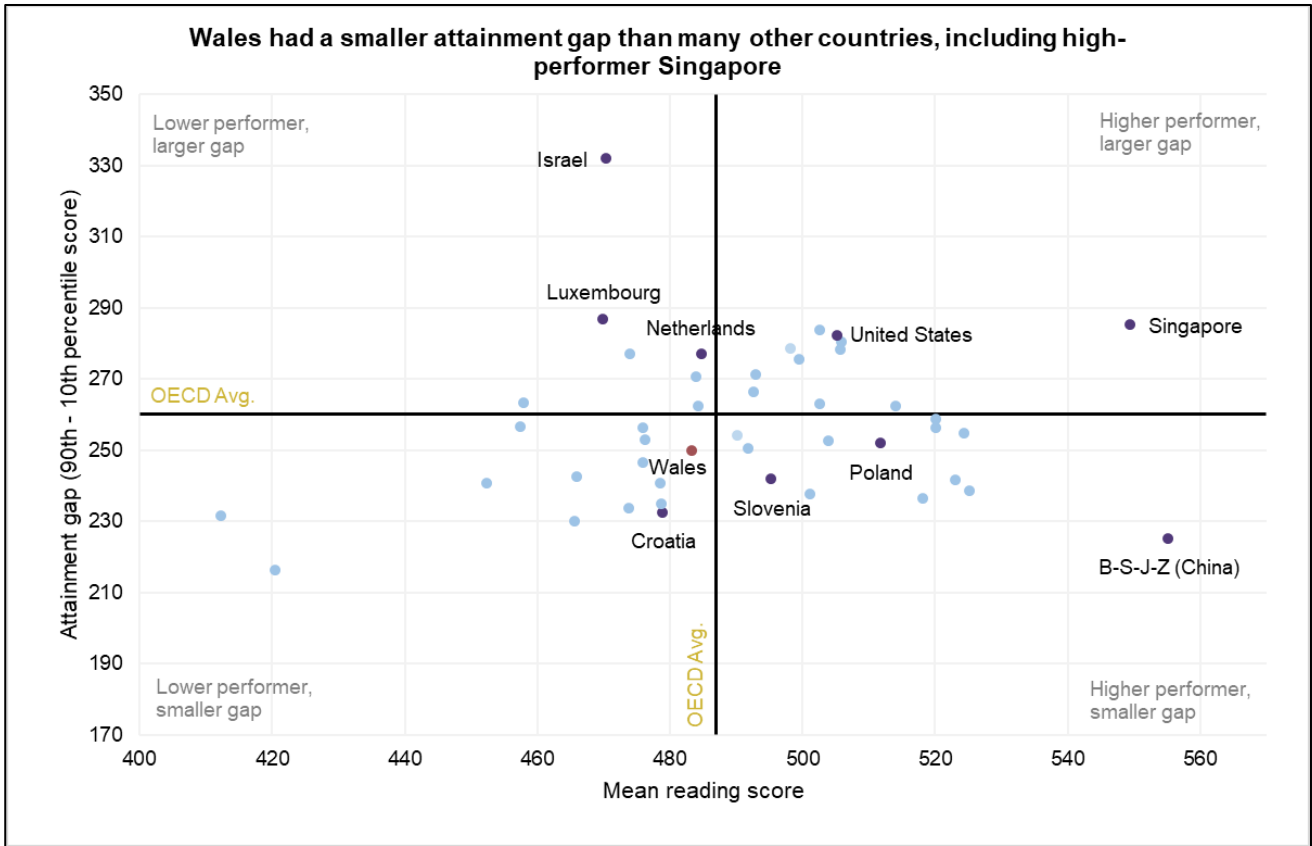
Note: This scatterplot includes all countries in the OECD and those with a mean score above 450

Source: PISA 2018 database

To further consider Wales' attainment gap and its relationship with overall performance, scores for pupils at the 10th and 90th percentiles can be compared with those of other countries. Figure 2.9 shows countries with similar scores at either the 10th and 90th percentile to Wales. Pupils at the 10th percentile in the United States scored similarly to those in Wales but pupils at the 90th percentile scored higher than Wales, making their attainment gap much larger. In comparison, pupils in Slovenia at the 90th percentile had similar scores to Wales but higher scores at the 10th percentile, meaning their gap is smaller. Although both Slovenia and the United States significantly outperformed Wales, their mean score is influenced by different things, i.e. Slovenia by the higher performance at the 10th percentile and the United States by the higher performance at the 90th percentile. This serves to illustrate the potential trade-offs to be made between policy that seeks to improve average performance by targeting low performers (which would give Wales a profile more like Slovenia), or higher performers (which would give Wales a profile more like the United States).

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We also saw earlier how Wales' average score is significantly above that of Luxembourg, having been similar in 2009. Figure 2.9 illustrates how the difference between the 2 countries is based on higher performance in Wales at the 10th percentile.

Figure 2.9   Attainment gap in countries with similar performance to Wales at either the 10th or 90th percentiles

Luxembourg and the United States had much wider attainment gaps than Wales, despite having similar scores at either the 10th or 90th percentile

Luxembourg	287
Slovenia	242
Wales	250
United States	282

Difference between the scores at the 10th and 90th percentile in reading
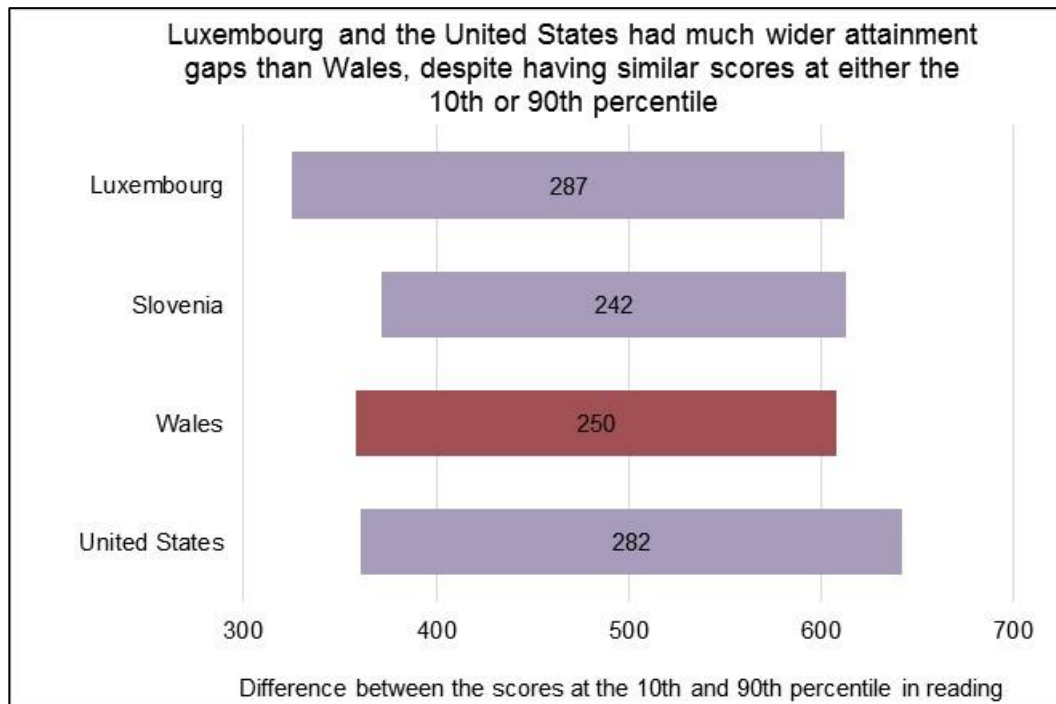
Source: PISA 2018 database

2.5.2   Performance across PISA proficiency levels

The second way of examining the spread of attainment is by looking at Wales' performance at each of the PISA proficiency levels. The PISA proficiency levels are devised by the PISA Consortium. Reading attainment in PISA is described in terms of 8 levels of achievement. These performance levels are outlined in Appendix A3.1 along with the cumulative percentages at each level for the OECD average and for Wales. In 2018, an additional proficiency level was added, Level 1c. This was as a result of the PISA for Development Programme (OECD, 2018a), which introduced less difficult items and provided more information about the pupils who would have previously been classified as below Level 1b (see Chapter 5 of the OECD International report (OECD, 2019b) for more details).

Figure 2.10 shows the proportion of pupils at the different proficiency levels. Pupils who score below Level 2 are considered low performers in reading and those that perform at Level 5 or above are considered top performers (OECD, 2019b).

Figure 2.10 Reading proficiency levels in Wales and the OECD

The proportions of pupils working at different benchmarks in Wales were broadly similar to the OECD average

	Below L1C	L1C	L1B	L1A	L2	L3	L4	L5	L6
Wales	1%	5%	16%	26%	27%		18%	6%	1%
OECD Avg.	1%	6%	15%	24%	26%		19%	7%	1%
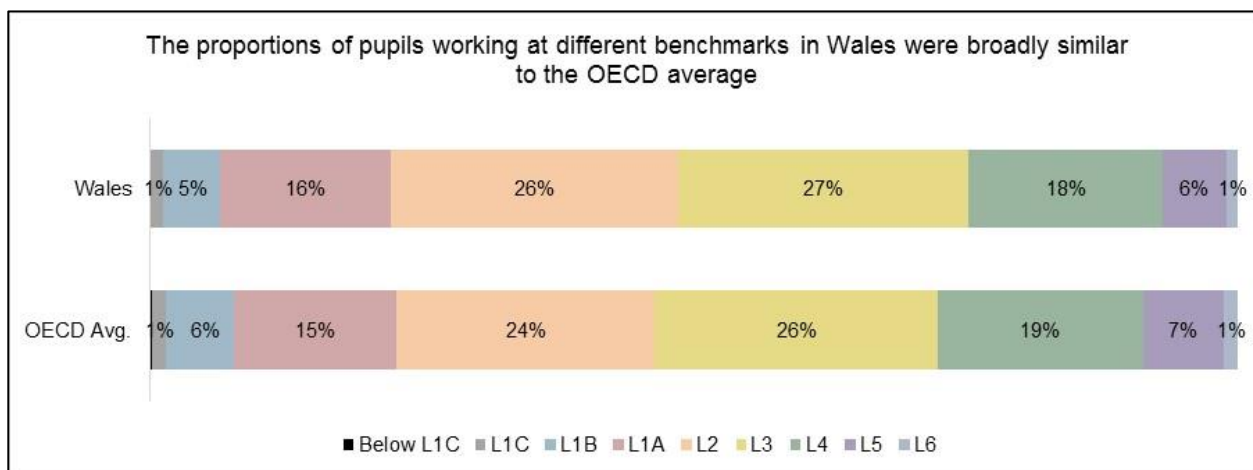
Note: All percentages are rounded.

Source: PISA 2018 database

In comparison to the OECD, Wales had a similar proportion of pupils working at the lowest proficiency levels (below Level 2), 23%[16] and 22% respectively. Wales had a significantly lower proportion of higher-achieving pupils (Levels 5 and 6), with 7% reaching Levels 5 or 6 for reading, compared with the OECD's 9%[17].

There was a significant increase in the proportion of higher-achieving pupils in Wales working at Levels 5 and 6, from 4% in 2015 to 7% in 2018. The proportion of lower-achieving pupils in 2018 (22%) was not significantly different from that of PISA 2015 (21%).

Key point

- Wales had similar proportions of pupils working below Level 2 to the OECD, but a significantly lower proportion working at Level 5 or above.

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[16] after taking into account the rounding of figures
[17] after taking into account the rounding of figures

Figure 2.11 Reading proficiency levels by cognitive process in Wales

Wales had more pupils at the lower proficiency levels for understanding than in the other two reading processes

Process	Below L1C	L1C	L1B	L1A	L2	L3	L4	L5	L6
Locating information	1%	4%		14%	25%	28%	19%	7%	1%
Understanding	1%	6%		17%	26%	26%	17%	5%	1%
Evaluating and reflecting	1%	5%		14%	25%	27%	19%	7%	2%
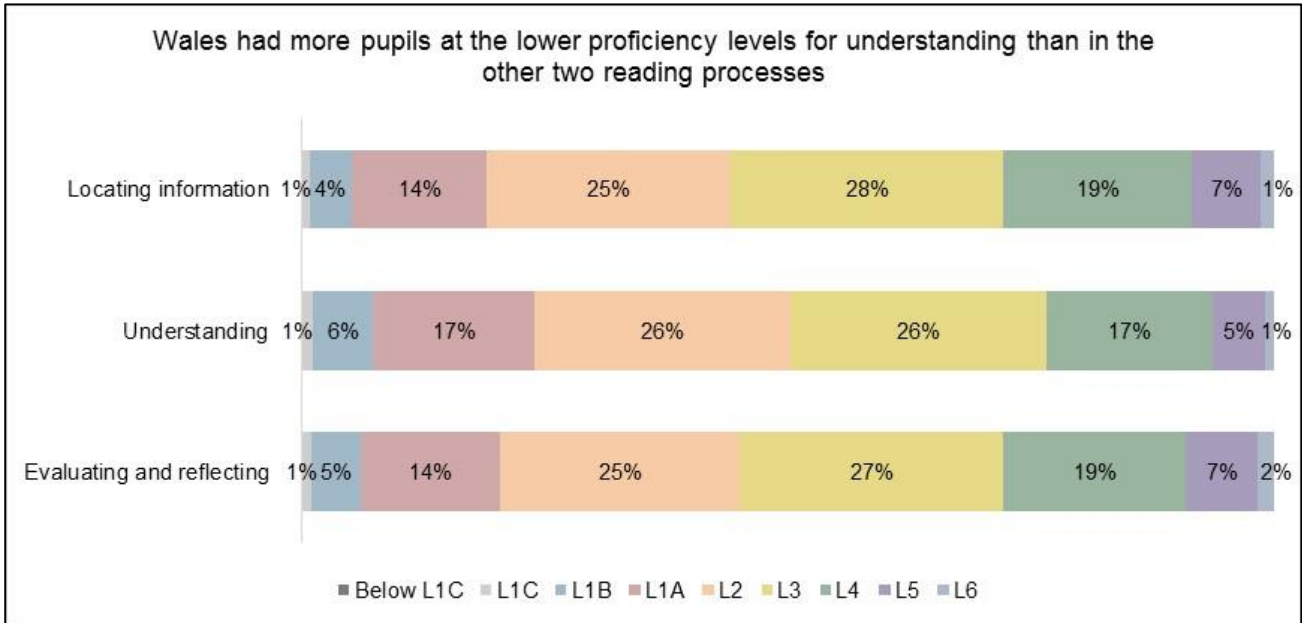
Note: All percentages are rounded.

Source: PISA 2018 database

In general, pupils in Wales performed better in the locating information and evaluating and reflecting processes than in understanding. Whilst all 3 processes have similar proficiency distributions, there were slightly higher numbers of pupils at the lower proficiency levels (below Level 2) in the understanding process than for the other 2 processes.

The subscales for reading have changed since 2009 and are not directly comparable but, looking at 'locating information', 'understanding' and 'evaluating and reflecting' (2018), alongside 'accessing and retrieving', 'integrating and interpreting' and 'reflecting and evaluating' (2009), similar broad patterns emerge that suggest improvements among higher-achieving pupils. This is particularly the case with regard to locating information, where a higher proportion of pupils reached Level 4 or above (22% in 2009 compared with 28%[18] in 2018).

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[18] after taking into account the rounding of figures

Figure 2.12   Reading proficiency levels by reading source in Wales

Wales had more pupils at the lower proficiency levels for single-source texts than for multiple-source texts

	L1C	L1B	L1A	L2	L3	L4	L5	L6
Single-source texts	1%	6%	16%	27%	27%	17%	6%	1%
Multiple-source texts	1%	5%	15%	26%	27%	19%	7%	1%
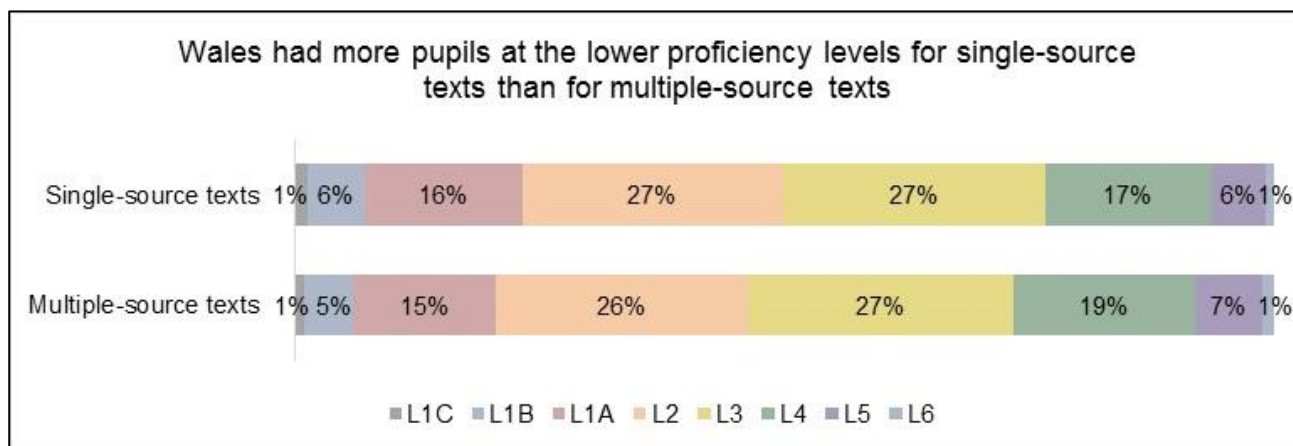
Note: All percentages are rounded.

In Wales, and across many other countries, pupils had higher scores for multiple-source texts than for single-source texts. It is unsurprising, therefore, that there was a higher proportion of pupils at the lower proficiency levels (below Level 2) for single-source texts than for multiple-source texts. Additionally, there was a slightly higher proportion of pupils at the highest proficiency levels (Level 5 and 6) for multiple-source texts than single-source.

The source subscales have a natural sequence; reading skills are developed first with single-source texts and readers progress to multiple-source texts (OECD, 2019b). Pupils at Level 4 and above can typically draw information from multiple-source texts (see Appendix B).

Key point

In Wales, there was a higher proportion of pupils at the higher proficiency levels (Level 5 and 6) for locating information and evaluating and reflecting, compared with understanding. There was also a higher proportion of pupils at the higher proficiency levels for multiple-source texts compared with single-source.

2.6 Differences between boys and girls

In Wales, there was a significant difference between the mean reading scores for boys (470) and that for girls (497), a difference of 26 score points[19]. This was smaller than, but not significantly different from, the OECD average gap of 30 points (with scores of 472 for boys and 502 for girls) as seen in Figure 2.13.

Figure 2.13 Gender differences in reading scores in Wales and the OECD

	Overall reading score	Mean score girls	Mean score boys	Difference girls - boys
Wales	483	497	470	+26*
OECD Avg.	487	502	472	+30*

*The difference is statistically significant

The gender gap in Wales was slightly lower than the OECD average

Range between boys' score and mean   Range between girls' score and mean
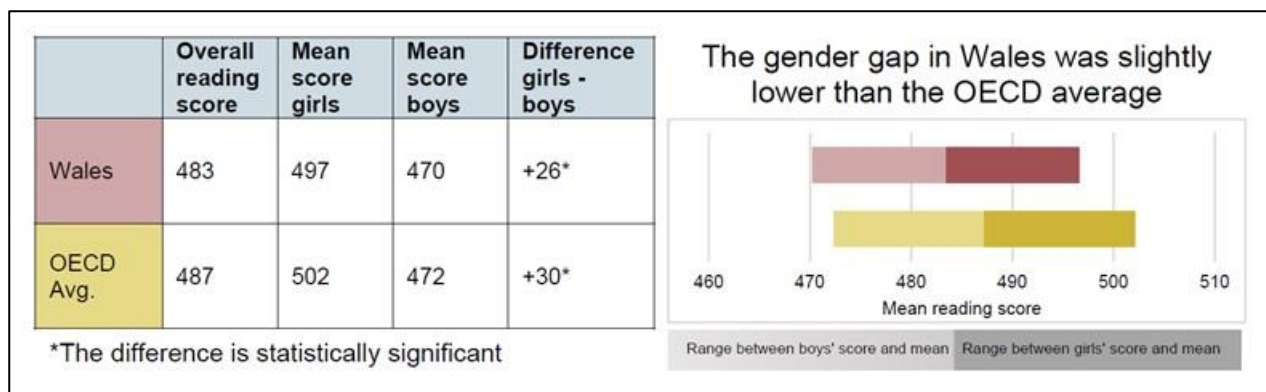
Source: PISA 2018 database

In 2009, the difference between boys and girls in Wales was 27 score points, similar to 2018. However, in 2015, the gender gap in Wales had decreased to 11 score points, significantly lower than in 2018. The significant increase in the size of the gender gap between 2015 and 2018 is attributable to a significant increase in mean scores for girls (483 in 2015 and 497 in 2018) compared to a similar performance for boys (472 in 2015 and 470 in 2018).

Internationally, girls outperformed boys in reading in every participating country and, in the majority of cases, the difference was significant, although the gap was much wider in some countries than in others. This can be seen in Figure 2.14, where the closer a country's dot is to the diagonal line, the smaller the gap between scores for girls and boys. The smallest gender differences were seen in Colombia (10 score point difference) followed by Mexico (11 score point difference) and B-S-J-Z (China) (13 score point difference). Finland had the largest difference between reading scores of boys and girls among OECD countries, with a difference of 52 score points.

In all countries, more boys than girls failed to reach the baseline level of proficiency in reading (Level 2). In the majority of participating countries, significantly more girls than

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[19] after taking into account the rounding of figures

boys attained the highest levels of performance (Level 5 or 6) (see Chapter 7 of the PISA International report (OECD, 2019c)).

Figure 2.14 Gender differences in reading scores across PISA 2018 countries
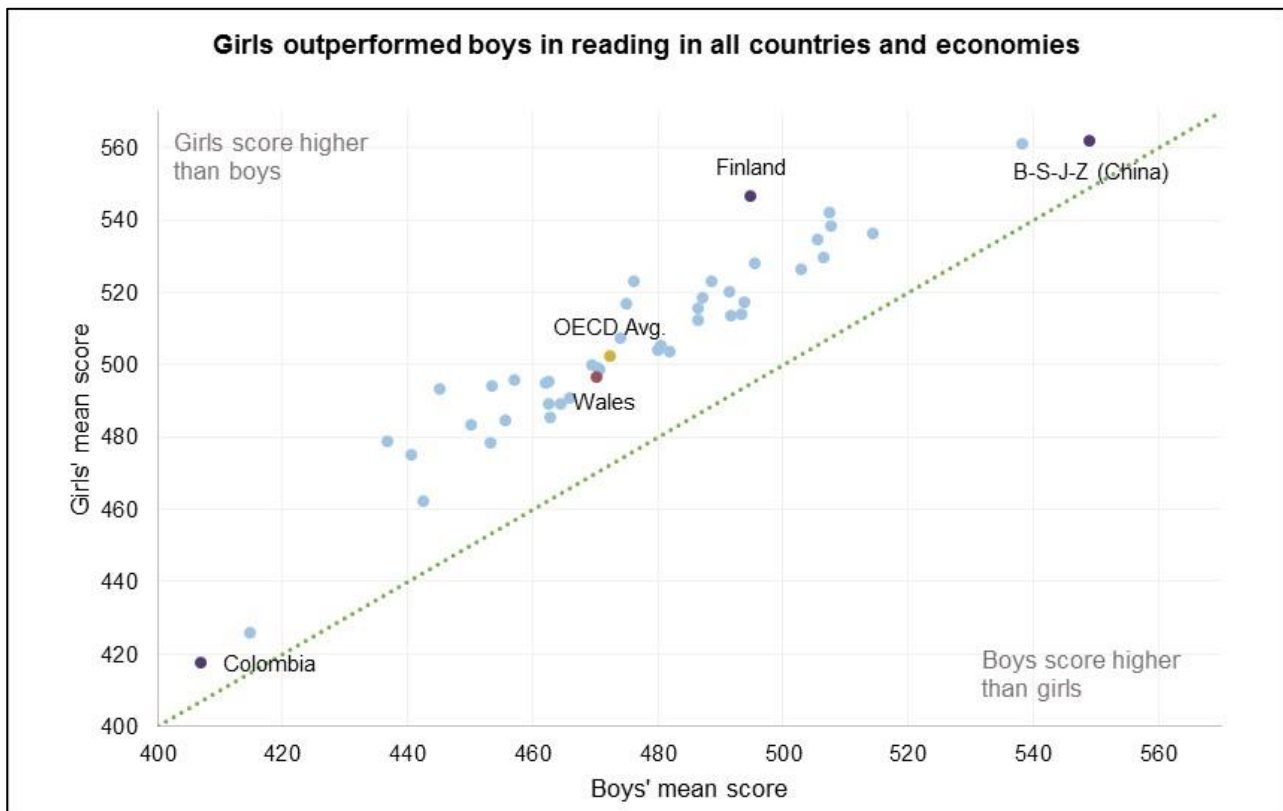
Note: This scatterplot includes all countries in the OECD and with a mean score above 450

Comparisons between the 4 UK countries are provided in Chapter 7.

Key point

Girls significantly outperformed boys in reading in all countries, including Wales.

Figure 2.15 Gender differences in reading processes in Wales and the OECD

	Overall score	Mean score girls	Mean score boys	Difference girls - boys
Wales	494	505	483	+22*
OECD Avg.	487	502	472	+30*

*The difference is statistically significant

Locating information

	Overall score	Mean score girls	Mean score boys	Difference girls - boys
Wales	479	490	467	+23*
OECD Avg.	487	502	472	+30*

*The difference is statistically significant

Understanding

	Overall score	Mean score girls	Mean score boys	Difference girls - boys
Wales	492	503	480	+23*
OECD Avg.	489	502	477	+26*

*The difference is statistically significant

Evaluating and reflecting

Source: PISA 2018 database

As noted in section 2.4, the performance of pupils in Wales varied somewhat across the 3 reading subscales: pupils were relatively strong in the locating information and evaluating and reflecting subscales, but performed less well in the understanding subscale. The mean score for girls in locating information was 505, 22 score points higher than boys' mean score. This gender difference in Wales was similar across the other 2 reading subscales (23 score points in each), with girls having significantly higher mean scores than boys for understanding and evaluating and reflecting.

As with the overall gender gap, the size of the OECD average gap for each process was larger than that in Wales. Across OECD countries, the gender gap was smallest in

evaluating and reflecting, with a 26 point[20] difference compared with locating information and understanding where the gaps were 30 points in each.

In Wales, both boys' and girls' mean scores in locating information and evaluating and reflective were higher than the OECD average, but in understanding they were lower.

Figure 2.16 Gender differences in reading source in Wales and OECD

	Overall score	Mean score girls	Mean score boys	Difference girls - boys
Wales	480	492	468	+24*
OECD Avg.	485	501	469	+32*

*The difference is statistically significant

Single-source texts
Mean reading score
Range between boys' score and mean   Range between girls' score and mean

	Overall score	Mean score girls	Mean score boys	Difference girls - boys
Wales	489	501	478	+22*
OECD Avg.	490	503	477	+26*

*The difference is statistically significant

Multiple-source texts
Mean reading score
Range between boys' score and mean   Range between girls' score and mean

Source: PISA 2018 database

In Wales there were differences in boys' and girls' performances on single-source and multiple-source texts. Girls significantly outperformed boys for both sources, with a gender gap of 24 score points for single-source and 22 score points[21] for multiple-source texts. This is unsurprising given girls' performance in reading overall. Both genders performed better on multiple-source texts (with a mean score of 478 for boys and 501 for girls) than on single-source texts (with a mean score of 468 for boys and 492 for girls).

Across OECD countries the gap between boys and girls was larger on single-source texts than multiple-source texts, with a gender gap of 32 points compared with 26 points for multiple-source. Boys' mean scores for single-source and multiple-source texts were

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[20] after taking account the rounding of figures
[21] after taking account the rounding of figures

similar for the OECD and Wales. Girls across OECD countries score higher than girls in Wales on both source types.

3   Pupils

In this chapter we first explore associations between pupil background and reading performance. We then report on pupil questionnaire responses to understand more about attitudes towards reading, experiences of reading, pupil wellbeing, and future aspirations of pupils in Wales, and how these compare with pupils across the OECD countries.

Key findings

Pupil background

- There was a gap in attainment between the most and least disadvantaged pupils in Wales, as was the case in all participating countries. The disadvantage gap in Wales was significantly smaller and pupils in Wales are relatively more able to overcome the disadvantages of their background than the average for OECD countries.
- Pupils eligible for free school meals scored 34 points below pupils not eligible for free school meals, on average. This difference was statistically significant.
- The performance of pupils in Wales with an immigrant background was not statistically significantly different from non-immigrant pupils, which differs from the international trend. There was no significant difference in performance in reading amongst pupils who spoke English or Welsh at home compared with pupils who spoke another language at home.

Pupils' attitudes to reading

- Pupils in Wales were more confident in their reading ability than pupils across the OECD countries.
- They were less likely to read books than pupils across the OECD: 44% of pupils in Wales rarely or never read books compared with 35% of pupils in the OECD.
- Pupils in Wales had more negative attitudes towards reading than pupils across the OECD. The biggest differences were the proportion of pupils who regarded reading as a favourite hobby (24% in Wales compared with 34% across the OECD), and who said they read only to get the information they need (60% in Wales compared with 50% across the OECD).

Pupils' experiences of reading

- Pupils in Wales and the OECD read online materials far more frequently than books or fiction. In Wales, 91% of pupils chatted online at least several times a week, whereas 44% rarely or never read books.

Pupil wellbeing

- Pupils in Wales were slightly less satisfied with their lives than pupils across the OECD countries.
- They were more likely to feel miserable and worried than pupils across the OECD and less likely to feel joyful, cheerful and proud.

Future aspirations

Pupils in Wales had lower expectations of their highest level of qualification than pupils across the OECD, but there was very close alignment in career expectations with the OECD average.

3.1 Pupil background

This section examines the associations between pupils' background characteristics and reading scores, in order to explore educational inequalities and how they compare with other participating countries. We consider how socio-economic background, immigrant background and language relate to reading scores.

3.1.1 Socio-economic background

Here we report on interactions between socio-economic background and reading scores using the PISA measure of socio-economic background. We also compare findings with information from the school census on eligibility for free school meals (FSM).

Socio-economic background in PISA is reported as the ESCS (economic, social and cultural status) Index. This is based on pupils' responses to questions about their parents' backgrounds and education, and possessions in their homes. The Index is set to a mean of 0 across OECD countries with a standard deviation of 1. Wales' mean score on the ESCS Index was +0.23 indicating that, on average, pupils in Wales have a higher socio-economic status than the average across OECD countries.

There are 2 different ways to think about the relationships between socio-economic status and attainment

The first is to consider the difference in attainment between the average pupil with high socio-economic status and with low socio-economic status. This can be seen as the 'steepness of the slope' (i.e. gradient of the line) when plotting the relationship between socio-economic status and attainment, as in Figure 3.1. We refer to it as the **size of the effect**.

The second is to consider how much variation in attainment there is between pupils of the same socio-economic status, or to put it another way, how strongly correlated socio-economic status is with attainment. If there is a strong correlation, then there will be less variability in the attainment of pupils with the same socio-economic status, which implies that socio-economic status is the dominant factor in determining outcomes. We refer to it as the **strength of the effect**.

Both of these perspectives are important and they do not necessarily coincide. For example, a small, strong effect would imply that it is difficult for pupils to overcome the impact of their socio-economic status, but that in practice this impact is small and so may be of lesser concern to policymakers. Conversely, a large, weak effect would imply that there are large differences in attainment between pupils from different backgrounds, but that many pupils also buck this trend – with some disadvantaged pupils nevertheless attaining highly (and some more advantaged pupils attaining poorly).

In all participating countries, there was a gap in attainment between pupils who are highest and those who are lowest on the ESCS Index, and this was also the case in Wales. Figure 3.1 shows the average reading performance of pupils in Wales when they are divided into 4 equal groups (quartiles) according to their ESCS score, compared with the OECD average[22]. More advantaged pupils achieved higher reading scores than their less advantaged peers, and this was true for each quartile. There was a 49 point difference in average reading performance between the most advantaged (4th quartile) and least advantaged (1st quartile) pupils in Wales.

This disadvantage gap was significantly[23] narrower than the equivalent OECD disadvantage gap, which is 89 points. The most disadvantaged pupils across the OECD

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[22] The 2018 OECD average is based upon the 'AVR' results published in the OECD International results.
[23] When statistical significance is reported, it indicates that the compared means are significantly different at the 5% level.

countries scored lower than the most disadvantaged pupils in Wales, on average, whereas the least disadvantaged pupils scored higher than the least disadvantaged pupils in Wales, on average. Therefore, the **size of the effect** of socio-economic status (ESCS) is smaller in Wales than across the OECD. It should be noted, however, that the gap in socio-economic status (ESCS score) between the most and least advantaged quartiles is less for pupils in Wales compared with the OECD countries (2.18 in Wales compared with 2.36 across the OECD). This implies that Wales' narrower disadvantage gap could partly be accounted for by a narrower gap in the socio-economic status of its most and least disadvantaged pupils.

Figure 3.1   Reading performance by ESCS Index quartile
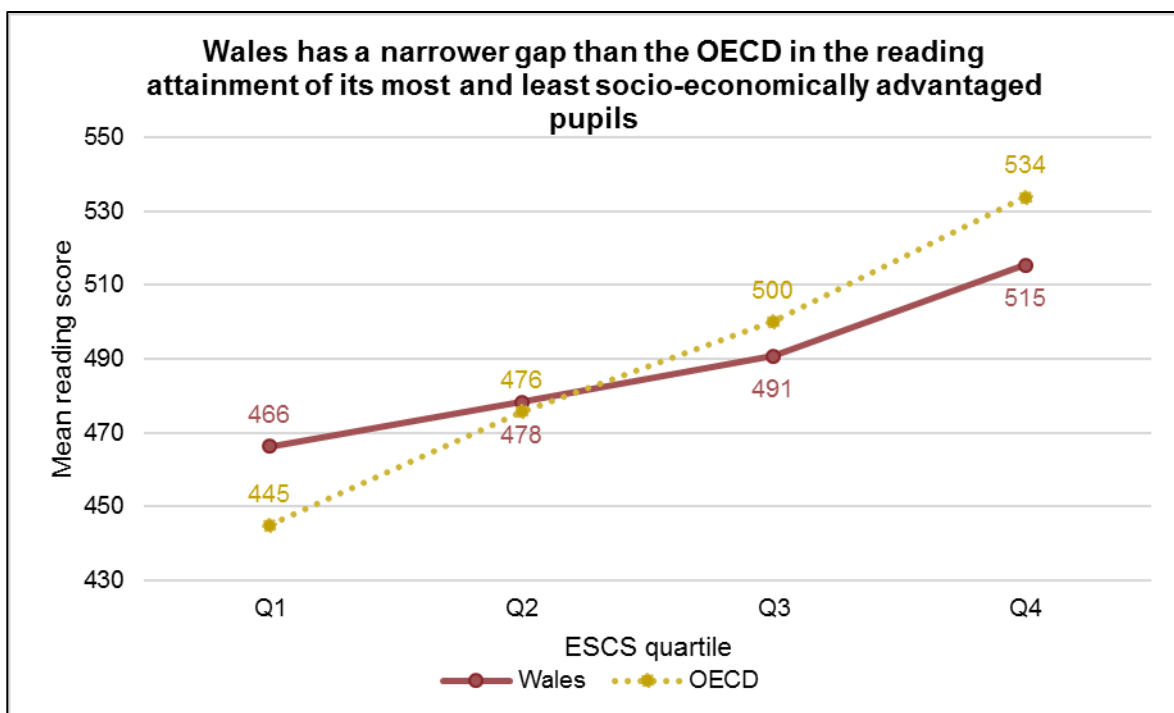
It is interesting that in Figure 3.1, compared with the OECD countries, the differences in reading performance between the first and second and second and third quartiles in Wales are comparatively small. This tells us that the most disadvantaged pupils in Wales perform better than would be expected, and indeed that pupils at the first quartile perform above the OECD average. It may be that policies which target disadvantaged groups have had a positive impact in bringing up performance. There is a larger difference between the third and fourth quartiles which may suggest that pupils who are most advantaged have other associated advantages which impact on their reading scores. Appendix B shows the ESCS Index for comparator countries.

While Figure 3.1 shows that the difference in performance between the *average* pupil from a high and low socio-economic background is large, there is also a lot of variation in

performance within these groups. To gain an accurate picture of interactions between reading score and the ESCS Index, it is also necessary to look at the amount of variance in scores which can be explained by socio-economic background, or the **strength of the effect**. This shows the extent to which the scores of pupils in each country are predicted by socio-economic background, rather than by other variables. The percentage of the variance in reading performance explained by socio-economic status in Wales was 4%. This was significantly lower than the OECD average of 12%, and indicates that factors other than ESCS have a greater impact in Wales than across the OECD countries.

We can look at similarly performing countries to see how the impact of socio-economic background differs. For instance, pupils in Croatia performed similarly in reading to pupils in Wales, achieving a mean score of 479. However, the difference between the most and least disadvantaged quartiles by socio-economic background in Croatia was 63 points, 12[24] points higher than Wales, and the explained variance in reading performance was 8%, 4 percentage points higher than Wales. Therefore, socio-economic background was associated with a greater difference in reading performance for pupils in Croatia (size of effect), and the extent to which socio-economic background predicted reading performance was also greater than in Wales (strength of effect).

The country in which the most disadvantaged pupils have the best chance of succeeding in spite of their background is high-performing Macao (China). Here, the difference in reading performance between the most and least deprived quartiles was only 31 points and the amount of variance explained was just 2%. The gap in socio-economic status (ESCS score) between the most and least advantaged quartiles in Macao (China) is 2.32; similar to the figure of 2.36 across the OECD. This shows that it is possible for a country to be high-performing and for the impact of socio-economic background to be low, even with a population with a wider range of socio-economic status than Wales.

The ESCS Index allows us to compare the proportion of pupils who succeed academically despite their socio-economic background, that is, who are academically resilient. For the purpose of this analysis, a pupil is classified as resilient if he or she is in the bottom quarter of the ESCS Index in the country of assessment and performs in the top quarter of pupils in reading in that country[25]. In Wales, 13% of pupils were academically resilient, which is not significantly different from 11% across the OECD countries.

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[24] after taking into account rounding of figures
[25] In the 2015 national report (Jerrim *et al.*, 2016) a different definition was used which identified the proportion of disadvantaged pupils who performed in the top quarter of pupils internationally, therefore these figures are not comparable.

Key point

The gap in performance between the most and least disadvantaged pupils in Wales was relatively low and pupils in Wales were relatively well able to overcome the disadvantages of their background.

The national measure usually used to understand the effects of disadvantage is eligibility for free school meals (FSM). Unlike the ESCS Index, which puts all pupils on a scale from most to least disadvantaged, eligibility for free school meals divides pupils into two groups – those who are eligible and those who are not. Table 3.1 below presents the mean reading score for these two groups of pupils. The analysis was carried out with pupil data which was matched to the Wales school census database[26]. Eleven per cent of matched pupils in Wales were eligible for free school meals and, on average, these pupils scored 34 points below pupils not eligible for free school meals. This difference was significant.

Table 3.1   FSM eligibility and PISA reading scores: Wales

	Number of pupils	Per cent	Mean score
Not eligible for FSM	2621	89	485
Eligible for FSM	338	11	451*

Note: * Indicates significant difference from the 'not eligible for FSM' group.

Source: PISA 2018 school census matched database

3.1.2 Immigration background and language

The pupil questionnaire collects information which enables us to identify whether pupils are first- or second-generation immigrants. The international report notes that the percentage of pupils across the OECD countries with an immigrant background has increased from 10% in 2009 to 12% in 2018. The performance of pupils with an immigrant background tends to be lower than their non-immigrant peers.

In OECD countries, non-immigrant pupils scored 41 points better than immigrant pupils, on average, but this difference reduced to 25 points when their socio-economic

[26] The school census data did not have information for 206 pupils; 144 from 6 independent schools and 62 from 7 maintained schools.

backgrounds were taken into account (OECD, 2019c). Given this context, it is interesting to examine how pupils with an immigrant background in Wales performed.

For the purpose of the analysis, immigrant background is defined as in the OECD international report.

- **Non-immigrant pupils** are pupils whose mother or father (or both) was/were born in the country where the pupil sat the PISA test, regardless of whether the pupil him/herself was born in that country.
- **First-generation immigrant pupils** are foreign-born pupils whose parents are also foreign-born.
- **Second-generation immigrant pupils** are pupils born in the country of assessment but whose parents are both foreign-born.

Table 3.2   Immigration background and PISA reading scores: Wales

	Number of pupils	Per cent	Mean score
Non-immigrant pupils	2704	93	487
First-generation immigrant pupils	116	4	481
Second-generation immigrant pupils	100	3	500

Source: PISA 2018 database

The proportion of pupils in Wales (7%) with an immigrant background was below the OECD average. These pupils in Wales also broke the international trend as their performance was not significantly different from non-immigrant pupils.

Pupils were also asked about home language. Table 3.3 provides the reading scores of pupils who speak English or Welsh at home compared with pupils who speak another language at home.

Table 3.3   Language spoken at home and PISA reading scores: Wales

Language	Number of pupils	Per cent	Mean score
English or Welsh	2842	95	487
Another language	158	5	472

Source: PISA 2018 database

In Wales, there was no significant difference in reading performance amongst pupils who spoke English or Welsh at home compared with pupils who spoke another language at home.

3.2 Pupils' attitudes to reading inside and outside school

This section reports on pupils' responses to questions about their reading activities and their attitudes to reading, and compares these to those of pupils in the rest of the OECD countries.

In this section, we do not report whether differences are statistically significant as, due to the large sample sizes, small differences can be statistically significant but not meaningful from a policy or practice perspective. Instead, we report on the size of differences. Throughout the remainder of the chapter, differences of 3 percentage points or less are described as *similar*, differences of 4 to 6 percentage points as *small*, differences of 7 to 9 percentage points as *moderate*, and differences of 10 or more percentage points as *large*.

3.2.1 Perceptions of competence in reading

Pupils were asked about their perceptions of their competence in reading. Responses of pupils who agreed or strongly agreed with each of the statements are presented for Wales alongside the OECD countries in Table 3.4.

Table 3.4   Pupils' perception of reading competence

Percentage of pupils who agree or strongly agree with each statement	Wales	OECD	Percentage point difference Wales-OECD
I am a good reader.	83	71	12
I am able to understand difficult texts.	78	67	11
I read fluently.	78	77	1
I have always had difficulty with reading.	20	19	1
I find it difficult to answer questions about a text.	26	26	0
I have to read a text several times before I completely understand it.	40	44	-3

Source: PISA 2018 database; Student Questionnaire, question ST161

Note: The percentage point difference column may not equal the difference between Wales and OECD due to rounding.

Pupils in Wales responded with more confidence in their reading ability than pupils across the OECD. There was a large difference in the percentage of pupils who agreed they were good readers and able to understand difficult texts compared with pupils in the OECD, although 40% of pupils had to read a text several times to completely understand it.

3.2.2 How do pupils read books?

Pupils were asked specifically about their reading of books, and whether they most often read paper books or books on a digital device. Table 3.5 compares the responses of pupils in Wales with pupils across the OECD countries.

Table 3.5 Pupils' reading mode preference

Percentage of pupils who read books in each mode			
	Wales	**OECD**	**Percentage point difference Wales-OECD**
I rarely or never read books.	44	35	8
I read books on digital devices more often than on paper.	16	15	1
I read paper books and books on digital devices equally often.	10	13	-3
I read paper books more often than books on digital devices.	30	36	-6

Note: The percentage point difference column may not equal the difference between Wales and OECD due to rounding.

Source: PISA 2018 database; Student Questionnaire, question ST168

Pupils in Wales were less likely to read books than pupils across the OECD: 44% of pupils in Wales rarely or never read books compared with 35% of pupils in the OECD, indicating a moderate difference. The proportion of pupils in Wales that read digital books most often was similar to the OECD, but there was a small difference in reading of paper books; 30% of pupils in Wales read paper books compared with 36% of pupils across the OECD.

3.2.3 Reading engagement

Pupils were asked about their attitudes towards reading. Pupils in Wales had more negative attitudes than pupils across the OECD countries. There was a large difference in the proportion of pupils in Wales who read only to get the information they need compared with pupils across the OECD, and in the proportion of pupils who regarded reading as a favourite hobby. There were moderate differences in the proportion of pupils who liked talking about books (28% in Wales compared with 37% across the OECD), and the proportion of pupils who read only if they have to (57% in Wales compared with 49% across the OECD). As we established in section 3.2.2, pupils in Wales were less likely to read books than their peers across the OECD, so it is not surprising that attitudes towards reading were more negative.

The same questions were asked in 2009 and it is interesting to examine how reading attitudes have changed in Wales compared with the OECD. Since 2009, a similar proportion of pupils in Wales regarded reading as a favourite hobby and said they liked

talking about books with other people; this was also the case across the OECD. On the other measures (I read only if I have to, reading is a waste of time, and I read to get information that I need), pupils in Wales and the OECD were less positive in 2018 than they were in 2009, but the changes were greater in Wales than the OECD.

Table 3.6   Pupils' reading engagement in 2018 compared with 2009

Percentage of pupils who agree or strongly agree with each statement				
	2018		**2009**	
	Wales	**OECD**	**Wales**	**OECD**
I read only if I have to.	57	49	44	41
Reading is one of my favourite hobbies.	24	34	25	33
I like talking about books with other people.	28	37	31	38
For me, reading is a waste of time.	33	28	24	24
I read only to get information that I need.	60	50	51	46

Source: PISA 2018 database; Student Questionnaire, question ST160; PISA 2009 database

Key point

Attitudes of pupils in Wales towards reading were more negative than pupils across the OECD. In general, pupils in Wales and the OECD countries had more negative attitudes than in 2009, but the change in attitudes of pupils in Wales was greater than on average in OECD countries.

3.2.4 Time spent reading for enjoyment

Pupils were asked about the amount of time they spent reading for enjoyment. The results for Wales and the OECD countries are presented in Table 3.7, along with the results from 2009 when the same question was asked.

Table 3.7   Pupils' responses about time spent reading in 2018 compared with 2009

About how much time do you usually spend reading for enjoyment? (per cent)				
	2018		**2009**	
	Wales	**OECD**	**Wales**	**OECD**
I do not read for enjoyment	53	42	42	37
30 minutes or less a day	22	24	30	30
More than 30 minutes and less than 60 minutes a day	14	17	15	17
1 to 2 hours a day	7	11	10	11
More than 2 hours a day	4	6	4	5

Source: PISA 2018 database; Student Questionnaire, question ST175; PISA 2009 database

Reading for pleasure is not a popular activity for pupils in Wales: more than half (53%) of pupils in Wales do not read for enjoyment, and only one quarter (25%) read for more than 30 minutes a day for enjoyment. The proportion of pupils who do not read for enjoyment has increased by 11 percentage points in Wales since 2009, compared with only 5 percentage points across the OECD.

3.3   Pupils' experience of reading inside and outside school

3.3.1 Pupils' reading practices

Table 3.8 shows what pupils choose to read at least several times a month in order of popularity in Wales. The most common reading material (on paper and on digital devices) was fiction for pupils in Wales and the OECD countries, although there was a moderate difference in proportions: 22% of pupils in Wales read fiction at least several times a month compared with 29% of pupils across the OECD. This pattern was repeated across all text types; pupils in Wales were less likely to read each text type than their counterparts in the OECD.

Table 3.8   Pupils' responses about reading different text types in 2018 compared with 2009

Percentage of pupils who read these materials at least several times a month because they want to	2018		2009	
	Wales	**OECD**	**Wales**	**OECD**
Fiction	22	29	28	31
Non-fiction books	17	21	18	20
Newspapers	14	25	60	63
Magazines	9	19	61	59
Comic books	8	15	7	23

Source: PISA 2018 database; Student Questionnaire, question ST167; PISA 2009 database

The same question was asked in PISA 2009, when the proportion of pupils in Wales reading each text type at least several times a month was similar to the OECD proportion, except for a large difference in the reading of comic books which was much less popular in Wales. The comparison shows that there has been a small decrease in reading of fiction amongst pupils in Wales since 2009. Another change is the reduction in the popularity of newspapers and magazines in Wales: in 2009, newspapers and magazines were read by 60% and 61% of pupils at least several times a month, respectively; in 2018 this is the case for 14% and 9% of pupils only and reflects a similar pattern across the OECD countries.

3.3.2 Pupils' digital reading practices

Pupils were asked how often they read different types of online material. Table 3.9 shows that pupils read these online materials far more frequently than the materials discussed in previous sections, such as books or fiction.

In section 3.2.2 we established that pupils in Wales and the OECD were less likely to use digital devices to read books than to read paper books. In Table 3.9 we can see that this is not due to a lack of access to digital devices. In Wales, 91% of pupils chatted online at least several times a week, similar to the 88% of pupils across the OECD countries. In contrast to the reading activities discussed in previous sections, a similar proportion or more pupils in Wales used the internet to chat, search for information and read news frequently, compared with the OECD.

Pupils were also asked about their online reading in 2009. This had increased since 2009, except for reading emails which had declined in Wales and across the OECD.

Table 3.9   Pupils' responses about online reading in 2018 compared with 2009

Percentage of pupils who read these materials at least several times a week				
	2018		**2009**	
	Wales	**OECD**	**Wales**	**OECD**
Chatting online	91	88	85	73
Searching for information online to learn about a particular topic	67	68	50	52
Reading news online	57	58	46	46
Searching for practical information online	50	55	33	36
Reading emails	41	37	71	64
Taking part in online group discussions or forums	36	23	21	21

Source: PISA 2018 database; Student Questionnaire, question ST176; PISA 2009 database

3.3.3 Metacognition

Metacognition is 'an individual's ability to think about and control his or her reading and comprehension strategies' (OECD, 2019c). In order to assess their metacognitive knowledge, pupils were asked about how useful they thought various strategies were in three different reading tasks. These were to:

1. understand and remember text

2. write a summary of a 2-page text

3. respond on receipt of an unsolicited email saying they had won a competition.

In the first scenario, pupils were told their reading task was to understand and remember the information in a text and were asked to score the usefulness of 6 strategies.

Figure 3.2   Average ratings of usefulness of strategies for understanding and remembering text

Underlining was the most useful strategy for pupils in Wales and OECD to understand and remember text
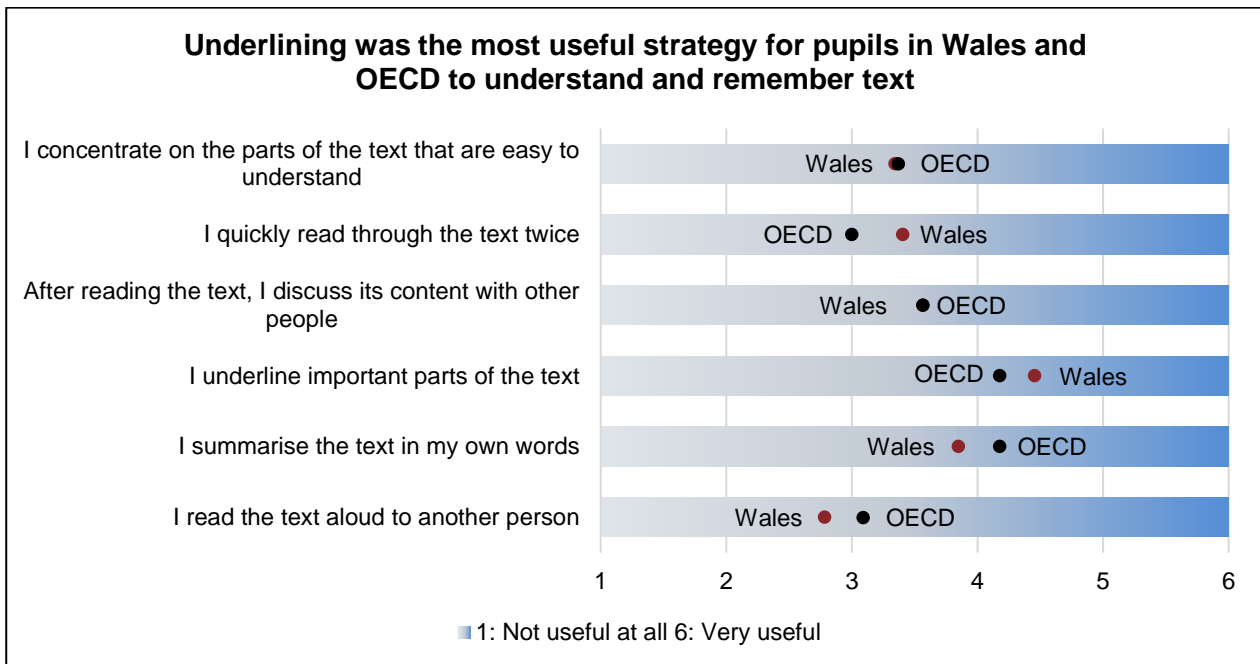
Source: PISA 2018 database; Student Questionnaire, question ST164

This question was asked in 2009 and a rating system developed to categorise responses into useful and less useful strategies: discussing the content with other people, underlining important parts of the text, and summarising were rated as better strategies than concentrating on the parts of the text that are easy to understand, quickly reading through the text twice, and reading the text aloud to another person.

Underlining important parts of the text was seen as the most useful strategy by pupils in Wales and the OECD. Pupils across the OECD countries also thought that summarising the text in their own words was important, but pupils in Wales did not value this strategy as highly. Pupils in Wales thought that the least useful strategy was to read the text aloud to another person.

In the second scenario, pupils were told they needed to read and summarise a long and difficult 2-page text. They were asked about the usefulness of 5 strategies.

Figure 3.3   Average ratings of usefulness of strategies for summarising a difficult text

Pupils in Wales and the OECD agreed closely on the usefulness of strategies for summarising a difficult text

Write a summary. Then I check that each paragraph is covered in the summary.

Try to copy out accurately as many sentences as possible.

Before writing the summary, I read the text as many times as possible.

Carefully check whether the most important facts in the text are represented.

Underlining the most important sentences. Then I write them in my own words.

1: Not useful at all 6: Very useful

Source: PISA 2018 database; Student Questionnaire, question ST165

This question was asked in 2009 and a rating system developed to categorise the usefulness of the strategies: checking whether the most important facts are represented, and underlining the most important sentences then summarising were rated as the best strategies, followed by writing a summary and checking each paragraph is covered in the summary, and reading the text as many times as possible. Trying to copy out accurately as many sentences as possible was rated as the least useful strategy.

Trying to copy out accurately as many sentences as possible was not seen as a useful strategy by pupils in Wales or the OECD. The most useful strategies were to underline the most important sentences to form a summary, and checking that the most important facts are represented.

The third scenario asked pupils about the appropriateness of 5 strategies in response to an unsolicited email which says that they have won a smartphone. This question was new in PISA 2018 and information on how each strategy was rated will be published after publication of the main PISA database in 2019.

Figure 3.4   Average ratings of responses to the receipt of an email telling pupils they have won a smartphone

Pupils in Wales and OECD had very similar understandings of how to deal with unsolicited email

Answer the email and ask for more information about the smartphone	Wales ● ● OECD
Check the sender's email address	OECD ● Wales
Click on the link to fill out the form as soon as possible	Wales ● ● OECD
Delete the email without clicking on the link	OECD ● ● Wales
Check the website of the mobile phone operator	OECD ● Wales

1: Not appropriate 6: Very appropriate

Source: PISA 2018 database; Student Questionnaire, question ST166

OECD have not yet released their rating system for the responses, but it is possible to divide the strategies into 'good' and 'poor' based on National Cyber Security Centre advice on receipt of a suspicious email[27]. Clicking on a link to fill out a form with their data, and replying to the email to ask more about the smartphone were rightly seen as poor strategies by pupils in Wales and the OECD countries. Appropriate strategies were regarded as checking the sender's email address and the website of the sender to see if the offer was mentioned. Pupils in Wales responded in a similar manner to those across the OECD.

3.4   Pupil wellbeing

The pupil questionnaire collected information about pupils' wellbeing: their satisfaction with their life, to what extent their life has meaning or purpose, their subjective wellbeing, and also their experiences of bullying (discussed in Chapter 6).

Pupils aged 15 are making the transition to adulthood and making decisions about further education and careers. This is a time which can challenge young people's wellbeing and

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[27] https://www.ncsc.gov.uk/guidance/suspicious-email-actions

can also be made more challenging by poor wellbeing. The Welsh Government's *Well-being of Future Generations Act (2015)[28]* required ministers to set national indicators on progress towards improving the social, economic, environmental and cultural wellbeing of Wales; the indicators are linked to the United Nations Sustainability Goals. The findings from PISA 2018 are relevant to these indicators and also provide comparisons with pupils in other countries. Further analysis will help us to understand how wellbeing relates to achievement, allowing policymakers to better understand interventions to support pupils' wellbeing.

Pupils were asked to rate how satisfied they were with their life as a whole, with the minimum score of 0 and the maximum score of 10. Pupils in Wales were slightly less satisfied with their lives than pupils across the OECD countries; the average score was 6.5 in Wales, compared with 7.0 across the OECD.

Pupils were also asked to what extent their life had meaning or purpose. The responses of pupils in Wales and the OECD average are presented in Figure 3.5 below.

Figure 3.5   Percentage of pupils agreeing and disagreeing with questions about the extent to which their life had meaning
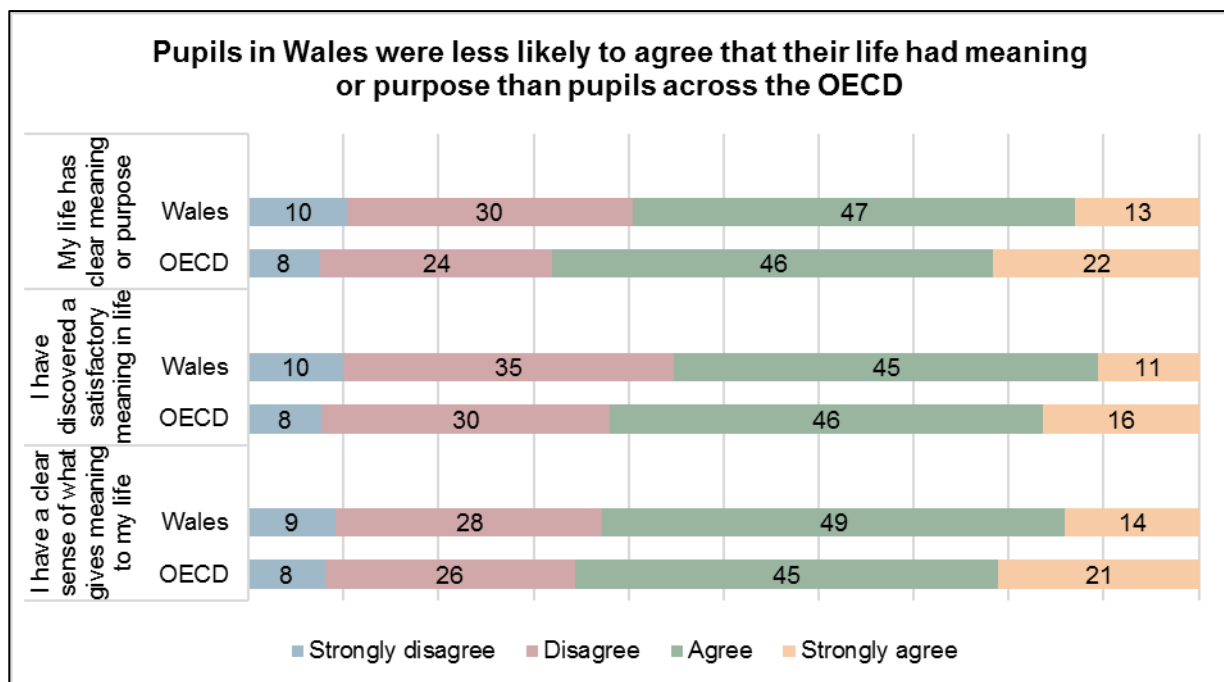
Source: PISA 2018 database; Student Questionnaire, question ST185

Pupils in Wales responded more negatively to questions about meaning and purpose in their lives than pupils across the OECD. Smaller proportions of pupils in Wales strongly agreed that their life has clear meaning or purpose, and that they have a clear sense of what gives meaning to their life compared with the OECD average, and these were moderate differences. Pupils in Wales were also less likely to strongly agree that they have discovered a satisfactory meaning in life compared with the OECD average, and this was a small difference.

Pupils were also asked how often they felt a range of positive and negative feelings. The responses for pupils in Wales compared with the OECD are presented in Figure 3.6 for positive feelings and Figure 3.7 for negative feelings.

Figure 3.6   Percentage of pupils who reported never, rarely, sometimes and always for each positive feeling

Source: PISA 2018 database; Student Questionnaire, question ST186

77
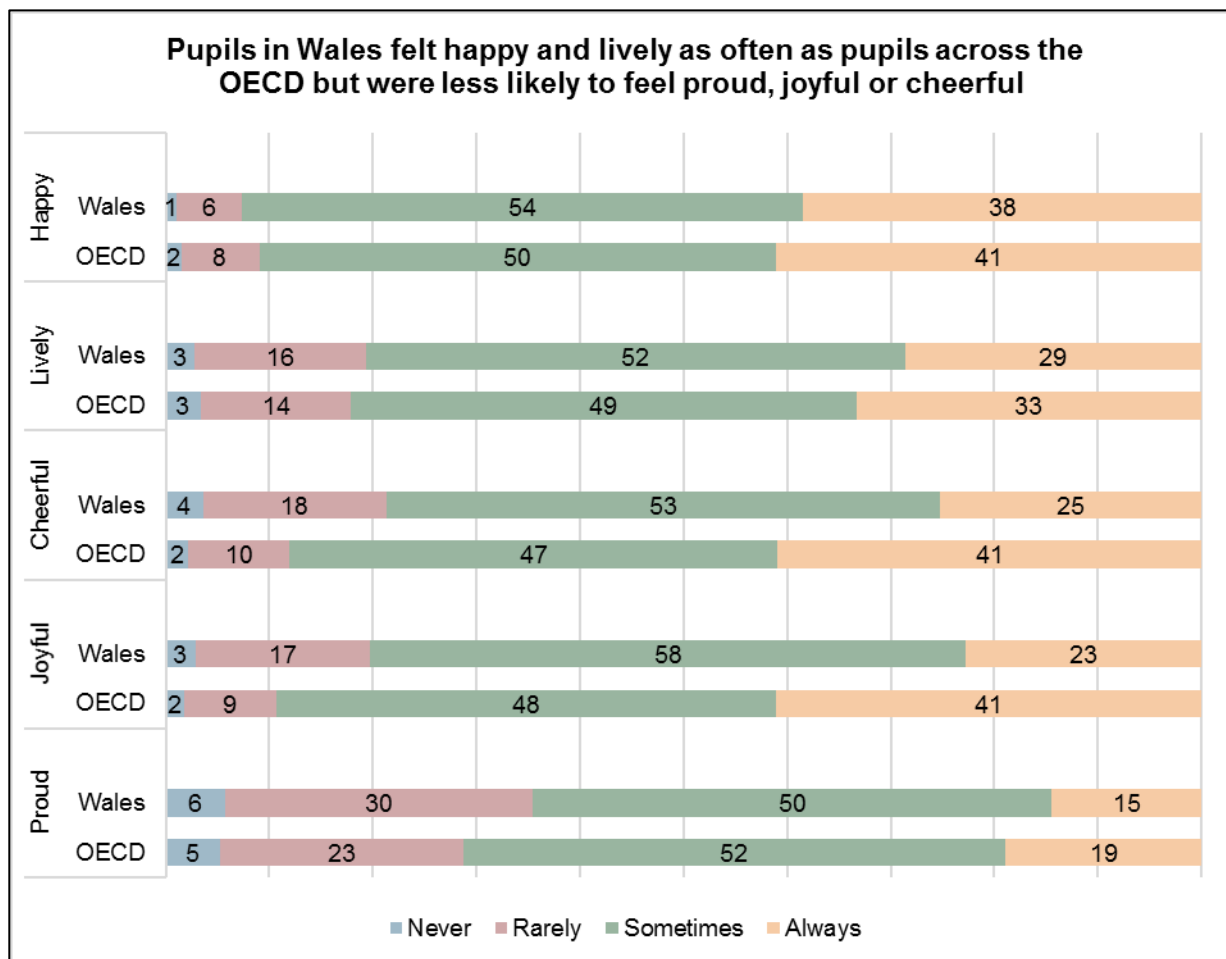
Figure 3.7   Percentage of pupils who reported never, rarely, sometimes and always for each negative feeling

Pupils in Wales had negative feelings more often than pupils across the OECD

Feeling		Never	Rarely	Sometimes	Always
Sad	Wales	7	36	48	9
	OECD	8	41	44	6
Worried	Wales	7	30	44	19
	OECD	12	38	39	10
Miserable	Wales	9	37	46	8
	OECD	17	44	33	5
Scared	Wales	14	47	34	5
	OECD	16	49	30	4

■ Never   ■ Rarely   ■ Sometimes   ■ Always
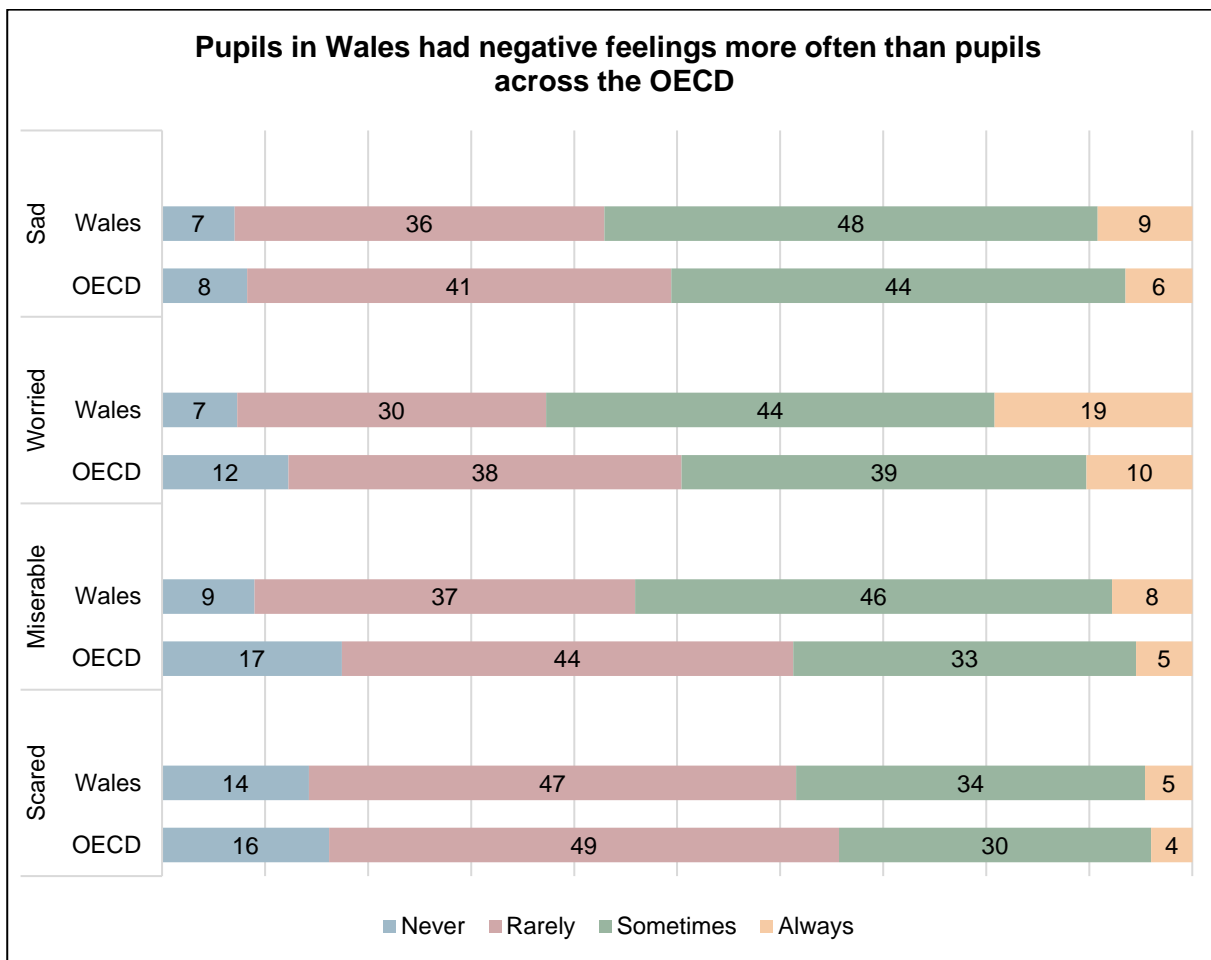
Source: PISA 2018 database; Student Questionnaire, question ST186

In Wales, 93%[29] of pupils felt happy sometimes or always, compared with 91% on average in the OECD countries. However, pupils in Wales were more likely to feel miserable and worried than pupils across the OECD; these were large differences. Pupils in Wales were also less likely to feel joyful, cheerful and proud, and more likely to feel sad; these were all moderate differences.

It should be expected that pupils have concerns and worries about their lives, but pupils' responses in Wales about the extent to which their lives have meaning and how often they experience negative feelings raise concerns when compared with pupils across the OECD.

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[29] after taking into account rounding of figures

3.5 Future aspirations

Pupils were asked about their expectations for the highest qualification they would achieve and their aspirations for the job they would be doing aged 30. Pupils in Wales had lower expectations of their highest level of qualification than pupils across the OECD. Pupils in Wales were less likely to expect to complete a university degree-level qualification, and more likely to expect to leave education with GCSE-level qualifications than pupils across the OECD; these were large differences.

Table 3.10 Pupil expectations of their highest qualification level

Percentage of pupils who expect to achieve each qualification level as their highest			
Level of qualification	**Wales**	**OECD**	**Percentage point difference Wales-OECD**
No qualifications	1	3	-1
GCSE, NVQ level 1 or 2, Vocational Qualification level 2, BTEC first diploma or certificate level 1 or 2, Apprenticeship	17	7	10
A-level (A2), AS, Vocational Qualification level 3, Advanced Apprenticeship, International Baccalaureate	15	13	2
A qualification for adults who want to go to university but don't have the necessary qualifications already (e.g. access course)	5	6	-1
Higher Education qualification below degree level, (e.g. NVQ level 4 or 5, Diploma of Higher Education, nursing qualifications or Higher levels in HNC, HND or BTEC)	14	13	1
A university degree (e.g. BA, BSc, BEd) or Master's degree (e.g. MA, MSc, MBA) or a doctorate or higher degree (e.g. MPhil, PhD)	48	58	-10

Source: PISA 2018 database; Student Questionnaire, question ST225

Note: The percentage point difference column may not equal the difference between Wales and OECD due to rounding.

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Pupils were asked about the job they thought they would have at 30 years old. This was an open response question and responses were coded using the International Labour Organisation's (ILO) International Standard Classification of Occupations (ISCO-08)[30]. Table 3.11 presents their career aspirations in ten major groups.

Table 3.11   Pupil expectations of future careers

Percentage of pupils who expect to have each type of job at 30 years old			
	Wales	OECD	Percentage point difference Wales-OECD
Armed Forces Occupations (e.g. army captain, navy rating, air force technician)	2	1	1
Managers (e.g. chief executive, government official, marketing manager, production manager, human resources manager)	4	3	1
Professionals (e.g. lawyer, accountant, teacher, computer programmer, doctor, engineer, scientist, nurse)	47	44	4
Technicians and Associate Professionals (e.g. dental assistant, nursing assistant, insurance agent, police inspector, web technician, estate agent)	9	11	-2
Clerical Support Workers (e.g. secretary, bank teller, bookkeeping clerk, call centre operator)	1	1	-1
Services and Sales Workers (e.g. waiter, hairdresser, child care worker, police officer, shop sales assistant)	9	8	1
Skilled Agricultural, Forestry and Fishery Workers (e.g. farmer, fisherman, gardener, animal producer)	1	1	0

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[30] The International Standard Classification of Occupations (ISCO) organises jobs into defined sets of groups according to the tasks and duties undertaken and enables comparisons to be made between countries.

Percentage of pupils who expect to have each type of job at 30 years old			
	Wales	OECD	Percentage point difference Wales-OECD
Craft and Related Trades Workers (e.g. carpenter, mechanic, tailor, butcher, electrician)	5	6	0
Plant and Machine Operators and Assemblers (e.g. miner, machine operator, bus/taxi/lorry driver)	0	1	0
Elementary Occupations (e.g. unskilled worker or labourer, cleaner or helper, packer in a factory)	1	0	0
Not working (e.g. student, stay at home parent, retiree)	0	0	0
Do not know or vague response	6	10	-3
Blank or did not answer question	14	15	0

Note: The percentage point difference column may not equal the difference between Wales and OECD due to rounding.

Source: PISA 2018 database; Student Questionnaire, question ST114

In general, pupils' expectations of their future careers were similar in Wales and the OECD. This is interesting given the higher proportion of pupils in the OECD who expected to complete higher education. It seems unlikely that similar proportions of pupils in Wales and the OECD countries will go on to be managers and professionals if there is a gap in highest qualification as suggested by responses in Table 3.10. The PISA international report (OECD, 2019c) finds that across the OECD countries there is misalignment between the career expectations of pupils and their expected highest level of qualification, with pupils' expectations of their future career exceeding what would usually be expected from their expected highest qualification.

4   Science

Chapter outline

This chapter reports the science attainment of pupils in Wales. It draws on findings outlined in the PISA International report (OECD, 2019b) and places outcomes for Wales in the context of those findings. Throughout the chapter, comparisons are made between the findings for PISA 2018 and previous cycles. In 2015, science was the main focus for study and in 2018, it is a minor domain.

Key findings

Overall science performance

- The mean score for Wales in science was 488. This was very slightly below the OECD average score of 489, but the difference was not statistically significant.
- The mean score has risen from 485 in the previous cycle in 2015, although this increase is not statistically significant. The 2018 score was not significantly different from scores back in 2009 but was significantly lower than that in 2006.
- Nineteen countries had mean scores in science that were significantly higher than that of Wales. This is an improvement on the relative performance for Wales since the PISA study in 2015 when 28 countries scored significantly higher than Wales in science.
- Twelve countries had mean scores that were not statistically different from that of Wales and Wales significantly outperformed the 45 remaining participating countries.

Gender gap

- In Wales, girls performed slightly better than boys in science, although this difference was not statistically significant. In 2015, the gap was of equivalent size, but favoured boys instead of girls. This represents a significant shift in the gender gap between these studies.

Attainment gap between highest and lowest achievers

- The attainment gap was significantly smaller than that of the OECD average.
- In terms of the PISA proficiency levels, a similar proportion of pupils scored in the lower ability proficiency levels (below Level 2) compared with that of the OECD average, and the proportion of pupils scoring in the high levels (Levels 5 and 6) was significantly lower than that of the OECD average.

In PISA 2018, science was a minor domain as reading was the focus for this cycle. Science was the main domain in the previous PISA cycle in 2015. Therefore, the science content reflects the framework that was developed by the OECD in 2015 and has remained unchanged since then.

4.1 Wales' performance in science

Pupils in Wales achieved a mean score of 488 in science in PISA 2018. This performance represents a slight increase from that achieved in PISA 2015 (485) (Jerrim *et al.*, 2016), but this increase is not statistically significant[31].

The performance in science in 2018 was almost the same as the OECD average[32] performance score of 489. This is closer than Wales' score has been to the OECD average for several PISA cycles as it was 6 score points below in 2015 and 7 points below in 2012. The OECD average for science has declined over recent PISA cycles from 498 in 2012 to 489 in 2018, and Wales' mean science score has got nearer to the OECD average over this timescale. The 2018 score was not significantly different from scores back in 2009. However, the science score was significantly higher in 2006.

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[31] When statistical significance is reported, it indicates that the compared means are significantly different at the 5% level.
[32] The 2018 OECD average is based upon the 'AV37' results published in the OECD International Results Table 1.B1.12.

Figure 4.1   Trends over time in science scores in Wales and the OECD
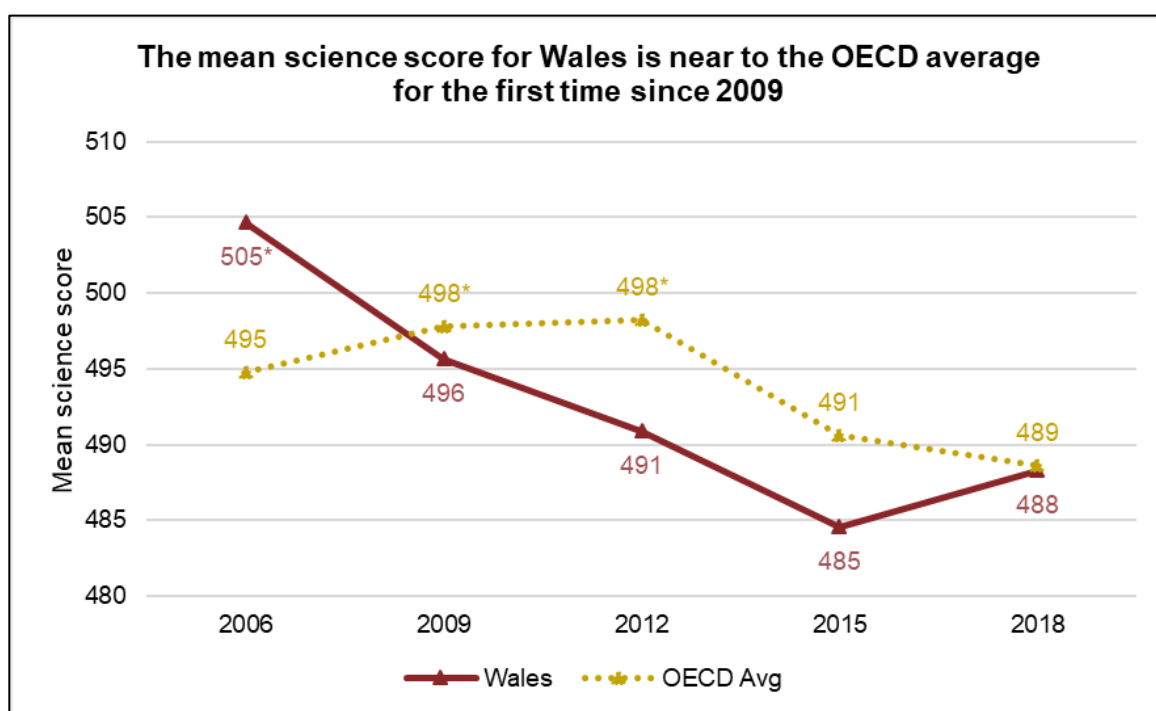
The mean science score for Wales is near to the OECD average for the first time since 2009

*Indicates a score that is statistically significantly different from the given country's 2018 score

Source: PISA 2018 database; Bradshaw et al., 2007; Bradshaw et al., 2010; Wheater et al., 2014; Jerrim et al., 2016

4.2 International results

Results for 76 countries other than Wales were reported for science in PISA in 2018[33]. Of these, 19 scored significantly higher than Wales. These higher-performing countries divide into 3 groups: those from east and south-east Asia (B-S-J-Z (China), Singapore, Macao (China), Japan, Korea, Hong Kong (China) and Chinese Taipei); those from Europe (Estonia, Finland, Poland, Slovenia, Netherlands, Germany, Sweden and Belgium); and other English-speaking countries, or countries with significant proportions of English-speakers (Canada, New Zealand, Australia and the United States). This represents an improved relative position compared with 2015 when 28 countries scored significantly higher than Wales (Jerrim *et al.*, 2016).

Twelve countries had scores that were not significantly different from that of Wales. All of these are countries from the European continent (Czech Republic, Republic of Ireland,

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[33] Results are not available for Cyprus. See Chapter 1 for further details of the countries included in this report.

Switzerland, France, Denmark, Portugal, Norway, Austria, Latvia, Spain, Lithuania and Hungary). The performance of Wales in science was significantly higher than that of the remaining 45 countries, the majority of countries that participated in the study.

Among the 37 countries that are members of the OECD (and whose performance contributes to the OECD average), 14 countries performed significantly better than Wales and all of the 12 countries whose performance was comparable to Wales are OECD members. The scores of the OECD participants are presented in Table 4.1 to 4.3.

Of the OECD members in the study, 12 had a significant drop in science performance from 2015 to 2018, compared with only 2 (Poland and Turkey) that had a significant increase. This is reflected in the (non-significant) fall of the OECD average score from 491 to 489 over this period and continues the significant downward trend in the OECD average from 2012 (Figure 4.1). All of these results are presented in Table 4.1 to 4.3.

Key point

In 2015, 28 countries scored significantly higher than Wales in PISA science. In 2018, Wales' relative position improved, with only 19 countries scoring significantly higher.

Table 4.1   **PISA International results for science: participants with significantly HIGHER science scores than Wales**

Country	Scale score		Country	Scale score	
B-S-J-Z (China)	590		Poland	511	∧
Singapore	551		New Zealand	508	
Macao (China)	544	∧	Slovenia	507	∨
Estonia	530		Netherlands	503	
Japan	529	∨	Germany	503	
Finland	522	∨	Australia	503	∨
Korea	519		United States	502	
Canada	518	∨	Sweden	499	
Hong Kong (China)	517		Belgium	499	
Chinese Taipei	516	∨			

∧∨ Indicates a statistically significant change in science since PISA 2015
OECD countries (not italicised)
Countries not in OECD (italicised)
*B-S-J-Z (China) different provinces from 2015

Source: PISA 2018 database

Table 4.2   PISA International results for science: participants with SIMILAR science scores to Wales (not statistically significantly different)

Country	Scale score		Country	Scale score	
Czech Republic	497		Austria	490	
Republic of Ireland	496		**OECD Average**	**489**	
Switzerland	495	∨	**Wales**	**488**	
France	493		Latvia	487	
Denmark	493	∨	Spain	483	∨
Portugal	492	∨	Lithuania	482	
Norway	490	∨	Hungary	481	

∧∨ Indicates a statistically significant change in science since PISA 2015
OECD countries (not italicised)
Countries not in OECD (italicised)

Table 4.3   PISA International results for science: participants with significantly LOWER science scores than Wales

Country	Scale score		Country	Scale score	
Russian Federation	478	∨	Slovak Republic	464	
Luxembourg	477	∨	Israel	462	
Iceland	475		*Malta*	457	∨
Croatia	472		Greece	452	
Belarus	471		Chile	444	
Ukraine	469		Mexico	419	
Turkey	468	∧	Colombia	413	
Italy	468	∨	plus 30 non-OECD countries scoring <450		

∧∨ Indicates a statistically significant change in science since PISA 2015
OECD countries (not italicised)
Countries not in OECD (italicised)

Figure 4.2 illustrates the trends in performance for Wales since 2006, alongside the trends for 4 other countries. These countries have been selected from the group of countries whose mean science score was not significantly different from that of Wales in 2009 (Bradshaw *et al.,* 2010). This allows comparison of how these countries'

performances have developed over the past three cycles from a similar starting point. The 2009 study was chosen as this represents the first PISA study since the revision of the National Curriculum for Wales in 2008.

In 2009, 14 countries had scores in science that were not significantly different from that of Wales. Tracking the performance of these countries to 2018, Wales' performance has remained approximately in the middle of this group. Two of these countries performed significantly higher than Wales in 2018: Sweden and the United States, whilst the performance of three other countries has fallen significantly below that of Wales: Iceland, Italy and the Slovak Republic. Wales' performance was still not significantly different from that of the remaining 9 countries: Latvia, Spain, Hungary, Czech Republic, Norway, Denmark, France, Portugal and Lithuania.

Figure 4.2   Trends in science scores for a selection of countries that performed similarly to Wales in 2009[34]
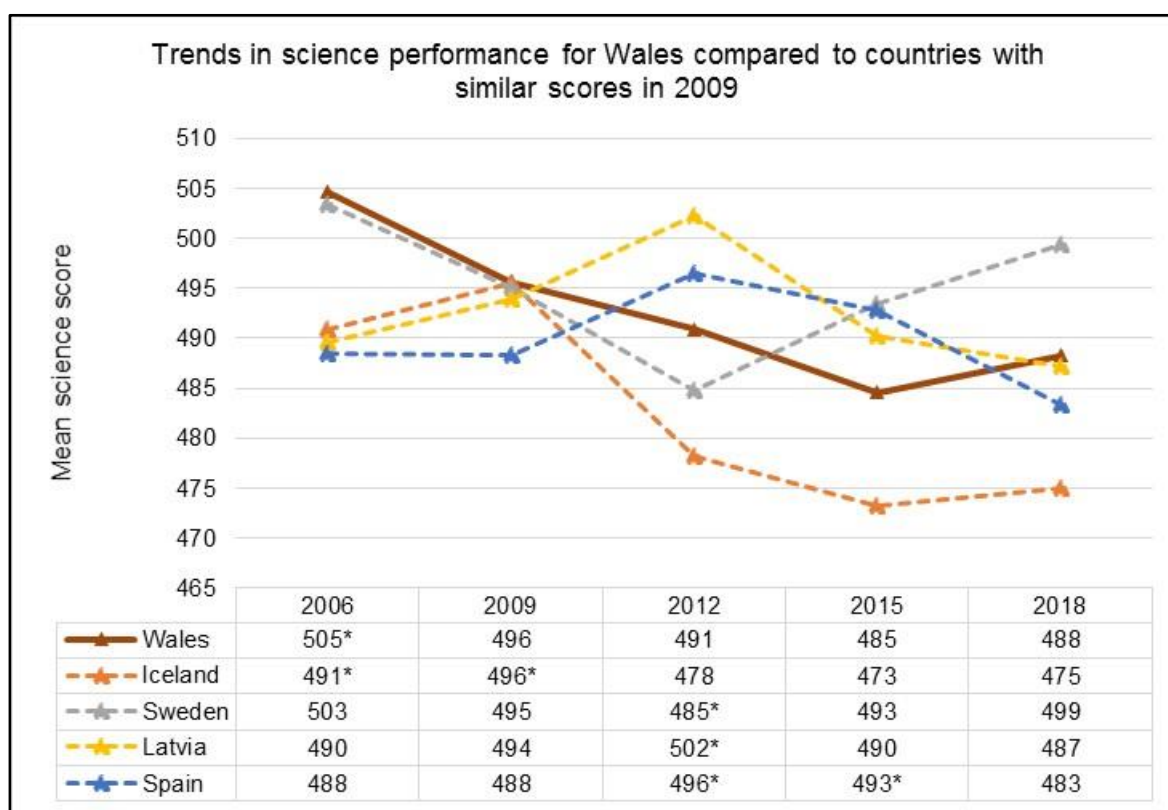
Trends in science performance for Wales compared to countries with similar scores in 2009

	2006	2009	2012	2015	2018
Wales	505*	496	491	485	488
Iceland	491*	496*	478	473	475
Sweden	503	495	485*	493	499
Latvia	490	494	502*	490	487
Spain	488	488	496*	493*	483

* Indicates a score that is statistically significantly different from the given country's 2018 score

Source: PISA 2018 database; Bradshaw et al., 2007; Bradshaw et al., 2010; Wheater et al., 2014; Jerrim et al., 2016

Sweden's performance in science fell from 2009 to 2012 before improving since then, such that the 2018 score is significantly higher than the 2012 score and significantly higher than that of Wales. By contrast, the score in Iceland has fallen in both the 2012 and 2015 studies and, although the score has stabilised in the 2018 study, this represents a significant drop in performance from 2009 to 2018 to a level significantly below that of Wales. The scores for Latvia and Spain have also fluctuated and both scored higher than Wales in 2012 and 2015, whilst in 2018 their scores were not significantly different from that of Wales. The position of these two countries in 2018,

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[34] Note: the OECD average for 2006, 2012, 2015 and 2018 is based upon 'AV37' results presented in the OECD International results Table 1.B1.12 made up of the current 37 OECD countries. See Chapter 1 for further information on the countries included in the OECD average. The OECD average for 2009 is based on the 'AV36' results (excluding Austria), which are also presented in the OECD International results Table 1.B1.12.

represent the majority of the countries that were not significantly different from Wales in 2009, indicating that, despite fluctuations between studies, Wales has performed broadly in line with this group from 2009 to 2018.

It is also informative to look at the long-term trends of countries that performed significantly better and worse than Wales in 2009. Of the 18 countries that performed significantly better than Wales in 2009 (Bradshaw *et al.,* 2010) and also took part in the 2018 study, only 2 of these (the Republic of Ireland and Switzerland) did not have significantly higher scores that Wales in 2018, whilst 2 other countries (Sweden and the United States) moved in the opposite direction. Of the countries that had scores significantly below Wales in 2009, all of those participating in 2018 also performed significantly below Wales in that study. Therefore, despite fluctuations between cycles, this indicates that the long term relative position of Wales in PISA studies in science is stable and the pattern of countries performing above and below them has changed little.

4.3   Differences between highest and lowest achievers

In addition to knowing how well pupils in Wales performed overall, it is also important to examine the spread in performance between the highest and lowest achievers. Amongst countries with similar mean scores, there may be differences in the numbers of high- and low-scoring pupils (the highest and lowest achievers). A country with a wide spread of attainment may have large numbers of pupils who are underachieving as well as pupils performing at the highest levels. A country with a lower spread of attainment may have fewer very high achievers but may also have fewer low achievers.

4.3.1 Distribution of scores

The first way in which the spread of performance in each country can be examined is by looking at the distribution of scores. Appendix C1.1 shows the scores achieved by pupils at different percentiles. The 10th percentile is the score at which the lowest performing 10% lay, while the 90th percentile is the score at which that the highest performing 10% of pupils lay. The difference between the 10th and 90th percentiles is a better measure of the spread of scores for comparing countries than using the very lowest- and highest-scoring pupils. Such a comparison may be affected by a small number of pupils with unusually high or low scores. Comparison of the 10th and the 90th percentiles gives a better indication of the typical spread of attainment.

> **Key point**
>
> In 2018, Wales had a significantly smaller attainment gap that the OECD average.

Figure 4.3   Attainment gap in science scores in Wales and the OECD
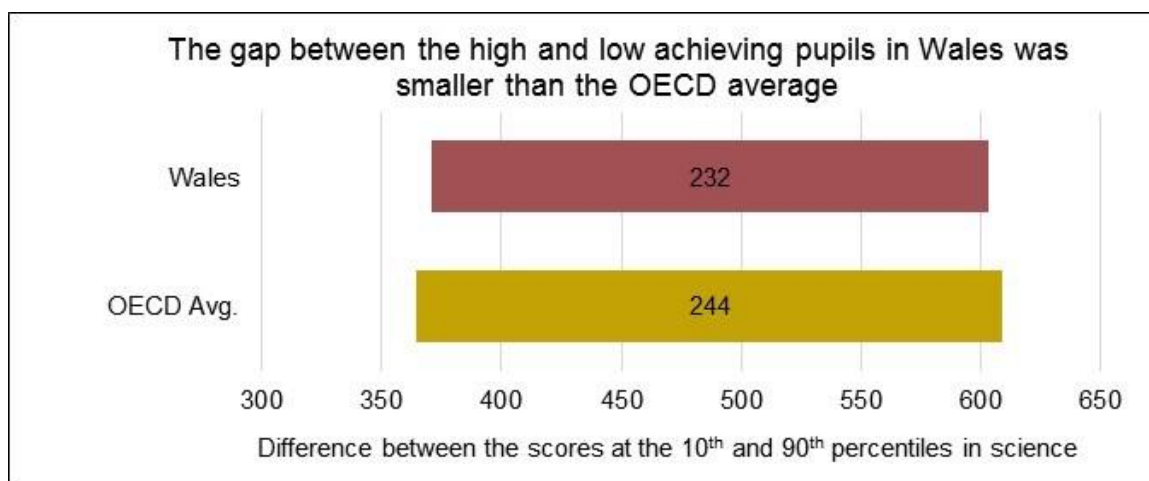
The gap between the high and low achieving pupils in Wales was smaller than the OECD average

Wales	232
OECD Avg.	244

Difference between the scores at the 10ᵗʰ and 90ᵗʰ percentiles in science

The gap between the highest and lowest achieving pupils in Wales was 232 score points, significantly smaller than the OECD average gap of 244 score points (Figure 4.3). Lower achieving pupils in Wales, i.e. those at the 10th percentile, had a score of 371, while the score of those at the 90th percentile was 603. The OECD score at the 10th percentile was slightly lower than Wales' (365) and that at the 90th percentile was slightly higher (609). Therefore, Wales has a narrower attainment gap than that of the OECD average.

In Wales scores at both the 10th and the 90th percentiles have not changed significantly since 2015.

Figure 4.4 presents a scatterplot that shows the mean score for each country plotted against its attainment gap, as measured by the difference between the score at the 10th percentile and the score at the 90th percentile. Countries can be separated into 4 categories in relation to the OECD average: lower-performing countries with a larger gap, lower-performing countries with a smaller gap, higher-performing countries with a larger gap, and higher-performing countries with a smaller gap.

Figure 4.4   Attainment gap in science scores across PISA 2018 countries
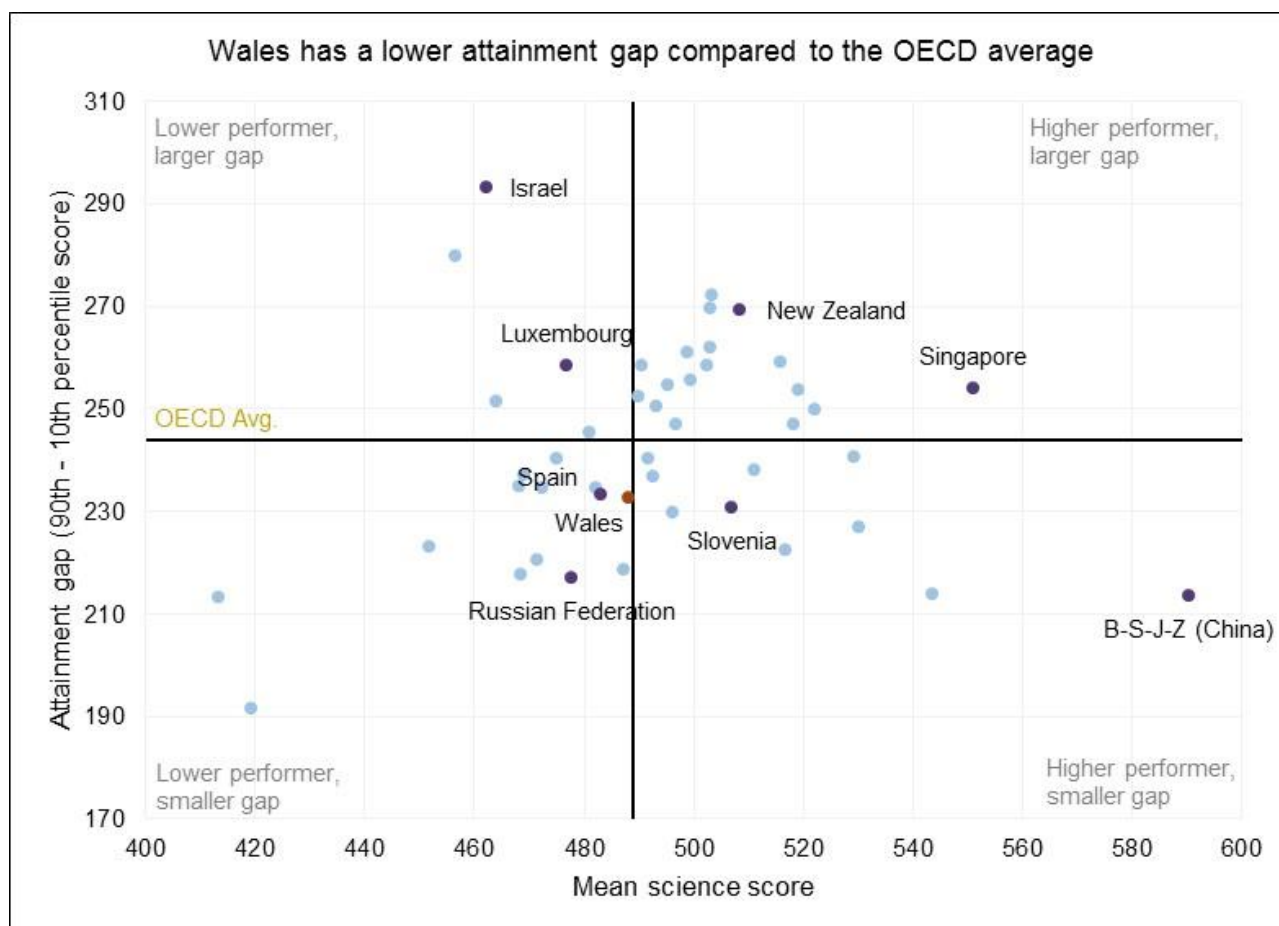
Note: This scatterplot contains all countries either in the OECD or with a mean score above 450

Source: PISA 2018 database

The scatterplot indicates that there is no clear relationship between high science score and attainment gap. For example, whilst the highest scoring country, B-S-J-Z (China), has a very low attainment gap, the second highest scoring country, Singapore, has an above average attainment gap. These differences are seen also with scores below the OECD average, as the Russian Federation has a low attainment gap, comparable to that of B-S-J-Z (China), whilst Israel, with a similar mean score, has the highest attainment gap of the countries on the scatterplot.

On this scatterplot Wales lies just within quadrant III, the quadrant for scores below the OECD average with an attainment gap below the OECD average. To further consider Wales' attainment gap and its relationship with overall performance, scores for pupils at the 10th and 90th percentiles can be compared with those of other countries. Figure 4.5 shows countries with similar scores at either the 10th or 90th percentile compared with Wales (these countries are also marked on Figure 4.4).

Figure 4.5   Attainment gap in countries with similar performance to Wales at either the 10th or 90th percentiles
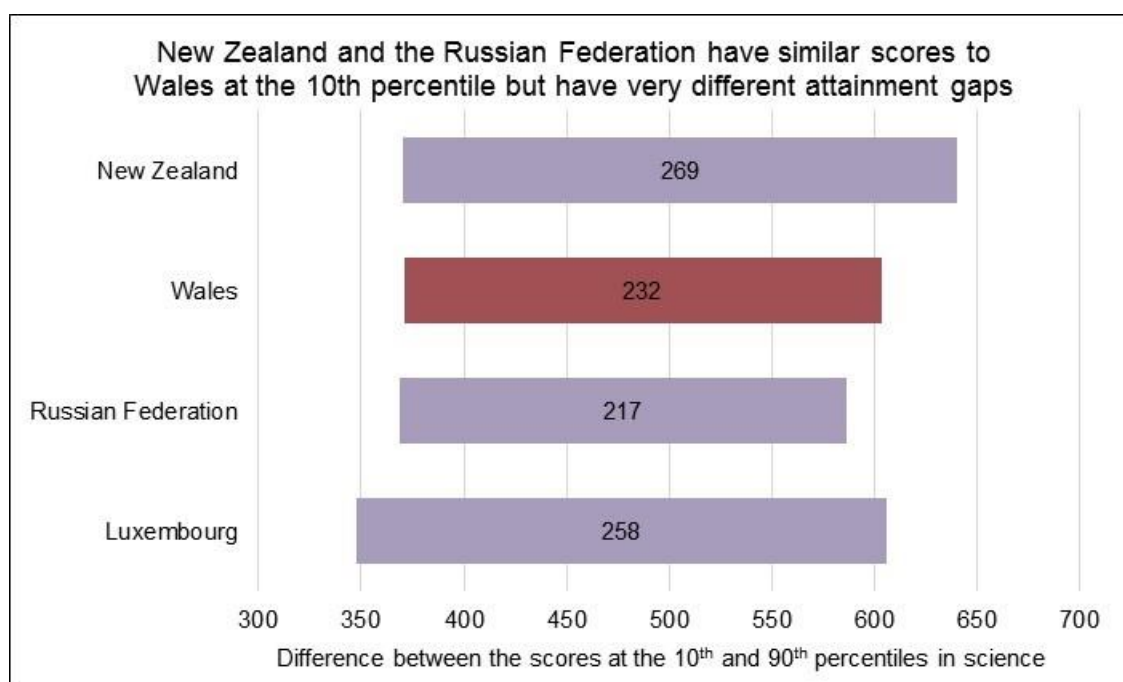
Both New Zealand and the Russian Federation had scores at the 10th percentile that were very similar to that of Wales. However, New Zealand, a country that performs significantly higher than Wales, has a larger attainment gap with a score much higher than that of Wales at the 90th percentile. This suggests that the mean performance of New Zealand was significantly higher than that of Wales, due to higher performance at the top ability range. In contrast, the Russian Federation also had comparable performance at the lower abilities, but a smaller attainment gap indicates lower performance than Wales at the higher abilities.

Luxembourg, like the Russian Federation, had a significantly lower mean score than that of Wales, but a comparable performance to Wales at the 90th percentile. However, the performance at the 10th percentile for Luxembourg was lower than that for Wales and the attainment gap larger, such that the mean score was lower. This serves to illustrate the potential trade-offs to be made between policy that seeks to improve average performance by targeting low performers or higher performers.

4.3.2 Performance across PISA proficiency levels

Proficiency levels for science

The second way of examining the spread of attainment is by looking at the science performance in Wales at each of the PISA proficiency levels. The PISA proficiency levels

for science were devised by the PISA Consortium. They are categorised as 7 levels of achievement (Levels 1-6, with Level 1 subdivided into 1a and 1b) which describe the abilities of pupils performing at each of these levels. The performance levels are outlined in Appendix A3 which also shows the cumulative percentages at each level for the OECD average and for Wales.

Figure 4.6 presents the performance of Wales at the 8 different performance levels for science compared with the OECD average. Pupils who score below Level 2 (L2) are considered low performers and those that perform at Level 5 (L5) or above (L6) are considered top performers (OECD, 2019b). A significantly lower proportion of pupils in Wales performed at or above Level 5 (5%) compared with the OECD average (7%). The proportion of pupils performing at the lower proficiency levels (below Level 2) were not significantly different in Wales and the OECD (20%[35] and 22% respectively).

There was no significant change in the proportion of pupils working at the lower proficiency levels between 2015 and 2018 (20% in 2018 compared with 22% in 2015). Additionally, there was no significant change at the higher end between cycles, with 5% of pupils performing at Level 5 or above in both 2018 and 2015.

Figure 4.6   Science proficiency levels in Wales and the OECD average
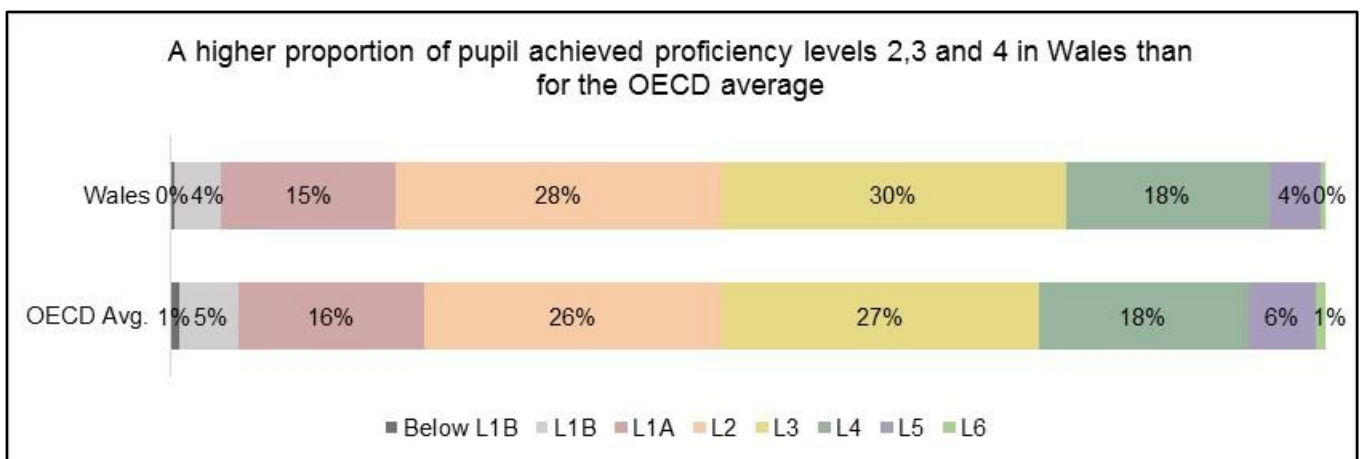
Note: All percentages are rounded.

Source: PISA 2018 database

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[35] after taking into account the rounding of figures

4.4 Differences between boys and girls

In Wales, girls performed slightly better than boys in science, but this difference was not statistically significant. Girls achieved a mean score of 491 whilst boys achieved a mean score of 486. This gender gap is slightly larger, but not significantly different from that of the OECD average difference for science which is an average score difference of 2 score points in favour of girls.

Figure 4.7   Gender gap for Wales compared to the OECD average

	Overall science score	Mean score girls	Mean score boys	Difference girls - boys
Wales	488	491	486	+5
OECD Avg.	489	490	488	+2*

*The difference is statistically significant

The gender gap in Wales was not statistically significant

Range between boys' score and mean   Range between girls' score and mean
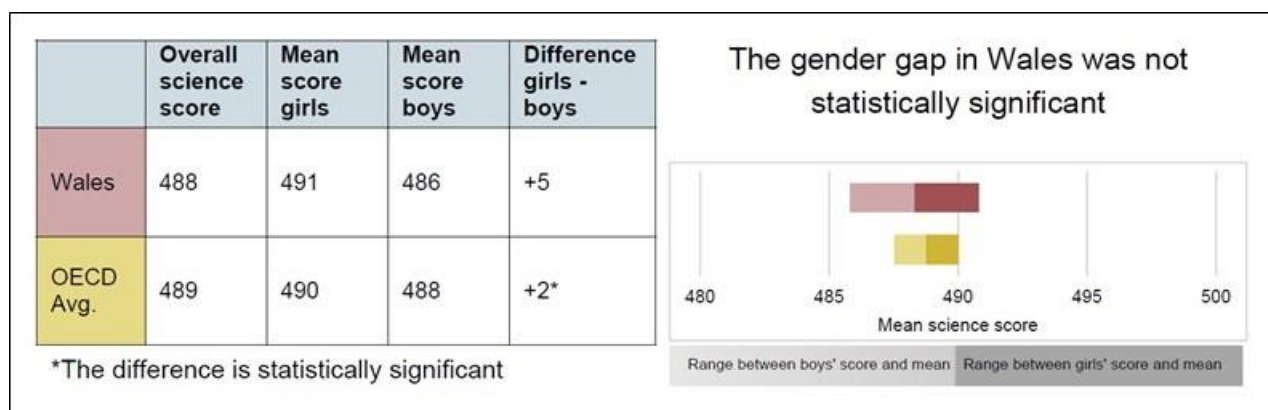
Source: PISA 2018 database

In 2015, there was a 5 point gender gap in favour of boys for Wales, which was also not statistically significant (Jerrim *et al.*, 2016). The mean score for boys has changed very little, and not significantly, from 2015 (487) to 2018 (486). However, the mean score for girls has increased from 482 to 491 over the same timescale. Although the increase in girl's score was also not significant, the shift in the gender gap from -5 to +5 was a significant change. This suggests that the improvement in performance in science in Wales from 2015 to 2018 predominantly reflects an improvement in the performance of girls.

> **Key point**
>
> Since 2015, there has been a significant shift in the gender gap from being in favour of boys to favouring girls. The performance of boys in science has changed very little. However, the performance of girls has increased by nearly 10 score points.

Figure 4.8 provides a scatterplot of the mean score for girls against the mean score for boys. For science, countries are scattered either side of the line of equality, with girls overall performing very slightly better than boys as shown by the OECD average. This illustrates that Wales performed very close to the OECD average in terms of performance of both boys and girls.

Some of the highest performing countries displayed the largest gender gaps, with the top performer, B-S-J-Z (China), significantly favouring boys and Finland, another high performer, significantly favouring girls.

Figure 4.8   Gender differences in science scores across PISA 2018 countries
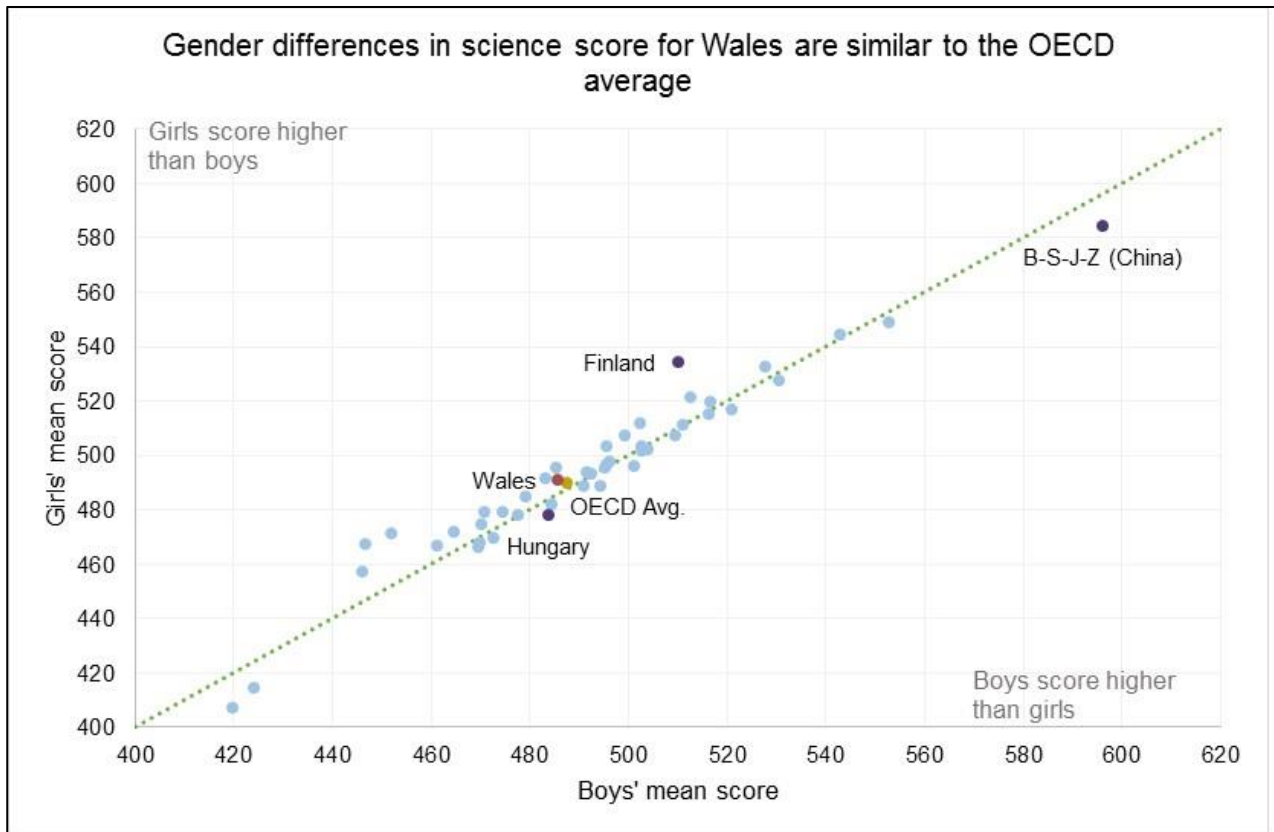
Gender differences in science score for Wales are similar to the OECD average

Note: This scatterplot contains all countries either in the OECD or with a mean score above 450

Source: PISA 2018 database

Comparisons between the four constituent countries of the UK are provided in Chapter 7.

5   Mathematics

Chapter outline

This chapter reports on the mathematics attainment of pupils in Wales. It draws on findings outlined in the PISA International report (OECD, 2019b) and places outcomes for Wales in the context of those findings. Throughout the chapter, comparisons are made between the findings for PISA 2018 and previous cycles. As in 2015, mathematics was a minor domain in 2018.

Key findings

Overall mathematics performance

- Wales achieved a mean score of 487 in 2018, similar to the OECD average (489) for the first time, rather than significantly below as in previous PISA cycles.
- The number of countries outperforming Wales decreased from 30 in 2015 to 23 in 2018.
- The composition of the top performing group of countries remains similar to previous cycles, dominated by east and south-east Asian countries.

Gender gap

- Girls improved significantly in mathematics performance, making the difference in scores between boys and girls non-significant, for the first time.

Attainment gap between highest and lowest achievers

- The highest achieving pupils in mathematics scored significantly higher than in PISA 2015.
- Wales' attainment gap (211 score points) was significantly narrower than the spread of attainment in the OECD average (235 score points).
- In terms of the PISA proficiency levels, the percentage of pupils in Wales achieving below Level 2 was 21% and the percentage of pupils reaching Levels 5 or 6 was 7%. Wales' performance has improved significantly at the upper end of the scale since 2015, with the proportion of pupils reaching Level 5 or 6 increasing by 2 percentage points.

5.1 Wales' performance in mathematics

In PISA 2018, mathematics was one of the minor domains, as reading was the major domain for this cycle. Mathematics was most recently the major domain in 2012 (and will next be the major domain in 2021). The mathematics content tested in PISA 2018 is described in the OECD 2012 mathematics framework, which was developed by the OECD for PISA 2012, and will be updated again for PISA 2021.

The mathematics performance of pupils in Wales has improved, relative to the OECD average[36]. In PISA 2018, pupils in Wales achieved a mean score of 487 in mathematics which was not statistically significantly[37] different from the OECD average score of 489. This is the first time that mathematics performance in Wales has not been significantly below the OECD average.

Key point

For the first time, Wales' performance in mathematics was not significantly below the OECD average.

Pupils in Wales performed significantly better in mathematics in 2018 than in the previous cycles in 2012 and 2009. They also performed better than in 2015, though this difference was not statistically significant.

In 2006, Wales' mean score was not significantly different from that achieved in 2018 but, like 2009, 2012 and 2015, it was significantly below the OECD average. So in 2018, the mean score returned to a similar level as achieved in 2006, showing significant improvements since 2009 and 2012 and, for the first time, improvements relative to the OECD average.

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[36] The 2018 OECD average is based upon the 'AV37' results published in the OECD International results Table 1.B1.11.
[37] When statistical significance is reported, it indicates that the compared means are significantly different at the 5% level.

Figure 5.1   Trends over time in mathematics scores in Wales and the OECD [38]
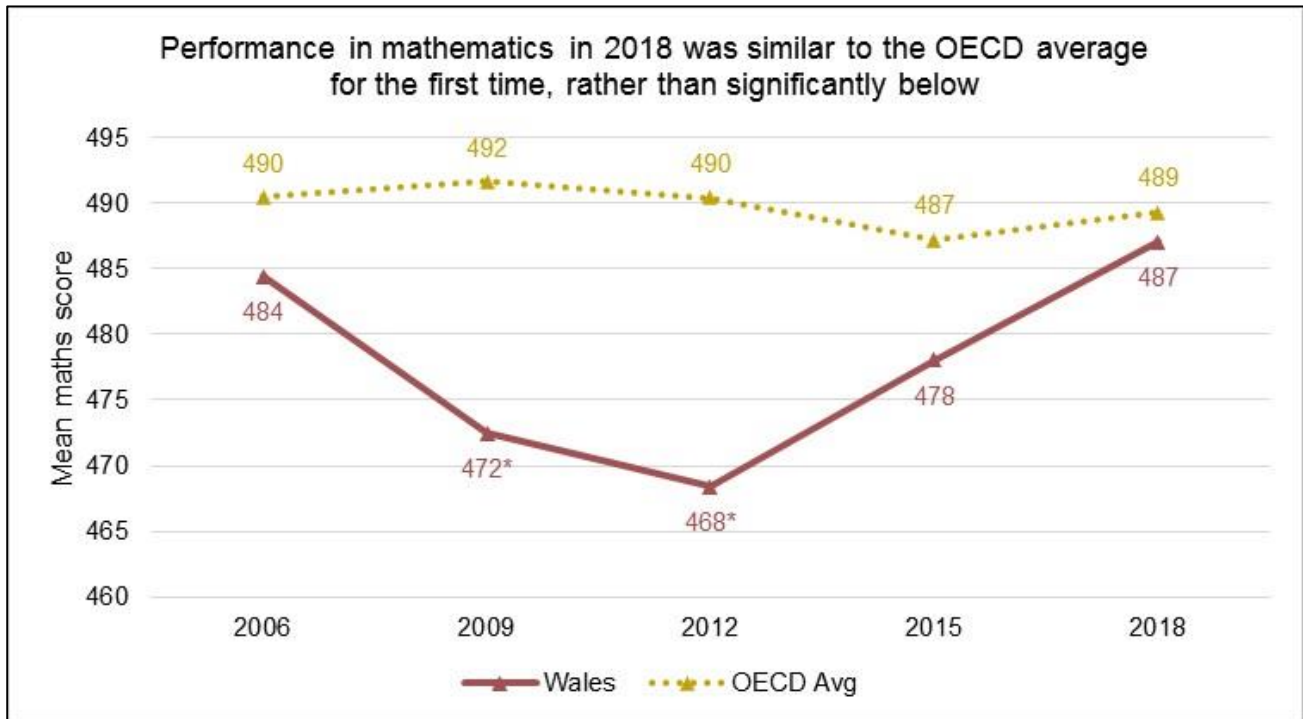
Performance in mathematics in 2018 was similar to the OECD average for the first time, rather than significantly below

*Indicates a score that is significantly different from the given country's 2018 score

Source: PISA 2018 database; Bradshaw et al., 2007; Bradshaw et al., 2010; Wheater et al., 2014; Jerrim et al., 2016

5.2   International results

Of the 76[39] other reported participating countries in PISA 2018, 23 scored significantly higher than Wales and, as in previous cycles, most of the top-performing countries were from east or south-east Asia: B-S-J-Z (China), Singapore, Macao (China), Hong Kong (China), Chinese Taipei, Japan and Korea. The number of countries significantly outperforming Wales in 2018 was 7 less than in 2015. Thirteen countries performed at a level that was not significantly different from that of Wales, which has increased from 9 countries in 2015. The remaining 40 countries performed significantly less well. These results are shown in Tables 5.1 to 5.3. Only 6 countries in Tables 5.1 to 5.3 made significant improvements in their mathematics performance since 2015; these were

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[38] The OECD average for 2006, 2012, 2015 and 2018 is based upon the 'AV37' results presented in the OECD International results Table 1.B1.11, made up of the current 37 OECD countries. See Chapter 1 for further information on the countries included in the OECD average. The OECD average for 2009, based upon 'AV36' results (excluding Austria), is also presented in the OECD International results Table 1.B1.11.

[39] Whilst Vietnam and Cyprus did participate in PISA 2018, their results are not included in this report. See Chapter 1 for further details of the countries included in this report.

Macao (China), Poland, Latvia, Iceland, Turkey and Slovak Republic. Chinese Taipei and Malta both had scores that were significantly below their scores in 2015.

Among the OECD countries, 18 outperformed Wales, 12 performed similarly and 6 performed less well. Five of the 6 countries that showed significant improvement in mathematics since 2015 were OECD countries (Poland, Latvia, Iceland, Turkey and Slovak Republic). No OECD country's score declined significantly.

Table 5.1   PISA International results for mathematics: participants with significantly HIGHER mathematics scores than Wales

Country	Scale score		Country	Scale score	
B-S-J-Z (China)*	591		Denmark	509	
Singapore	569		Slovenia	509	
Macao (China)	558	∧	Belgium	508	
Hong Kong (China)	551		Finland	507	
Chinese Taipei	531	∨	Sweden	502	
Japan	527		Norway	501	
Korea	526		Germany	500	
Estonia	523		Republic of Ireland	500	
Netherlands	519		Czech Republic	499	
Poland	516	∧	Austria	499	
Switzerland	515		Latvia	496	∧
Canada	512				

∧∨ Indicates a significant change in mathematics since PISA 2015
OECD countries (not italicised)
Countries not in OECD (italicised)
*B-S-J-Z (China) different provinces from 2015

Source: PISA 2018 database

Table 5.2   PISA International results for mathematics: participants with SIMILAR mathematics scores to Wales (not statistically significantly different)

Country	Scale score		Country	Scale score	
France	495		Italy	487	
Iceland	495	∧	Slovak Republic	486	∧
New Zealand	494		Luxembourg	483	
Portugal	492		Spain	481	
Australia	491		Lithuania	481	
OECD Average	**489**		Hungary	481	
Russian Federation	488		United States	478	
Wales	**487**				

∧∨ Indicates a significant change in mathematics since PISA 2015
OECD countries (not italicised)
Countries not in OECD (italicised)

Source: PISA 2018 database

Table 5.3   PISA International results for mathematics: participants with significantly LOWER mathematics scores than Wales

Country	Scale score		Country	Scale score	
Belarus	472		Greece	451	
Malta	472	∨	Chile	417	
Croatia	464		Mexico	409	
Israel	463		Colombia	391	
Turkey	454	∧	plus 30 other countries scoring <450		
Ukraine	453				

∧∨ Indicates a significant change in mathematics since PISA 2015
OECD countries (not italicised)
Countries not in OECD (italicised)

Source: PISA 2018 database

Mathematics was last the major domain in 2012, but in order to look at long-term trends in mathematics performance it is useful to look at performance over the previous 3 cycles of PISA, from 2009.

Mathematics performance in Wales has significantly improved since both 2009 and 2012 and also shows relative improvement since 2015, although this difference was not statistically significant.

In 2009, 3 countries performed similarly to Wales: Lithuania, the Russian Federation and Greece (Bradshaw *et al.,* 2010). These 3 countries have followed different patterns of performance since 2009, compared with each other and to Wales, as shown in Figure 5.2. Lithuania and the Russian Federation both performed similarly to Wales again in 2018; Lithuania has had a relatively stable level of performance since 2009 while performance has been more varied in the Russian Federation. Performance improved in both 2012 and 2015 in the Russian Federation, becoming significantly higher than Wales, but then dropped slightly in 2018, converging with Wales' score. The Russian Federation's rate of improvement from 2009 to 2015 was similar to that of Wales' improvement from 2012 to 2018.

The third country that had been similar to Wales in 2009 was Greece, which since 2012 has performed significantly below Wales.

Figure 5.2   Trends in mathematics scores for countries that performed similarly to Wales in 2009
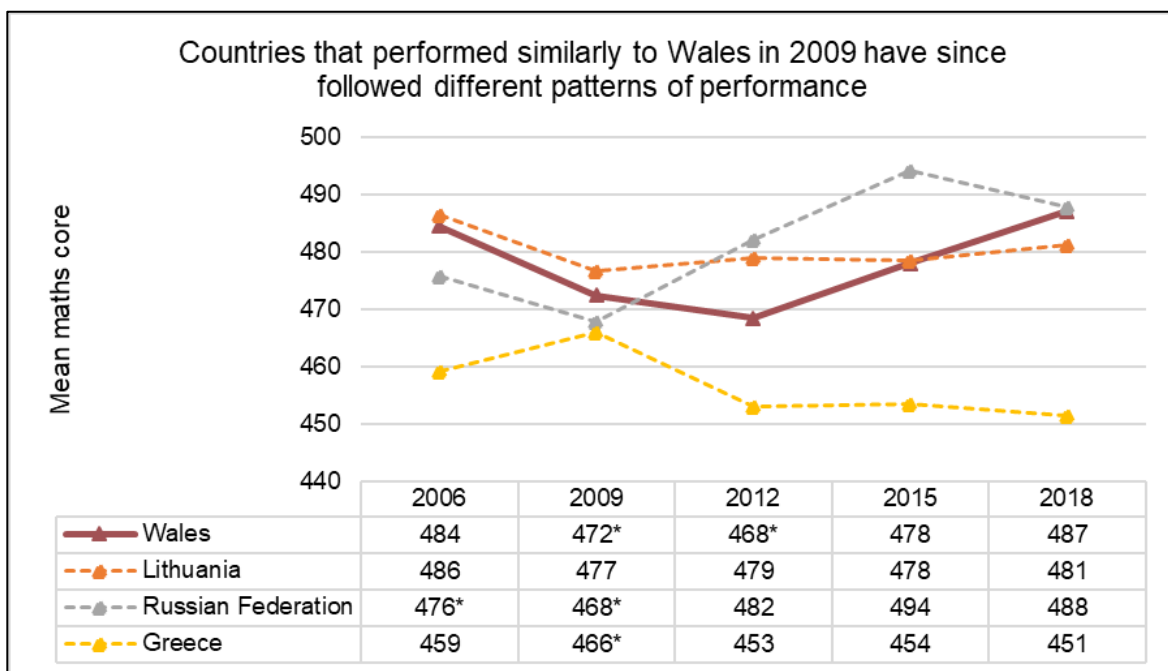
Countries that performed similarly to Wales in 2009 have since followed different patterns of performance

	2006	2009	2012	2015	2018
Wales	484	472*	468*	478	487
Lithuania	486	477	479	478	481
Russian Federation	476*	468*	482	494	488
Greece	459	466*	453	454	451

*Indicates a score that is significantly different from the given country's 2018 score

Source: PISA 2018 database; Bradshaw et al., 2007; Bradshaw et al., 2010; Wheater et al., 2014; Jerrim et al., 2016

In 2009, there were 35 countries that significantly outperformed Wales (Bradshaw *et al.,* 2010). In 2018, Wales performed similarly to 11 of these 35 countries, showing a notable improvement in relative performance across this time period. Furthermore, in 2009, 26 countries performed significantly below Wales, and in 2018 none of these countries performed similarly to or better than Wales, again demonstrating Wales' relative strength in performance over time.

> **Key point**
>
> The number of countries outperforming Wales reduced by 7 since 2015. Wales now performs similarly to four additional European countries plus New Zealand, Australia and the Russian Federation.

Looking at more recent changes in performance, in 2018 Wales performed similarly to 7 countries that had performed significantly higher than Wales in 2015 (Jerrim *et al.*, 2016). Furthermore, no additional countries outperformed Wales in 2018 than had done so in 2015 or 2012 (Wheater *et al.,* 2013). These factors show that Wales has made good progress, relative to other countries.

5.3   Differences between highest and lowest achievers

In addition to knowing how well pupils in Wales performed overall, it is also important to examine the spread in performance between the highest and lowest achievers. Amongst countries with similar mean scores there may be differences in the numbers of high- and low-scoring pupils (the highest and lowest achievers). A country with a wide spread of attainment may have large numbers of pupils who are underachieving as well as pupils performing at the highest levels. A country with a lower spread of attainment may have fewer very high achievers but may also have fewer underachievers.

5.3.1 Distribution of scores

The first way in which the spread of performance in each country can be examined is by looking at the distribution of scores. Appendix D shows the scores achieved by pupils at different percentiles. The 10th percentile is the score below which the lowest-performing 10% of pupils lay, while the 90th percentile is the score above which the highest-performing 10% lay. The difference between the highest and lowest achievers at the 10th and 90th percentiles is a better measure of the spread of scores for comparing countries than using the very lowest and highest scoring pupils. Such a comparison may be affected by a small number of pupils in a country with unusually high or low scores.

Pupils at the 10th percentile in Wales had a score of 381, while those at the 90th percentile had a mean score of 592, a difference of 211 score points.

This difference is statistically significantly smaller than the OECD average of 235 score points. In the OECD average, the score at the 10th percentile was lower than in Wales, and the score at the 90th percentile was higher, as shown in Figure 5.3.

Figure 5.3   Attainment gap in mathematics scores in Wales and the OECD

The attainment gap in Wales was significantly smaller than the OECD average

Difference between the scores at the 10th and 90th percentiles in maths
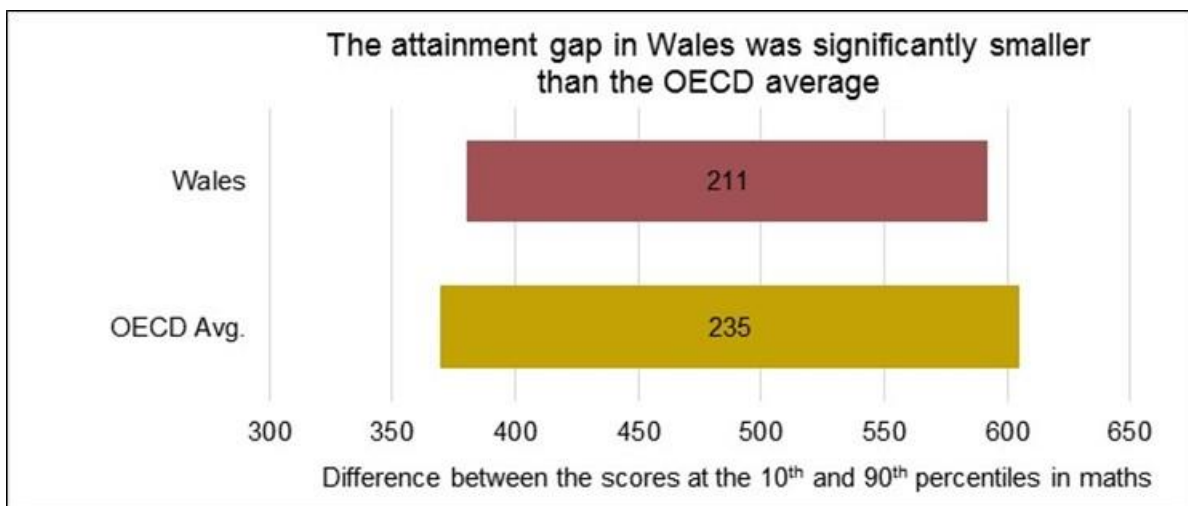
In Wales, pupils at the 90th percentile achieved significantly higher scores than in 2015, when they scored 578. Scores at the 10th percentile also improved slightly, but this change was not statistically significant. Therefore, as pupils at the 90th percentile made a bigger improvement than those at the 10th percentile, the difference in attainment between the highest and lowest achievers was slightly larger than in 2015, when it was 201 score points.

> **Key point**
>
> In Wales, high achievers achieved significantly higher scores than in 2015 and Wales maintained a narrower attainment gap than the OECD average.

Figure 5.4 compares countries' mean mathematics scores with the size of their attainment gap. Countries can be separated into four categories in relation to the OECD average: lower performing countries with a larger gap, lower performing countries with a smaller gap, higher performing countries with a larger gap, and higher performing countries with a smaller gap. Wales falls into the second category as it has a slightly (but not significantly) lower score than the OECD average and a smaller attainment gap. Most countries cluster around the OECD average; however, some countries differ quite

noticeably. For example, high-performing B-S-J-Z (China) had a smaller attainment gap than many other countries (205 points), though this is only 6 points smaller than Wales' gap. Conversely, another high-performing country, Chinese Taipei, had a much wider gap of 259 points. Israel, which scored significantly below Wales in mathematics, had an attainment gap of 285 points, noticeably wider than any other country.

Figure 5.4   Attainment gap in mathematics scores across PISA 2018 countries
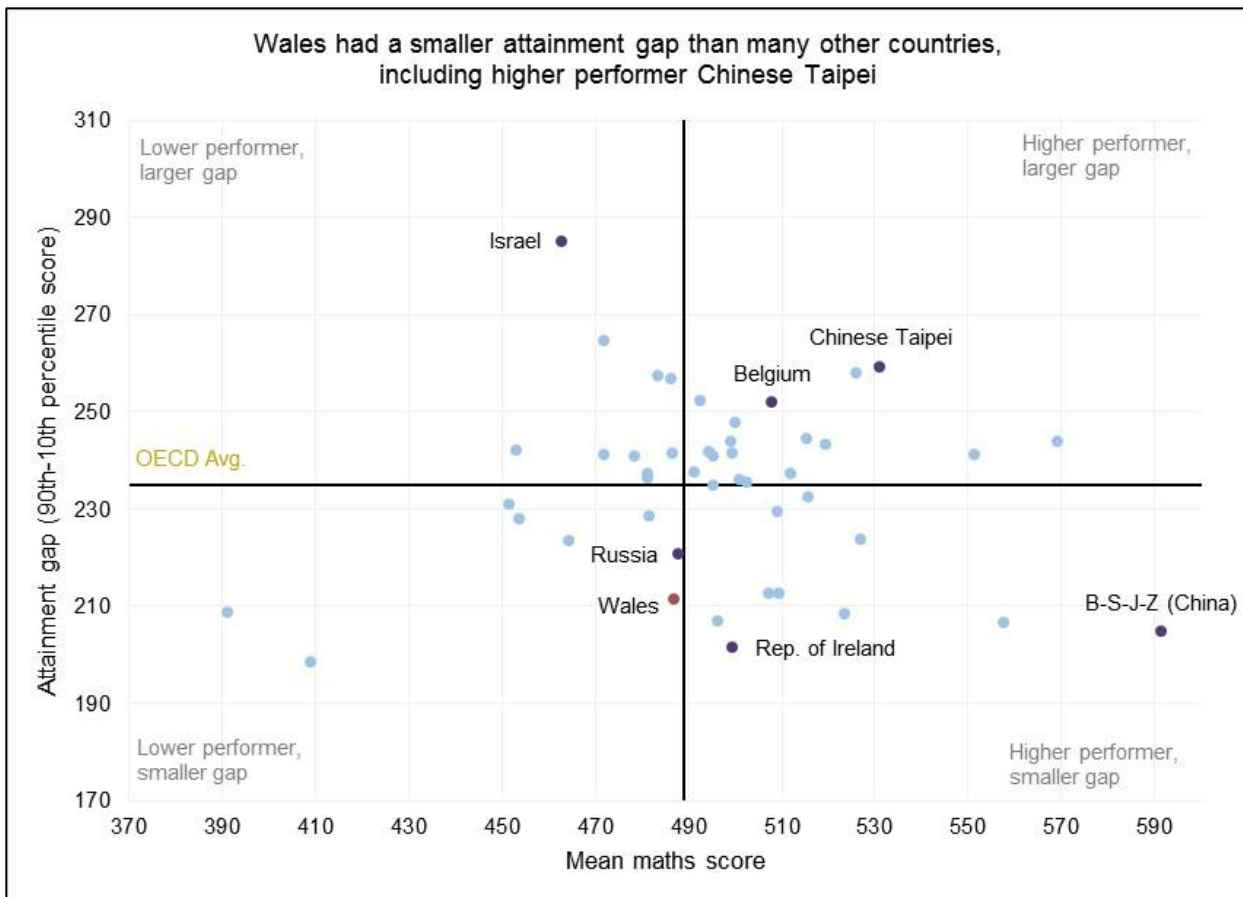
Note: This scatterplot contains all countries either in the OECD or with a mean score above 450

Source: PISA 2018 database

To further consider Wales' attainment gap and its relationship with overall performance, scores for pupils at the 10th and 90th percentiles can be compared with those of other countries. Figure 5.5 shows countries with similar scores to Wales at either the 10th or 90th percentile. In Belgium, pupils achieved a mean score of 508 which was significantly higher than in Wales. At the 10th percentile, pupils in Belgium and Wales scored similarly but Belgium had a much larger attainment gap with pupils at the 90th percentile scoring 36 points higher than those in Wales, driving their higher overall mean score. In comparison, pupils in the Republic of Ireland had similar scores to Wales at the 90th percentile but higher scores at the 10th percentile, meaning their attainment gap was smaller. As a result, the Republic of Ireland's mean score is significantly higher than Wales'.

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These comparisons serve to illustrate the potential trade-offs to be made between policy that seeks to improve average performance by targeting low performers (which would give Wales a profile more like the Republic of Ireland) or higher performers (which would give Wales a profile more like Belgium). As discussed earlier, Wales' average score has come back in line with that of the Russian Federation having been similar in 2009 and then falling significantly below in 2012 and 2015. This chart illustrates that, although their mean scores are now very similar, the profile of performance at the 10th and 90th percentiles differs, with the gap being larger in the Russian Federation.

Figure 5.5   Attainment gap in countries with similar performance to Wales at either the 10th or 90th percentiles
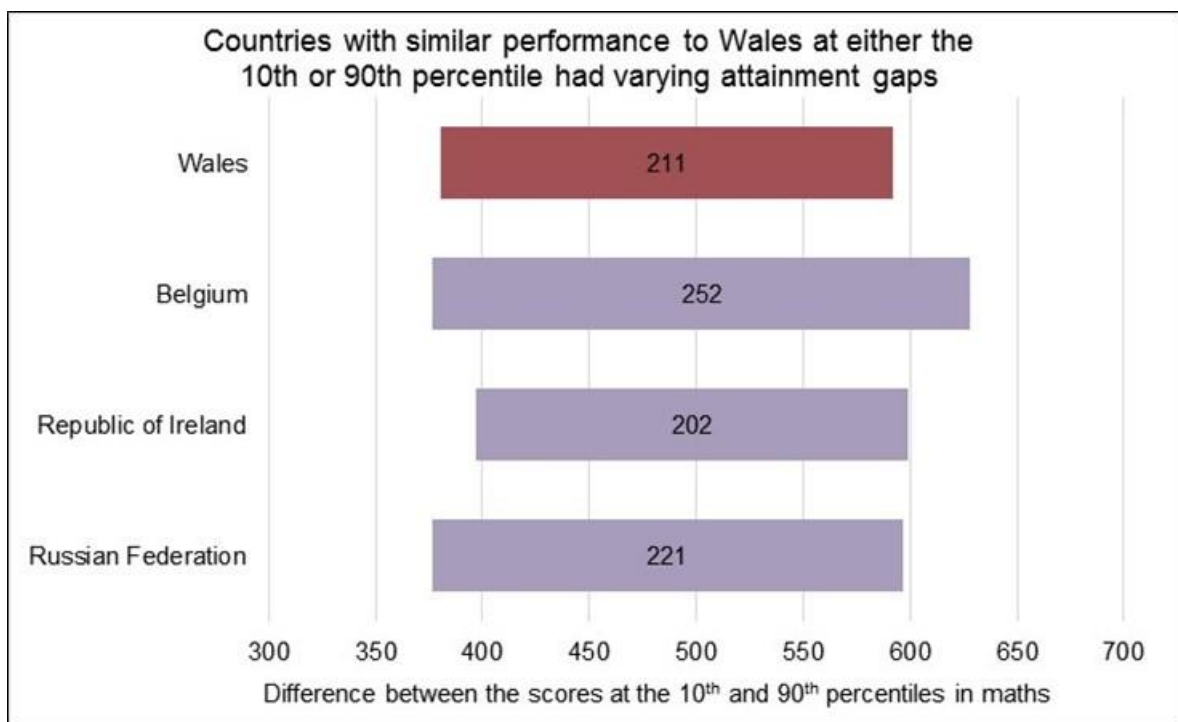
Source: PISA 2018 database

5.3.2 Performance across PISA proficiency levels

Proficiency levels for mathematics

The second way of examining the spread of attainment is by looking at Wales' performance at each of the PISA proficiency levels. The PISA proficiency levels for mathematics are devised by the PISA Consortium. There are 6 levels of achievement which describe the abilities of pupils performing at each of these levels. These performance levels are outlined in Appendix A3 along with the cumulative percentages at each level for the OECD average and for Wales.

Pupils who score below Level 2 are considered low performers in mathematics and those that perform at Level 5 or above are considered top performers (OECD, 2019b).

Figure 5.6 shows that, compared with the OECD average, Wales had a lower proportion of pupils working at both the highest proficiency levels (Levels 5 and 6) and at the lowest proficiency levels (below Level 2).

Figure 5.6   Mathematics proficiency levels in Wales and the OECD

The proportion of pupils reaching each mathematics proficiency level in Wales was similar to the OECD average but slightly lower at each end of the scale

	Below L1	L1	L2	L3	L4	L5	L6
Wales	6%	15%	26%	28%	18%	6%	1%
OECD Avg.	9%	15%	22%	24%	19%	9%	2%
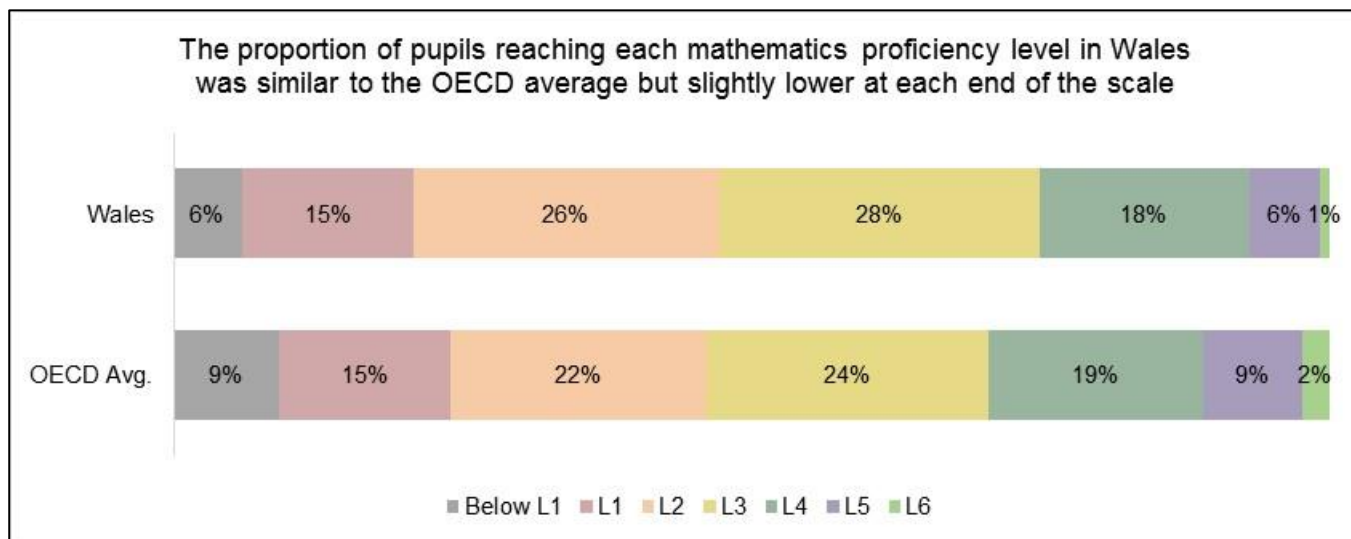
Note: All percentages are rounded.

Source: PISA 2018 database

Since 2015, the proportion of pupils in Wales working at the highest proficiency levels has increased significantly, by 2%. Those working at the lowest proficiency levels has decreased slightly, but not significantly. This shows a general upward trend in performance.

5.4   Differences between boys and girls

In Wales, boys performed marginally better than girl in mathematics but this difference was not statistically significant. Boys achieved a mean score of 488 while girls achieved a mean score of 486.

Figure 5.7 shows that, for the OECD average, there was a significant difference of 5 score points favouring boys. However, the difference between the gender gap for Wales and that for the OECD average was not statistically significant.

Figure 5.7   Gender differences in maths scores in Wales and the OECD

	Overall maths score	Mean score girls	Mean score boys	Difference girls - boys
Wales	487	486	488	-2
OECD Avg.	489	487	492	-5*

*The difference is statistically significant
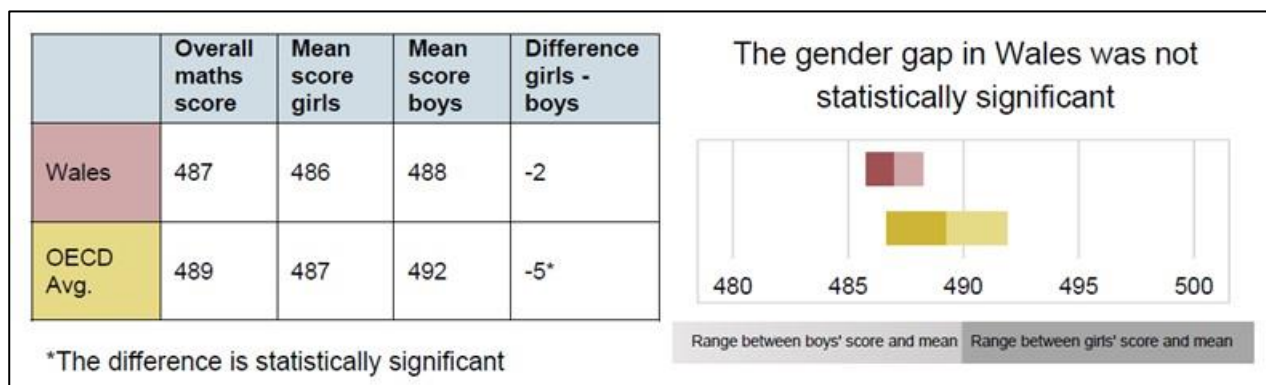
Source: PISA 2018 database

The gender gap results in Wales show a marked improvement in girls' performance. In 2015, Wales had a statistically significant gender gap of 10 score points, favouring boys (Jerrim *et al.,* 2016). In 2018, girls scored significantly higher than in 2015, by 13 score points, and although boys' scores did improve slightly (by 5 score points) this change was not statistically significant. The result of the faster rate of improvement in girls' scores is that there is no longer a significant gender gap in 2018.

In most countries, boys scored higher than girls in mathematics and this difference was statistically significant in 31 countries. In a smaller number of countries, girls performed better than boys and this difference was significant in 13 countries. The difference in performance between girls and boys can be seen in Figure 5.8.

The largest significant gender difference in favour of boys was found in Colombia, which had a difference of 20 score points. The top-performing country of B-S-J-Z (China) also had a significant gender difference in favour of boys, of 11 score points. However, the other 4 of the top 5 performing countries did not have significant gender differences.

Qatar had the largest significant gender difference in favour of girls, with a difference of 24 score points. This was a larger difference than in all countries where boys performed significantly better. (N.B. Qatar is not shown on Figure 5.8 as its mean score was below 450.) Finland was the highest scoring country that had a gender difference that significantly favoured girls, with a difference of 6 score points.

Key point

Due to girls' faster rate of improvement, boys in Wales no longer significantly outperformed girls in mathematics.

Figure 5.8   Gender differences in mathematics scores across PISA 2018 countries
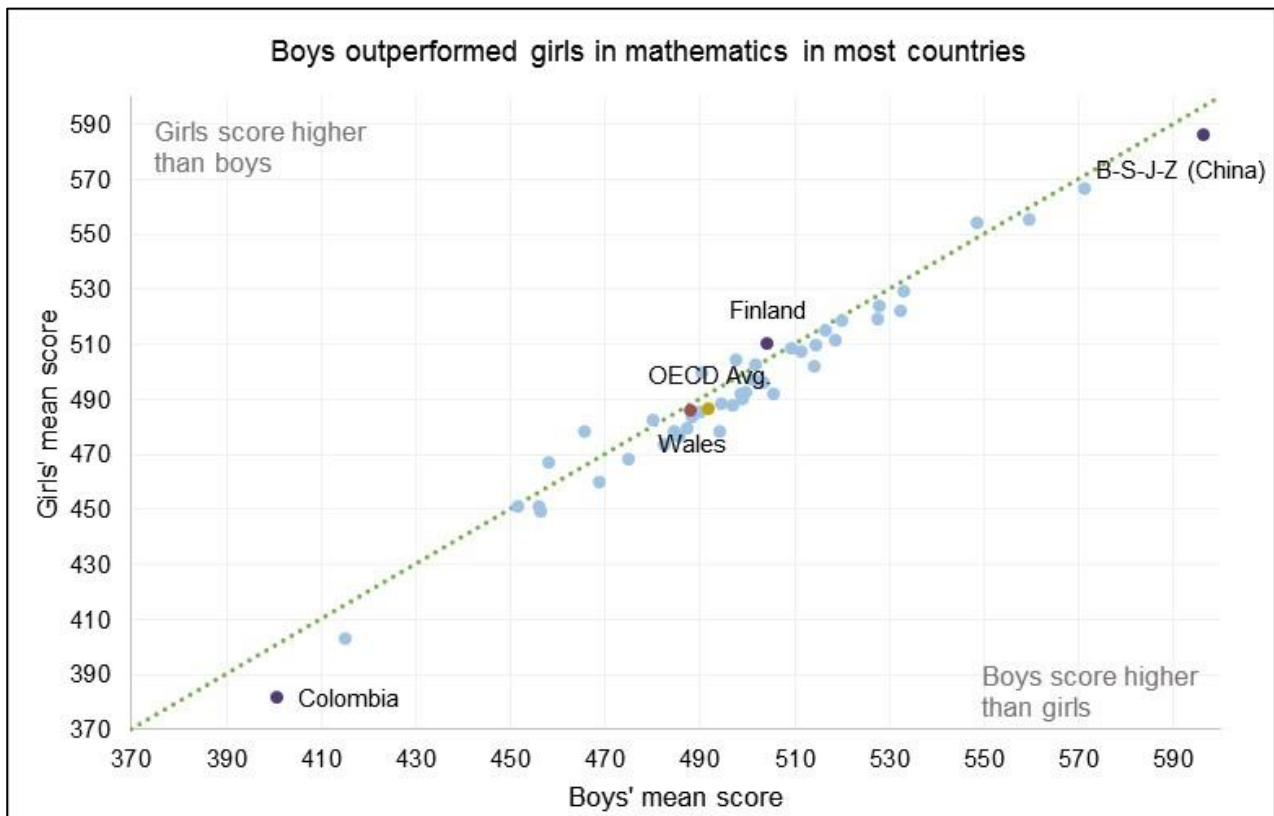
Note: This scatterplot contains all countries either in the OECD or with a mean score above 450

Comparisons between the four constituent countries of the UK are provided in Chapter 7.

6 Schools

Chapter outline

This chapter draws on responses to the school and pupil questionnaires to describe aspects of ability grouping, assessment practices, parental engagement, school climate and school resources.

Key findings

Variation in reading performance

- In Wales, there was less variation in reading scores *between* schools but more variation *within* schools compared with the OECD averages.

Grouping by ability

- Most participating headteachers in Wales reported that their school grouped pupils by ability *into different classes* for some subjects and grouped pupils by ability *within classes* for some subjects. Across the OECD, it was more common for schools not to group pupils by ability for any subject than it was in Wales.

Use of assessments

- Assessments of pupils in Years 10 and 11 were used by almost all schools in Wales for informing parents, guiding learning, adapting teaching, identifying areas of instruction to be improved, and monitoring school progress. Across the OECD on average, assessments of pupils were generally less commonly used to inform decisions in schools than in Wales. In particular, they were much less commonly used for the purposes of comparing schools locally or nationally, for judging teachers' effectiveness, or for grouping pupils.
- Achievement data was also considered more important as a measure of accountability to schools in Wales than the OECD on average.

Pupils' behaviour at school

- Hindrances to learning caused by the behaviour of pupils or teachers were less commonly reported in Wales than in the OECD on average. The most commonly reported cause of hindrance to pupils' learning in Wales and the OECD was pupils not paying attention.
- Pupils in Wales reported a similar level of experience of bullying to the average across the OECD, but they expressed a higher degree of disapproval of bullying behaviours. The most commonly reported bullying behaviour (being made fun of

by other pupils) was reported to have happened to just over a fifth of pupils in Wales (21%) at least monthly over the past year. The proportion on average across the OECD was lower, at 14%.

- Pupils in Wales reported that their fellow pupils were slightly more competitive than cooperative. The reverse was the case for the OECD average. Pupils in Wales expressed a higher degree of competition among pupils than those across the OECD on average. The level of cooperation reported by pupils in Wales was closer to (though still slightly lower than) the level reported across the OECD on average.

Schools' resources

- Schools in Wales, on average, reported a greater availability of ICT resources than schools across the OECD.
- Generally, headteachers in Wales reported that their schools were less well prepared to enhance learning and teaching using digital devices than headteachers across the OECD. Headteachers in Wales reported, for example, insufficient numbers of computers (despite their greater availability) or a lack of skills among teachers to use digital devices in lessons.
- Headteachers in Wales were more likely than those in other OECD countries to report that teaching was hindered by insufficiencies of school equipment, but less likely to report insufficient numbers of teaching or support staff.

Extra-curricular activities

More schools in Wales provided extra-curricular activities for pupils in the PISA age group than schools across the OECD on average.

6.1 Variation in scores within and between schools

The measure of variation in reading scores achieved by pupils can be considered in 2 ways: the amount of variation between pupils who attend the same school (within-school variation) and the amount of variation between pupils grouped by the school they attend (between-school variation). Small between-school variations indicate that there is little difference in reading achievement between the groups of pupils at different schools, which would typically be characteristic of a comprehensive education system. Large between-school variations would be expected in a selective system in which pupils are admitted on the basis of aptitude for a particular course of education.

The International report for PISA 2018 (OECD, 2019c) provides information about the total variation in reading performance across OECD countries. Based on this measure, it also gives the variation in reading performance for each participating country overall, and

for within- and between-school variation. This is described as a percentage of the average total variation in performance across OECD countries[40] (rather than as a percentage of each individual country's total variation).

Across the OECD, 29% of the average variation in reading performance was observed between schools. The remaining 71% of the variation was due to within-school differences. In Wales, the amount of between-school variation was lower at 14% of the OECD total, but higher within schools at 82% of the OECD total[41]. This indicates that reading achievement varied less from school to school in Wales than across the OECD on average.

C omparison with the OECD average

This chapter reports on the responses of principals to the school questionnaire and pupils to the pupil questionnaire. These are compared to the average responses from principals or pupils from across the OECD.

In the remainder of this chapter, we do not report whether differences are statistically significant because, due to the sample sizes, small differences can be statistically significant. Instead, we report on the size of differences. Throughout the chapter, differences of 3 percentage points or less are described as similar.

6.2   School management and policies

6.2.1 School admissions

Headteachers were asked which factors were taken into consideration when admitting pupils to their schools. The factors shown in Table 6.1 may be used as the basis for school admissions or for other purposes in preparation for pupils' first year in secondary education. Schools in Wales and in countries across the OECD were most likely to take into consideration pupils' place of residence; nearly a half of the headteachers in Wales (49%) said they always did this, as did just over two-fifths of headteachers across the

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[40] The 2018 OECD average reported in this chapter is based upon the 'AV37' results published in the OECD International results.
[41] For each participating country, the OECD reported the variation in reading performance as a percentage of the total variation in performance across OECD countries. As a result, a country's within- and between-school variation will not typically sum to 100%, reflecting the fact that its total variation will typically be higher or lower than the OECD average. For Wales, the total variation in reading performance was 97% when rounded to the nearest percentage: 14% between-school variation and 82% within-school variation. The sum of the between-school and within-school variation for the OECD does equal 100%.

OECD (41%). A third of headteachers (33%) across the OECD reported that they always considered pupils' records of academic performance (or entrance tests) when admitting pupils to their schools. In Wales, 10% of headteachers reported these were always taken into consideration. Other factors were less commonly considered than place of residence in Wales, with the second most popular factor (selected by 14% of headteachers) being the parents' endorsement of the instructional or religious philosophy of the school. This aligns with the criteria applied for the admission of pupils to faith-based schools in Wales. The OECD average for this factor was similar to that for Wales (16%).

Table 6.1   School admissions, reported by headteachers

How often are the following factors considered when students are admitted to your school?

	Always		
	Wales	**OECD average**	**Percentage point difference Wales-OECD[42]**
Residence in a particular area	49%	41%	9
Parents' endorsement of the instructional or religious philosophy of the school	14%	16%	-2
Recommendation of feeder schools	13%	14%	0
Preference given to family members of current or former students	12%	20%	-8
Student's record of academic performance (including 11-plus and entrance exams)	10%	33%	-22
Whether the student requires or is interested in a special programme	4%	22%	-18
Other	16%	11%	6

Source: PISA 2018 database; School Questionnaire, question SC012

6.2.2 Grouping policies

Headteachers were asked how common it was for pupils to be grouped by ability *into different classes* or *within classes* at their school. As shown in Table 6.2, in Wales,

[42] The sum of the difference and the OECD average may not equal the percentage for Wales due to rounding.

grouping *into different classes* for some subjects was more common than grouping for all subjects or not grouping for any subject. Nearly all of the participating headteachers in Wales (97%) reported that their schools grouped pupils by ability *into different classes* for some subjects (i.e. streaming). Grouping by ability into different classes for some subjects was less common across the OECD on average than it was in Wales, with just under half of headteachers (46%) in the OECD reporting that this was the case in their schools. Among the highest-performing countries, it was more common than in Wales for headteachers to report grouping into different classes for all subjects (e.g. Macao (China) 8%, Wales 3%) or not grouping in to different classes for any subject (e.g. Macao (China) 48%, Wales 0%).

Grouping *within classes* for some subjects was more common in Wales than grouping within classes for all subjects or not grouping for any subject. Just over three-quarters of headteachers (76%) in Wales reported that pupils were grouped by ability *within classes* for some subjects. This was more common than the OECD, where, on average, just over half (51%) of headteachers reporting grouping by ability within classes for some subjects. When compared with Wales, the highest-performing countries were more likely to group within classes for all subjects (e.g. Singapore 9%, Wales 2%), and less likely to group within classes for some subjects (e.g. Singapore 70%, Wales 76%). There was a more mixed picture among the highest-performing countries when considering how many schools did not group pupils within classes by ability; some countries reported this more frequently than Wales (22%) (e.g. Korea 42%) and others less frequently (e.g. Singapore 21%).

Table 6.2   Grouping of pupils by ability, reported by headteachers

Some schools organise instruction differently for students with different abilities. What is your school's policy about this for students in Years 10 and 11?

	For all subjects		For some subjects		Not for any subjects	
	Wales	OECD average	Wales	OECD average	Wales	OECD average
Students are grouped by ability into different classes.	3%	9%	97%	46%	0%	45%
Students are grouped by ability within their classes.	2%	6%	76%	51%	22%	43%

Source: PISA 2018 database; School Questionnaire, question SC042

6.2.3 Equity-oriented policies

In the UK, pupils defined by PISA as those whose 'heritage language' is not English are those who learnt a language at home as a mother tongue before learning English, or alongside English. In Welsh-medium schools, Welsh, rather than English, was the language referred to in the question. As shown in Table 6.3, four-fifths of headteachers in Wales (80%) indicated that pupils with a heritage language other than English (or Welsh) attended mainstream classes and received additional periods of instruction aimed at developing their language skills. This was the most common provision for such pupils, both in Wales and on average across the OECD (where the proportion of headteachers reporting this practice was 58%). The second most common provision in schools in Wales (selected by 63% of headteachers) was for classroom assistants to provide support to pupils in mainstream classes.

Table 6.3   Pupils with English (or Welsh) as an additional language

Does your school offer any of the following options to students whose heritage language is not English (or Welsh in Welsh-medium schools)? Please answer for students in Years 10 and 11. *('Heritage language' is a language learnt at home that a student acquired as a mother tongue before learning English (or Welsh), or alongside English (or Welsh).)*

	Yes		
	Wales	**OECD average**	**Percentage point difference Wales-OECD**
These students attend mainstream classes and receive additional periods of instruction aimed at developing their language skills (e.g. reading literacy, grammar, vocabulary, communication) in English (or Welsh in Welsh-medium schools).	80%	58%	22
These students are given support by classroom assistants in mainstream classes.	63%	n/a[43]	
Before transferring to mainstream classes, these students attend a preparatory programme aimed at developing their language skills (e.g. reading literacy, grammar, vocabulary, communication) in English (or Welsh in Welsh-medium schools).	34%	25%	9
Before transferring to mainstream classes, these students receive some instruction in school subjects in their heritage language.	16%	9%	7
Class size is reduced to cater to the special needs of these students.	11%	17%	-6
These students receive significant amounts of instruction in their heritage language aimed at developing proficiency in both languages.	9%	7%	2

Source: PISA 2018 database; School Questionnaire, question SC150

[43] No OECD average is available as this option was only included in the school questionnaire used in the UK.

6.2.4 Assessment and accountability

Headteachers were asked about the purposes of assessments taken by pupils in Years 10 and 11; the results are shown in Table 6.4. In Wales, for 5 purposes, 98% or more of schools used Year 10 and 11 assessments: guiding learning, informing parents, adapting teaching, identifying areas of instruction to be improved, and monitoring school progress. These were the same 5 most common purposes across the OECD countries, but the proportions of schools using them across the OECD on average were lower than in Wales (between 78% and 95%). For all but one of the possible options given, at least four-fifths of schools in Wales (83% or more) used pupil assessments for this reason. The exception was using assessments to make decisions about pupils' retention or promotion, which 62% of headteachers in Wales said they did compared with just under three-quarters (72%) of headteachers across the OECD on average.

Table 6.4   Use of school assessments, reported by headteachers

In your school, are assessments of students in Years 10 and 11 used for any of the following purposes?

	Yes		
	Wales	**OECD average**	**Percentage point difference Wales-OECD**[44]
To guide students' learning	100%	91%	9
To inform parents about their child's progress	100%	95%	5
To adapt teaching to the students' needs	100%	87%	13
To identify aspects of instruction or the curriculum that could be improved	99%	78%	20
To monitor the school's progress from year to year	98%	78%	20
To group students for instructional purposes	94%	49%	44
To compare the school to local or national performance	90%	57%	32
To compare the school with other schools	86%	46%	40
To award certificates to students	84%	69%	14
To make judgements about teachers' effectiveness	83%	44%	40
To make decisions about students' retention or promotion	62%	72%	-11

Source: PISA 2018 database; School Questionnaire, question SC154

Headteachers were also asked how achievement data was used for accountability purposes in their school. As shown in Table 6.5, the biggest difference between Wales and the average across schools in the OECD in terms of the use of achievement data, was the public posting of this data: nearly four-fifths of headteachers in Wales (79%) said that this was done, compared with just under two-fifths of headteachers in the OECD (38%). Of the headteachers in Wales, 95% said that achievement data was provided

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[44] The sum of the difference and the OECD average may not equal the percentage for England due to rounding.

directly to parents; the OECD average was lower at 83%, and 96% of headteachers in Wales also said that achievement data was tracked over time by an administrative authority; again, the OECD average was lower at 67%.

Table 6.5   Uses of achievement data, reported by headteachers

In your school, is achievement data used in any of the following accountability procedures?

Achievement data includes aggregated school or year-group test scores or grades, or rates of school completion.

	Yes		
	Wales	**OECD average**	**Percentage point difference Wales-OECD[45]**
Achievement data is tracked over time by an administrative authority.	96%	67%	28
Achievement data is provided directly to parents.	95%	83%	13
Achievement data is posted publicly (e.g. in the media).	79%	38%	41

Source: PISA 2018 database; School Questionnaire, question SC036

6.3 School climate

6.3.1 Teacher and pupil behaviour affecting school climate

Headteachers were asked to indicate the extent to which learning was hindered by the behaviour of pupils and the behaviour of teachers. The findings are shown in Table 6.6.

In Wales, headteachers were generally less likely than headteachers on average across the OECD countries to report that the issues listed in this question hindered pupils' learning to some extent or a lot. For both Wales and the OECD, the main cause of hindrance to pupils' learning was reported to be pupils not paying attention; nearly three-fifths of headteachers reported this across the OECD (59%) compared with three-tenths

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[45] The sum of the difference and the OECD average may not equal the percentage for Wales due to rounding.

in Wales (30%). Pupil truancy was the second most common cause, reported by a fifth of headteachers in Wales (20%) compared with just under two-fifths across the OECD (38%). Of the causes of hindrance relating to staff behaviour rather than pupil behaviour, the most common cause in Wales, reported by 15% of headteachers, was teachers not meeting individual pupils' needs. The OECD average was twice as large, at 30%. Staff resisting change was reported by a similar proportion of headteachers across the OECD (29%) as a cause of hindrance to learning to some extent or a lot. This compared to 12% in Wales.

Table 6.6 Pupil and teacher behaviour for learning, reported by headteachers

In your school, to what extent is the learning of students hindered by the following?

	To some extent / a lot		
	Wales	**OECD average**	**Percentage point difference Wales-OECD[46]**
Pupil behaviours			
Students not paying attention	30%	59%	-29
Student truancy	20%	38%	-18
Students lacking respect for teachers	19%	22%	-3
Students skipping classes	14%	34%	-21
Student use of alcohol or illegal drugs	7%	10%	-3
Students intimidating or bullying other students	6%	12%	-6
Teacher behaviours			
Teachers not meeting individual students' needs	15%	30%	-15
Teacher absenteeism	14%	18%	-4
Staff resisting change	12%	29%	-17
Teachers not being well prepared for classes	9%	13%	-4
Teachers being too strict with students	7%	12%	-6

Source: PISA 2018 database; School Questionnaire, question SC061

[46] The sum of the difference and the OECD average may not equal the percentage for Wales due to rounding.

Key point

Headteachers in Wales reported fewer hindrances to teaching caused by either pupil behaviour or teacher behaviour than headteachers across the OECD on average..

6.3.2 Parental engagement

Headteachers were asked about the proportion of pupils' parents that had participated in school-related activities in the previous academic year. The results are shown in Table 6.7. On average, just under two-thirds of parents in Wales (64%) were reported by headteachers to have discussed their child's progress with a teacher on the initiative of the teacher during the last academic year. Across the OECD, the mean percentage of parents was 7 percentage points lower at 57%. Two-fifths of parents in Wales (40%) were reported to have discussed their child's progress on their own initiative, which was similar to the OECD average (41%). On average, parents in Wales were less likely than parents across the OECD countries to participate in school governance, or to volunteer to help with physical or extra-curricular activities at school. The OECD average for participation in school governance was 17% of parents, compared with 3% in Wales.

Table 6.7   Parental engagement, reported by headteachers

During the last academic year, what proportion of students' parents (or guardians) have participated in the following school-related activities?

	Mean percentage		
	Wales	**OECD average**	**Percentage point difference Wales-OECD**
Discussed their child's progress on the initiative of one of their child's teachers	64%	57%	7
Discussed their child's progress with a teacher on their own initiative	40%	41%	-1
Volunteered in physical or extra-curricular activities (e.g. building maintenance, carpentry, gardening, school play, sports, field trip)	5%	12%	-7
Participated in local school governance, e.g. as a parent governor	3%	17%	-14

Source: PISA 2018 database; School Questionnaire, question SC064

6.3.3 Extra-curricular activities

Headteachers were asked to indicate which of a series of extra-curricular activities were available to pupils in Years 10 and 11. Generally, schools in Wales were more likely than schools across the OECD on average to offer the extra-curricular activities listed in Table 6.8.

More than 95% of headteachers in Wales reported that their schools offered sports activities, volunteering, art clubs and musical groups as extra-curricular activities. These were also common activities across the OECD, but less common, with between 63% and 91% of schools offering them. Two activities less common in Wales than in the OECD countries were collaboration with local libraries (Wales 29%, OECD 49%) and collaboration with local newspapers (Wales 23%, OECD 27%).

Table 6.8   Extra-curricular activities, reported by headteachers

This academic year, which of the following activities does your school offer to students in Years 10 and 11?

	Yes		
	Wales	**OECD average**	**Percentage point difference Wales-OECD[47]**
Sports teams or sports activities	100%	91%	9
Volunteering or service activities, e.g. a local community volunteering programme, Duke of Edinburgh's Award	98%	74%	24
Art club or art activities	97%	66%	31
Band, orchestra, instrumental group or choir	96%	63%	33
School play or school musical	89%	60%	30
Lectures and/or seminars (e.g. guest speakers such as writers or journalists)	84%	74%	10
School clubs or school competitions for foreign languages	71%	n/a[48]	
Debating club or debating activities	71%	40%	31
School yearbook, newspaper or magazine	68%	50%	18
Book club	56%	37%	18
Collaboration with local libraries	29%	49%	-21
Collaboration with local newspapers	23%	27%	-4

Source: PISA 2018 database; School Questionnaire, question SC053

[47] The sum of the difference and the OECD average may not equal the percentage for Wales due to rounding.
[48] No OECD average is available because each country selected its own final option for this question. Consequently, this option was only included in the school questionnaire used in the UK.

6.3.4 Disciplinary climate

In the student questionnaire, pupils were asked to indicate how often 5 disruptive events occurred in their English lessons (or Welsh lessons in Welsh-medium schools). As shown in Table 6.9, there was little difference between the responses of pupils in Wales and pupils in the OECD countries. All of the disruptive events were reported to occur by at least 16% of pupils in Wales in all or most lessons of English (or Welsh). The most commonly disruptive event reported by pupils, happening in most or every lesson, was noise and disorder. This was reported by over a third of pupils in Wales (36%), which was 5 percentage points higher than the OECD average (31%).

Table 6.9   Disruption in English (or Welsh) lessons, reported by pupils

How often do these things happen in your English lessons?

	Most lessons / every lesson		
	Wales	**OECD average**	**Percentage point difference Wales-OECD[49]**
There is noise and disorder.	36%	31%	5
Students don't listen to what the teacher says.	32%	29%	3
The teacher has to wait a long time for students to settle down.	28%	26%	2
Students don't start working for a long time after the lesson begins.	21%	24%	-3
Students cannot work well.	16%	19%	-2

Source: PISA 2018 database; Student Questionnaire, question ST097

6.3.5 Bullying

Pupils were asked how often they had experienced a series of bullying behaviours in the previous 12 months at school. The results are shown in Table 6.10.

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[49] The sum of the difference and the OECD average may not equal the percentage for Wales due to rounding.

On average, across OECD countries, 23% of pupils reported being bullied at least a few times a month. In Wales, the percentage was slightly greater, at 28% (OECD, 2019d). Of the 6 bullying behaviours listed in this question, at least 6% of pupils in Wales reported that they had experienced them a few times a month or once or more a week over the previous 12 months.

Generally, the rates of incidence of bullying reported by pupils in Wales were similar to those reported on average across the OECD. The biggest difference was seen for the behaviour that was the most commonly reported in both Wales and the OECD: *Other students made fun of me.* Just over a fifth of pupils in Wales (21%) reported that this had occurred a few times a month or once or more a week at school over the previous 12 months; the proportion on average across the OECD was lower, at 14%.

Pupils were also asked about their attitude towards bullying. Table 6.11 shows that pupils in Wales and across the OECD on average expressed a high degree of disapproval of bullying behaviours. Around 9 out of 10 pupils in Wales agreed or strongly agreed with the 5 statements about bullying. In each case, the percentage was around 5 percentage points greater than the proportion for the OECD average.

An index of exposure to bullying was constructed by the OECD from pupils' responses to the statements in this question. Pupils were classified as being *frequently bullied* if they were among the 10% of pupils with the highest values on the index across all PISA countries. On average, across OECD countries, 8% of pupils were classified as being frequently bullied. In Wales, the proportion was similar, at 11% (OECD, 2019c).

Table 6.10   Experience of bullying, reported by pupils

During the past 12 months, how often have you had the following experiences at school?
(Some experiences can also happen electronically, e.g. on social media.)

	A few times a month / once a week or more		
	Wales	**OECD average**	**Percentage point difference Wales-OECD**
Other students made fun of me.	21%	14%	7
Other students spread nasty rumours about me.	11%	10%	1
Other students left me out of things on purpose.	11%	9%	2
I was threatened by other students.	8%	6%	2
I got hit or pushed around by other students.	8%	7%	1
Other students took away or destroyed things that belonged to me.	6%	7%	-1

Source: PISA 2018 database; Student Questionnaire, question ST038

Table 6.11   Attitude towards bullying, reported by pupils

To what extent do you agree with the following statements?

	Agree / strongly agree		
	Wales	**OECD average**	**Percentage point difference Wales-OECD[50]**
I like it when someone stands up for other students who are being bullied.	94%	90%	4
It is wrong to take part in bullying.	93%	88%	5
I feel bad when I see other students being bullied.	92%	87%	6
It is a good thing to help students who can't defend themselves.	92%	88%	4
It irritates me when nobody defends students who are being bullied.	88%	81%	7

Source: PISA 2018 database; Student Questionnaire, question ST207

Key point

Pupils in Wales reported a similar level of experience of bullying at school in the previous 12 months to that reported by pupils across the OECD on average.

6.3.6 Competitiveness and cooperation

Pupils were asked 2 similarly worded questions, either about competition between, or cooperation among, the pupils at their school. The results are shown in Tables 6.12 and 6.13.

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[50] The sum of the difference and the OECD average may not equal the percentage for Wales due to rounding.

Across the OECD countries, pupils indicated that the statements about cooperation between pupils better reflected the behaviour and attitudes of pupils in their schools than the statements about competition. For example, 62% of pupils across the OECD indicated that it was true that *It seems that students cooperate with each other*, compared with 50% for the statement *It seems that students compete with each other*. In Wales, there was less of a difference between pupils' responses to the statements about competition and cooperation. The exception was the statement that was supported by the highest proportion of pupils in Wales as being true for their school, which was *Students feel that they are being compared with others*. Just over two-thirds of pupils in Wales (67%) reported this was true. For the similar statement about cooperation, *Students feel that they are encouraged to cooperate with others*, the percentage of pupils in Wales who felt this was true was 57%.

Generally, pupils in Wales were more likely to feel that the statements about competition were very true or extremely true for their schools than pupils on average across the OECD. For example, 54% of pupils in Wales felt it was true that *Students seem to value competition*, compared with 48% across the OECD. For the statements about cooperation, pupils in Wales were slightly less likely to feel that they were true of pupils at their school than pupils across the OECD on average. For example, 52% of pupils in Wales felt it was true that *Students seem to value cooperation*, compared with 57% across the OECD.

Table 6.12   Competition amongst pupils, reported by pupils

Thinking about your school, how true are the following statements?

	Very true / extremely true		
	Wales	**OECD average**	**Percentage point difference Wales-OECD[51]**
Students seem to value competition.	54%	48%	5
It seems that students compete with each other.	63%	50%	13
Students seem to share the feeling that competing with each other is important.	53%	44%	9
Students feel that they are being compared with others.	67%	55%	13

Source: PISA 2018 database; Student Questionnaire, question ST205

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[51] The sum of the difference and the OECD average may not equal the percentage for Wales due to rounding.

Table 6.13   Cooperation between pupils, reported by pupils

Thinking about your school, how true are the following statements?

	Very true / extremely true		
	Wales	**OECD average**	**Percentage point difference Wales-OECD[52]**
Students seem to value cooperation.	52%	57%	-5
It seems that students cooperate with each other.	60%	62%	-2
Students seem to share the feeling that cooperating with each other is important.	54%	60%	-5
Students feel that they are encouraged to cooperate with others.	57%	60%	-3

Source: PISA 2018 database; Student Questionnaire, question ST206

Key point

Pupils in Wales reported a greater level of competition between pupils at their school than the OECD average. The level of cooperation among pupils reported by pupils in Wales was similar to both (a) the level of cooperation reported by pupils across the OECD on average, and (b) the level of competition between pupils reported by pupils in Wales.

6.4 Resources

6.4.1 ICT

Headteachers were asked about the number of pupils and ICT resources available in their schools. On average, schools in Wales participating in PISA had more pupils in the

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[52] The sum of the difference and the OECD average may not equal the percentage for Wales due to rounding.

PISA-age grade[53] than the OECD average, with an average of 173 Year 11 pupils per school compared with 157 for the OECD average.

Schools in Wales, on average, reported a greater availability of ICT resources than schools across the OECD, as shown in Table 6.14. For example, for every group of 30 Year 11 pupils in Wales, there were on average 52 computers available for them to use at school for educational purposes. In contrast, across the OECD countries there were insufficient computers available for each pupil in the PISA-age grade to have access to one at the same time: for every 30 pupils, there were on average 21 computers available. A similar picture was found for the number of computers with internet connection available for teachers; there were 18 such computers available for each group of 10 full-time or part-time teachers at schools in Wales on average. This compares with 8 computers with internet connection for each group of 10 teachers at schools across the OECD on average.

Nearly all computers in school that were available to pupils to use for educational purposes had internet access; on average, only 2% in Wales and 2% across the OECD were not connected to the internet. Nearly two-fifths of the computers in Wales (38%) were laptop or tablet computers. Across the OECD, this average was greater at just under half (49%). These figures indicate that schools in Wales were better resourced with ICT equipment than schools on average across the OECD.

However, in terms of being prepared to enhance learning and teaching using digital devices, schools across the OECD reported that they were better prepared on average than schools in Wales. This was shown by the responses to a related but separate question, in which headteachers were asked the extent to which they agreed with a series of statements about their school's capacity to enhance learning using digital devices. The results are shown in Table 6.15.

With respect to equipment, around two-thirds of headteachers across the OECD agreed or strongly agreed that they had sufficient digital devices connected to the internet, that the internet bandwidth or speed was sufficient, and that devices were sufficiently powerful (67%, 68%, 68% respectively). For each of these, the proportion of headteachers in Wales agreeing or strongly agreeing was lower at around a half (50%, 49% and 47% respectively). Schools in Wales were also less likely than the OECD average to report that the number of digital devices for teaching was sufficient (45% compared with 59%). When considered alongside the findings discussed above, this may

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[53] The PISA-age grade is the modal grade for 15-year-old pupils in each participating country. In Wales, this is Year 11.

indicate that schools in Wales make greater use of ICT for teaching or have greater demand for equipment than schools across the OECD.

The responses of headteachers in Wales to the statements about the availability of resources (e.g. software) were similar to those made by headteachers on average across the OECD.

The final set of statements in this question related to staff. Headteachers in Wales, compared with the OECD average, were more likely to report that they had sufficient qualified technical assistant staff (Wales 63%, OECD 54%). They were, however, less likely to report that teachers had the necessary skills to integrate digital devices into teaching (Wales 60%, OECD 65%), or that teachers had sufficient time to prepare lessons that integrate digital devices (Wales 49%, OECD 61%). Teachers in Wales were also reported to be less likely to be provided with incentives to integrate digital devices in their teaching than teachers across the OECD; 33% of headteachers in Wales agreed or strongly agreed that this was the case, compared with 57% across the OECD on average.

Table 6.14   ICT equipment in school, reported by headteachers

The goal of the following set of questions is to gather information about the student-computer ratio for students in Year 11 at your school.

	Mean number		
	Wales	**OECD average**	**Difference Wales-OECD[54]**
At your school, what is the total number of students in Year 11?	173	157	16
Number of computers available to these pupils for educational purposes, for each group of 30 Year 11 pupils	52	21	31
Number of these computers connected to the internet, for each group of 30 Year 11 pupils	51	20	31
Number of these computers that are portable (e.g. laptop, tablet), for each group of 30 Year 11 pupils	20	10	10
Number of computers with internet connection available for teachers in your school for each group of 10 full-time and part-time teachers[55]	18	8	11

Source: PISA 2018 database; School Questionnaire, question SC004 and SC018

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[54] The sum of the difference and the OECD average may not equal the percentage for Wales due to rounding.

[55] Calculated using the number of teachers reported in Table 6.18 (question SC018)

Table 6.15   Preparedness for using ICT, reported by headteachers

To what extent do you agree with the following statements about your school's capacity to enhance learning and teaching using digital devices? *(Please think of different kinds of digital devices, for example, desktop computers, laptops, tablet computers or interactive whiteboards.)*

	Agree / strongly agree		
	Wales	**OECD average**	**Percentage point difference Wales-OECD[56]**
The availability of adequate software is sufficient.	72%	71%	1
Effective professional resources for teachers to learn how to use digital devices are available.	64%	65%	0
The school has sufficient qualified technical assistant staff.	63%	54%	9
Teachers have the necessary technical and pedagogical skills to integrate digital devices into teaching.	60%	65%	-5
An effective online learning support platform is available.	59%	54%	4
The number of digital devices connected to the internet is sufficient.	50%	67%	-17
The school's internet bandwidth or speed is sufficient.	49%	68%	-18
Teachers have sufficient time to prepare lessons that integrate digital devices.	49%	61%	-12
Digital devices at the school are sufficiently powerful in terms of computing capacity (i.e. they are not too slow or do not crash frequently).	47%	68%	-22

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[56] The sum of the difference and the OECD average may not equal the percentage for Wales due to rounding.

	Agree / strongly agree		
	Wales	**OECD average**	**Percentage point difference Wales-OECD**[56]
The number of digital devices for teaching is sufficient.	45%	59%	-14
Teachers are provided with incentives to integrate digital devices in their teaching.	33%	57%	-24

Source: PISA 2018 database; School Questionnaire, question SC155

Headteachers were asked about the existence of policies and procedures supporting the use of digital devices at their schools. As shown in Table 6.16, more headteachers in Wales reported that their schools had in place such policies and procedures than headteachers on average across the OECD. The biggest differences related to e-safety, with 96% of headteachers in Wales reporting they had a scheme in place to prepare pupils for responsible internet behaviour, and 88% having a specific policy about the use of social networks. This compares to 60% and 52% respectively for the OECD on average.

Table 6.16 ICT policies and procedures, reported by headteachers

Does your school have any of the following?

	Yes		
	Wales	**OECD average**	**Percentage point difference Wales-OECD[57]**
A specific scheme to prepare students for responsible internet behaviour	96%	60%	37
Its own written statement about the use of digital devices	94%	62%	32
A specific policy about using social networks (e.g. Facebook) in teaching and learning	88%	52%	37
Regular discussions with teaching staff about the use of digital devices for pedagogical purposes	79%	63%	16
Its own written statement specifically about the use of digital devices for pedagogical purposes	68%	46%	21
A scheme to use digital devices for teaching and learning in specific subjects	66%	48%	19
A specific scheme to promote collaboration on the use of digital devices among teachers	60%	36%	24
Scheduled time for teachers to meet to share, evaluate or develop teaching materials and approaches that employ digital devices	57%	44%	14

Source: PISA 2018 database; School Questionnaire, question SC156

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[57] The sum of the difference and the OECD average may not equal the percentage for Wales due to rounding.

6.4.2 Problems due to resource shortages

Headteachers were asked about the extent to which teaching was hindered by a number of factors related to staffing or physical resources. The results are shown in Table 6.17.

Generally, headteachers in Wales were more likely than those in schools in the OECD to report insufficiencies of physical resources. The most commonly reported issue in Wales was a lack of educational material, such as textbooks or equipment. This was reported to hinder teaching at least to some extent by 46% of headteachers in Wales; the comparable average proportion across the OECD was 28%. The extent to which staffing shortages hindered teaching was similar in Wales to the OECD average. There was a moderate difference in the level of hindrance due to inadequate or poorly qualified teaching staff, with 15% of headteachers across the OECD reporting that this was the case, compared with 8% in Wales.

Table 6.17   Resource shortages, reported by headteachers

Is your school's capacity to provide teaching hindered by any of the following issues?

	To some extent / a lot		
	Wales	**OECD average**	**Percentage point difference Wales-OECD[58]**
A lack of educational material (e.g. textbooks, IT equipment, library or laboratory material)	46%	28%	17
Inadequate or poor quality educational material (e.g. textbooks, IT equipment, library or laboratory material)	41%	25%	16
Inadequate or poor quality physical infrastructure (e.g. building, grounds, heating/cooling, lighting and acoustic systems)	39%	33%	7
A lack of physical infrastructure (e.g. building, grounds, heating/cooling, lighting and acoustic systems)	38%	33%	5
A lack of support staff	33%	33%	0
A lack of teaching staff	28%	27%	1
Inadequate or poorly qualified support staff	16%	17%	0
Inadequate or poorly qualified teaching staff	8%	15%	-7

Source: PISA 2018 database; School Questionnaire, question SC017

Key point

Headteachers in Wales were more likely than headteachers across the OECD, on average, to report that teaching was hindered by insufficiencies of physical resources. The level of staffing shortages reported in Wales was similar to the OECD average.

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[58] The sum of the difference and the OECD average may not equal the percentage for Wales due to rounding.

6.5   Teachers

6.5.1 Teacher qualifications

Headteachers provided information about the numbers of full- and part-time teachers at their schools and their levels of qualifications; the results are presented in Table 6.18.

The average number of teachers at secondary schools in Wales was similar to the OECD averages, with 56 full-time and 11 part-time teachers on average at schools in Wales. Teachers across the OECD were more likely to have a Master's degree qualification than teachers in Wales, which may reflect system-level differences in requirements for teaching.

Among the schools in Wales participating in PISA, nearly four-fifths of teachers (79%) had attended a programme of professional development in the previous 3 months. This was greater than the OECD average, at 53%. A programme of professional development was defined as: *a formal programme designed to enhance teaching skills or pedagogical practices. It may or may not lead to a recognised qualification. The programme must last for at least one day in total and have a focus on teaching and education.*

Table 6.18   Teacher qualifications, reported by headteachers

How many of the following teachers are on the staff of your school? Include both full-time and part-time teachers. A full-time teacher is employed at least 90% of the time as a teacher for the full school year. All other teachers should be considered part-time.

Regarding the qualification level, please refer only to the teacher's highest qualification level.

| | Mean number[59] | | | |
| | Full-time | | Part-time | |
	Wales	OECD average	Wales	OECD average
Teachers in TOTAL	56	55	11	14
Teachers with Qualified Teacher Status	56	50	11	11
Teachers with a university Bachelor's degree (e.g. BA, BSc, BEd) qualification	54	33	10	7
Teachers with a university Master's degree (e.g. MA, MSc, MBA) qualification	8	24	1	6
Teachers with a doctorate or higher degree (e.g. MPhil, PhD) qualification	1	2	0	0

Source: PISA 2018 database; School Questionnaire, question SC018

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[59] Columns may not sum to the total number of teachers. This tables reports the rounded weighted averages reported by headteachers for each part of the question and is not adjusted for cases in which the response for *Teachers in TOTAL* was exceeded by the responses to the rest of the question.

7 PISA in the UK

Chapter outline

This chapter describes some of the main outcomes of the PISA survey in England, Wales, Northern Ireland and Scotland. In particular, it outlines where there were differences in attainment in reading, science and mathematics, in the range of attainment, in the pattern of gender differences, or in responses to the school and pupil questionnaires.

Key findings

Performance in reading, mathematics and science

- There were no significant differences between mean scores for reading in England, Scotland and Northern Ireland. All 3 countries were significantly above the OECD average. The mean score in Wales was significantly lower than the other countries of the UK but not significantly different from the OECD average.
- In science, the mean score in England was significantly higher than the rest of the UK and was significantly above the OECD average. Northern Ireland, Scotland and Wales had mean scores that did not significantly differ from each other or from the OECD average.
- England's mean score in mathematics was significantly higher than the rest of the UK and was also above the OECD average. Mean scores in Northern Ireland, Scotland and Wales did not differ significantly from each other or from the OECD average.

Gender differences

- In all countries of the UK, girls significantly outperformed boys in reading, as was the case across the OECD. In science, girls significantly outperformed boys in Northern Ireland but there were no significant gender differences in England, Wales or Scotland. In mathematics, boys significantly outperformed girls in England and Scotland but there were no significant differences in Wales or Northern Ireland.

Trends in performance

- All countries of the UK show a stable trend in reading, apart from a significant improvement in Scotland since PISA 2015, which followed a similarly sized decrease between 2012 and 2015.

- In science there has been a decline in performance over successive cycles of PISA in Scotland, Wales and Northern Ireland, all of which had mean scores thatwere significantly lower than those in PISA 2006.
- In mathematics, both England and Wales show an improving trend across successive PISA cycles, while Scotland has declined and Northern Ireland has remained broadly stable.

Schools

- Whilst headteachers and principals in all UK countries agreed some purposes of assessments were to guide pupils' learning and adapt teaching to pupils' needs, more headteachers in Wales and England reported using assessments to make judgements about teacher effectiveness.
- Headteachers in England responded more favourably towards their school's capacity to enhance learning and teaching using digital devices than the other UK nations.
- Headteachers in Scotland were more likely than those in England, Wales and Northern Ireland to report pupil truancy and teacher absenteeism as hindering their capacity to provide teaching.
- Headteachers in Wales reported greater shortages or inadequacies of educational materials (e.g. textbooks, IT equipment etc.) than headteachers and principals in Northern Ireland, England and Scotland.
- Principals in Northern Ireland were more likely to report a lack of physical infrastructure than headteachers in England, Wales and Scotland. They also reported more inadequacies with the physical infrastructure of their schools.

Pupils

- The gap in reading attainment between the most and least disadvantaged pupils (as measured by the PISA ESCS Index) was significantly smaller in Northern Ireland, Wales and Scotland compared to the OECD average but the difference in England was not significantly different.
- Pupils in Wales, Northern Ireland and Scotland were significantly more able to overcome the effects of socio-economic background compared with the OECD average.
- Pupils in all countries of the UK had more negative attitudes towards reading than the OECD average, but pupils in England reported that they read more than those in the other countries of the UK.
- Pupils in all UK countries reported that they were less satisfied with their lives than the OECD average.
- Pupils in England, Wales, Northern Ireland and Scotland had lower expectations of their highest level of qualification than pupils across the OECD.

Full results for the UK as a whole are in the PISA International Report (OECD 2019b, 2019c, 2019d).

7.1 Reading

This section compares the findings outlined in Chapter 2 with the comparable findings for the other countries of the UK. Full data can be found in Appendix B.

7.1.1 Mean scores in reading

Figure 7.1 and Table 7.1 summarise the mean scores for each of England, Wales, Northern Ireland and Scotland on the reading achievement scale, and indicate which differences were statistically significant[60] (*S*).

There were no significant differences between mean scores in England, Northern Ireland and Scotland, which were all statistically significantly higher than the OECD average[61] of 487. The lowest attainment in the UK was in Wales, where the mean score was significantly lower than the other countries of the UK, and not statistically different from the OECD average.

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[60] When statistical significance is reported, it indicates that the compared means are significantly different at the 5% level.
[61] The 2018 OECD average is based upon the 'AVR' results published in the OECD International results Table 1.B1.10.

Figure 7.1 Mean reading scores across the UK

England, Scotland and Northern Ireland outperformed Wales in reading
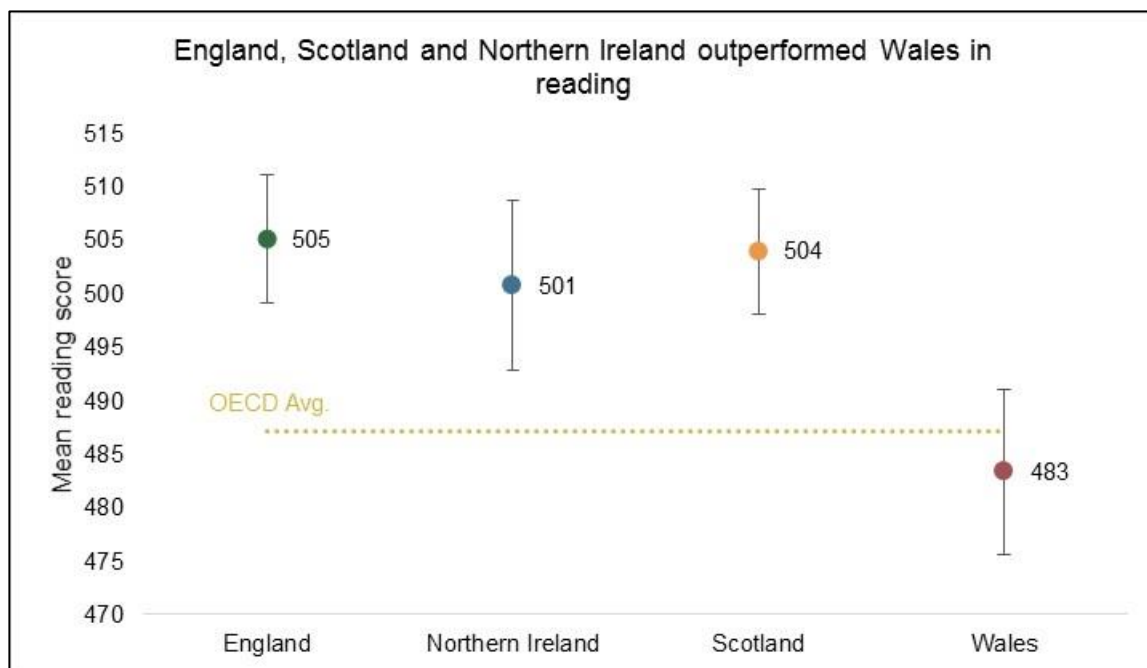
Source: PISA 2018 database

Table 7.1 Mean scores for reading

	Mean	England	Northern Ireland	Scotland	Wales
England	505		NS	NS	**S**
Northern Ireland	501	NS		NS	**S**
Scotland	504	NS	NS		**S**
Wales	483	**S**	**S**	**S**	
OECD average	487	**S**	**S**	**S**	NS

S Indicates a significant difference between mean scores
NS Indicates mean scores are not significantly different

Source: PISA 2018 database

Key point

There were no significant differences between mean scores for reading in England, Northern Ireland and Scotland. The mean score in Wales was significantly lower than the other countries of the UK but did not differ significantly from the OECD average.

On the 3 reading subscales, there was a more varied pattern of differences. Scores in these areas and the significance of the differences between UK countries and the OECD averages are shown in Tables 7.2 to 7.4.

On the 'understanding' scale, scores in England, Northern Ireland and Scotland did not differ significantly from each other and were significantly above the OECD average. Scores in Wales were significantly lower than the other countries of the UK but not significantly different from the OECD average.

On the 'locating information' and 'evaluating and reflecting' scales, scores in England, Northern Ireland and Scotland, again, did not differ significantly from each other and were significantly above the OECD average. Wales, while still significantly lower than England, was not significantly different from Scotland, Northern Ireland or the OECD average.

Table 7.2   Mean scores on the 'locating information' scale

	Mean	England	Northern Ireland	Scotland	Wales
England	507		NS	NS	**S**
Northern Ireland	505	NS		NS	NS
Scotland	507	NS	NS		NS
Wales	494	**S**	NS	NS	
OECD average	487	**S**	**S**	**S**	NS

S Indicates a significant difference between mean scores

NS Indicates mean reading are not significantly different

Table 7.3   Mean scores on the 'understanding' scale

	Mean	England	Northern Ireland	Scotland	Wales
England	499		NS	NS	**S**
Northern Ireland	495	NS		NS	**S**
Scotland	499	NS	NS		**S**
Wales	479	**S**	**S**	**S**	
OECD average	487	**S**	**S**	**S**	NS

S Indicates a significant difference between mean scores

NS Indicates mean scores are not significantly different

Table 7.4   Mean scores on the 'evaluating and reflecting' scale

	Mean	England	Northern Ireland	Scotland	Wales
England	513		NS	NS	**S**
Northern Ireland	504	NS		NS	NS
Scotland	503	NS	NS		NS
Wales	492	**S**	NS	NS	
OECD average	489	**S**	S	S	NS

S Indicates a significant difference between mean scores

NS Indicates mean scores are not significantly different

Source: PISA 2018 database

7.1.2 Distribution of performance in reading

The first way in which the spread of performance in each country can be examined is by looking at the distribution of scores. This can be seen by comparing the scores of pupils at the 10th percentile (low achievers) and that of pupils at the 90th percentile (high achievers). The 10th percentile is the score at which 10% of pupils score lower, while the 90th percentile is the score at which 10% score higher.

The scores at the 10th and the 90th percentiles and the differences between them are shown in Figure 7.2 and Table 7.5. The figure shows that the attainment gap between high and low achievers was widest in England, mainly due to higher scores at the top end of the distribution.

The difference between the average score of OECD countries at the 10th percentile and at the 90th percentile was 260 score points. The range was similar in England at 262 score points and slightly narrower in Northern Ireland (255), and Wales (250). The lowest difference of 244 was found in Scotland.

At the 10th percentile, all 4 countries of the UK performed better than the OECD average, except in Wales where there was no significant difference. The highest score at this percentile was in Scotland, although this was not significantly different from England's. At the 90th percentile, the OECD average was 614 and the equivalent score in England (634) was 20 points above this. The score at the highest percentile in Scotland (627) was also significantly higher than the OECD average, while in Northern Ireland (623) and Wales (608) the highest performers scored similarly to the OECD average.

> **Key point**
>
> The attainment gap between high and low achievers was largest in England (262 score points) and lowest in Scotland (244 score points). Wales (250) and Northern Ireland (255) lie between the other 2 UK countries.

Figure 7.2   Attainment gap in reading scores across the UK

England is strong at the top while Scotland has the lowest gap between high and low achievers

Difference between the scores at the 10th and 90th percentile in reading
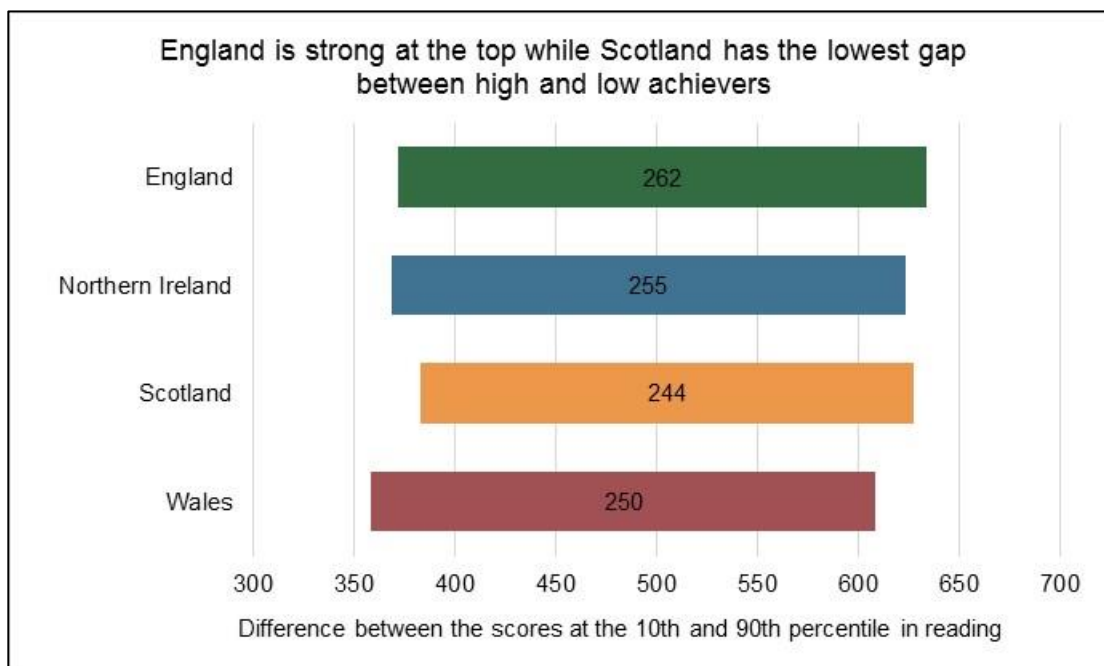
Source: PISA 2018 database

Table 7.5   Mean scores of highest and lowest performing pupils in reading

Country	Lowest (10th Percentile)		Highest (90th Percentile)		Difference
	Reading score	Standard error	Reading score	Standard error	
England	372	5.2	634	4.1	262
Northern Ireland	368	5.8	623	5.6	255
Scotland	383	3.6	627	4.7	244
Wales	359	5.8	608	4.5	250[62]
OECD Avg.	354	0.7	614	0.5	260

Source: PISA 2018 database

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[62] after taking into account the rounding of figures

7.1.3 Performance at each proficiency level in reading

The range of achievement in each country may also be described by the percentages of pupils at each of the PISA proficiency levels. These percentages are summarised in Figure 7.3, which shows that all countries of the UK have some pupils at the top and bottom of the achievement range, but that the percentages vary in each country.

Figure 7.3 also shows that there were very few pupils across the UK at the lowest levels of achievement (Levels 1c and below).

Scotland had the lowest percentage of pupils working below Level 2, the basic proficiency as defined by the OECD, in reading (15%) while Wales had the highest (22%), compared with an OECD average of 23%[63]. In England and Northern Ireland, the proportion of pupils working at the lowest proficiency levels in reading was 17% and 19% respectively.

At the other end of the scale, England had a significantly higher percentage of pupils in the 2 highest levels combined (Level 5 and Level 6) than the OECD average (12% in England, compared to 9%[64] across the OECD). The proportions at these levels in Scotland and Northern Ireland were similar to the OECD (10%[65] and 9% respectively) and Wales was significantly smaller (7%).

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[63] after taking into account the rounding of figures
[64] after taking into account the rounding of figures
[65] after taking into account the rounding of figures

Figure 7.3   Percentage of pupils reaching each reading level in the UK
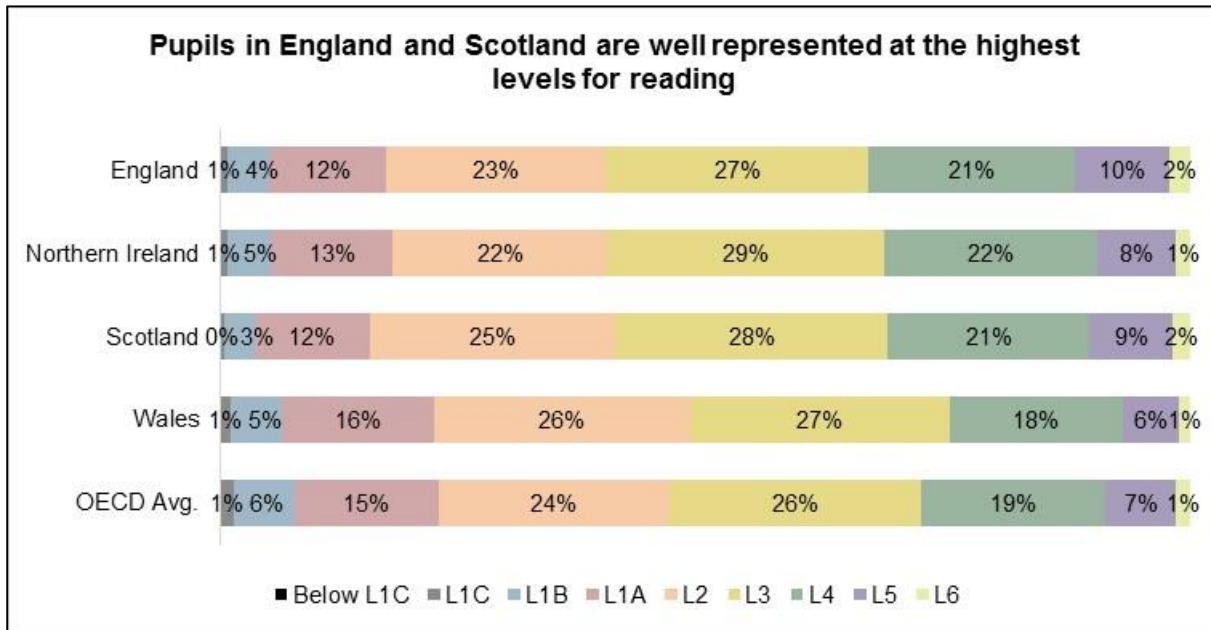
Pupils in England and Scotland are well represented at the highest levels for reading

	Below L1C	L1C	L1B	L1A	L2	L3	L4	L5	L6
England	1%	4%	12%	23%	27%	21%	10%	2%	
Northern Ireland	1%	5%	13%	22%	29%	22%	8%	1%	
Scotland	0%	3%	12%	25%	28%	21%	9%	2%	
Wales	1%	5%	16%	26%	27%	18%	6%	1%	
OECD Avg.	1%	6%	15%	24%	26%	19%	7%	1%	

Full details of the expected skills and performance at each of the PISA reading proficiency levels are provided in Appendix A3. It should be noted that the PISA levels are not the same as levels used in any of the educational systems of the UK.

7.1.4   Gender differences in reading

There were differences in each of the 4 countries of the UK in the achievement of boys and girls. Table 7.6 shows the mean scores for boys and girls and highlights differences that were statistically significant. These differences are further illustrated in Figure 7.4.

Figure 7.4   Gender differences in reading scores across the UK

*The difference between girls and boys score is statistically significant
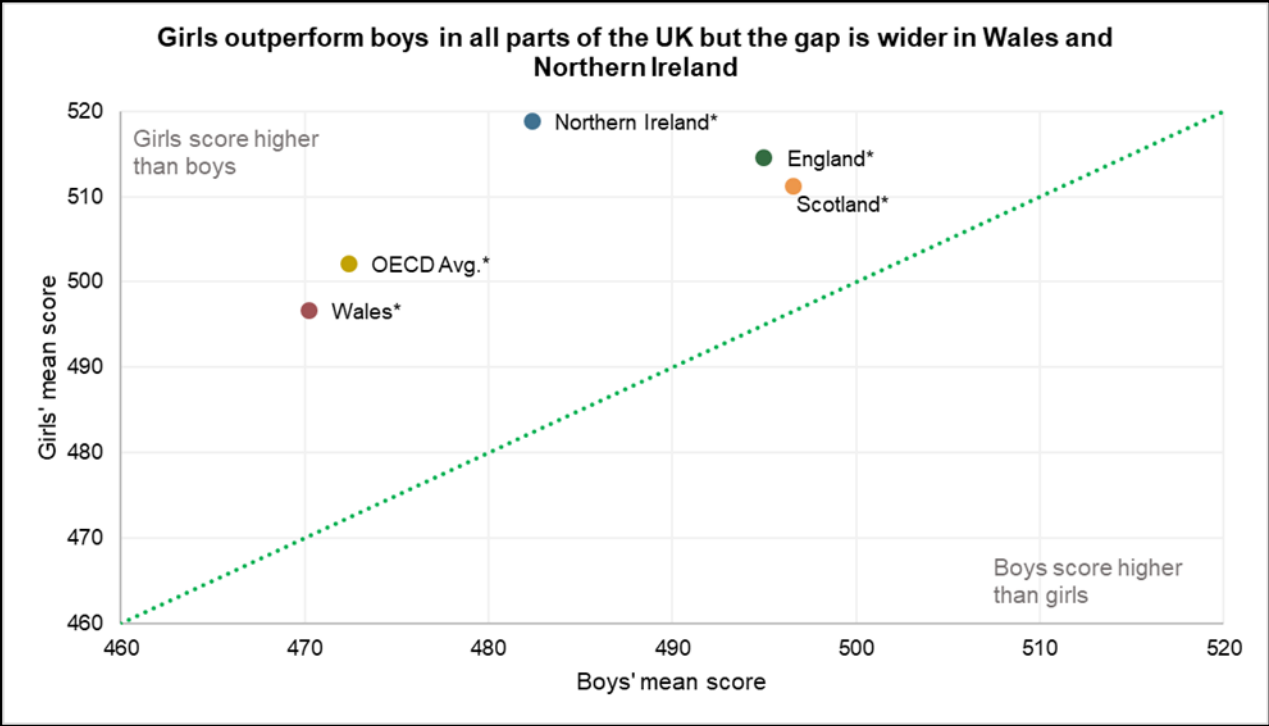
Source: PISA 2018 database

Table 7.6   Gender differences in reading in the UK

	Overall score	Mean score girls	Mean score boys	Difference girls-boys[66]
England	505	515	495	20*
Northern Ireland	501	519	482	36*
Scotland	504	511	497	15*
Wales	483	497	470	26*
OECD Avg.	487	502	472	30*

* The difference is statistically significant

Source: PISA 2018 database

In all cases, girls had a higher mean score than boys and these differences were statistically significant. The size of the differences in Northern Ireland and Wales were not significantly different from the OECD average while in England and Scotland the differences were significantly lower than the OECD average.

Of particular note is that the reading achievement of boys in Wales was especially low compared with the rest of the UK. Compared with England, for example, girls in Wales were 18 score points behind, but boys in Wales were 25 score points behind boys in England.

7.2 Science

This section compares the findings outlined in Chapter 4 with the comparable findings for the other countries of the UK. Full data can be found in Appendix C.

7.2.1 Mean scores in science

Figure 7.5 and Table 7.7 below show the mean scores in England, Wales, Northern Ireland and Scotland for science and indicate any statistically significant differences between countries by (S).

The highest attainment for science was in England, where scores were significantly higher than all other countries of the UK and higher than the OECD average[67]. There was

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[66] after taking into account the rounding of figures
[67] The 2018 OECD average is based upon the 'AV37' results published in the OECD International results Table 1.B1.12.

less difference between Scotland, Wales and Northern Ireland, with none being significantly different from each other or the OECD average of 489.

Figure 7.5   Mean science scores across the UK
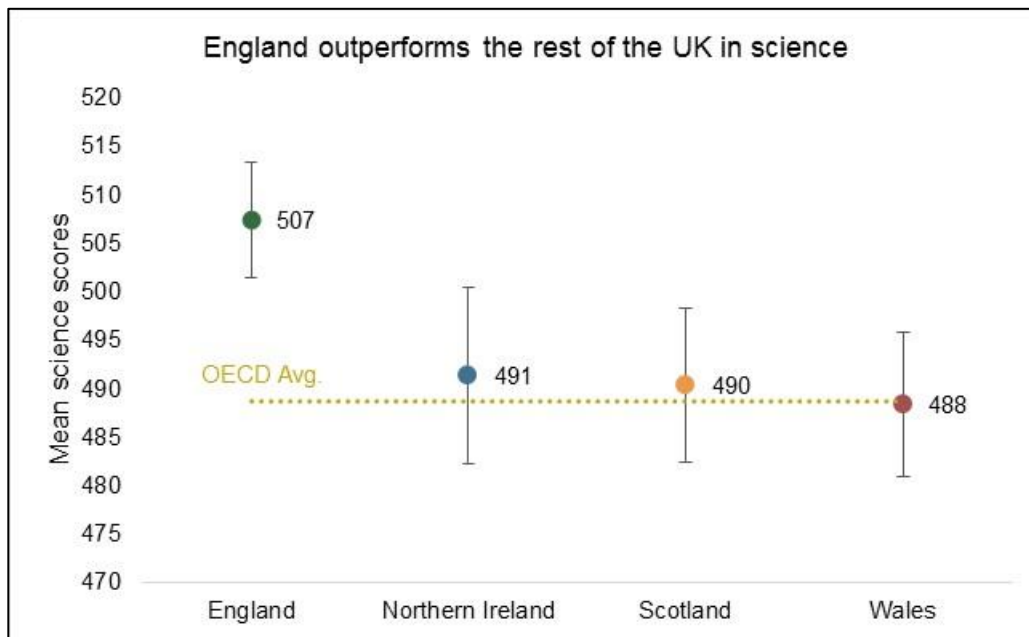
Table 7.7   Mean scores for science

	Mean	England	Northern Ireland	Scotland	Wales
England	507		S	S	S
Northern Ireland	491	S		NS	NS
Scotland	490	S	NS		NS
Wales	488	S	NS	NS	
OECD average	489	S	NS	NS	NS

S Indicates a significant difference between mean science scores
NS Indicates mean science scores are not significantly different

7.2.2 Distribution of performance in science

Table 7.8 and Figure 7.6 show the scores of pupils in each UK country at the 10th and the 90th percentiles, along with the OECD average score at each of these percentiles. The table indicates the range of scores in each country and also shows the difference in score points at the 2 percentiles. Full data can be found in Appendix C.

Scores in England were highest at both ends of the distribution – at both the 10th and the 90th percentiles. At the highest percentile, the score was 26 points above the OECD average. However, England also had the widest spread of attainment, with a score point difference of 260 points between the lowest and highest achieving groups, mainly due to higher scores at the top end of the distribution. This compares with the lowest difference of 232 points in Wales and an OECD average difference of 244.

Figure 7.6   Attainment gap in science scores across the UK

Source: PISA 2018 database

154
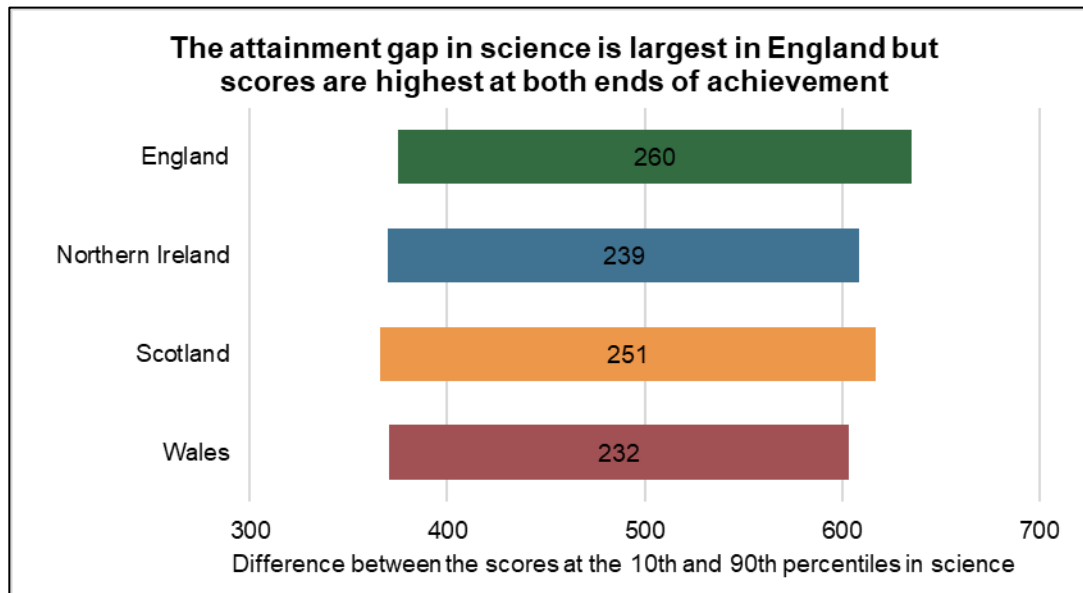
Table 7.8   Mean scores of highest and lowest performing pupils in science

Country	10th Percentile		90th Percentile		
	Science score	Standard error	Science score	Standard error	difference
England	375	4.6	635	3.8	260
Northern Ireland	370	5.7	609	6.2	239
Scotland	366	5.7	617	5.9	251
Wales	371	5.3	603	4.6	232
OECD Avg.	365	0.6	609	0.5	244

Source: PISA 2018 database

7.2.3 Performance at each science proficiency level

The distribution of attainment in science can be further illustrated by looking at the percentages of pupils at each PISA proficiency level. Figure 7.7 shows the percentages of pupils at each level of science attainment.

England had the largest percentage of pupils (10%[68]) at the 2 highest levels of attainment (Levels 5 and 6), significantly above the OECD average (7%). Scotland and Northern Ireland had a similar percentage of pupils at these levels compared with the OECD (7% and 5% respectively). Wales had a significantly smaller percentage than the OECD average (4%[69]). At the other end of the scale, all countries of the UK had similar percentages to the OECD average of pupils below Level 2 (Northern Ireland 19%[70], Scotland 21%, Wales 20%[71], OECD 22%), except for England, where the percentage was significantly lower (17%).

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[68] after taking into account the rounding of figures
[69] after taking into account the rounding of figures
[70] after taking into account the rounding of figures
[71] after taking into account the rounding of figures

Figure 7.7   Percentage of pupils reaching each science level in the UK
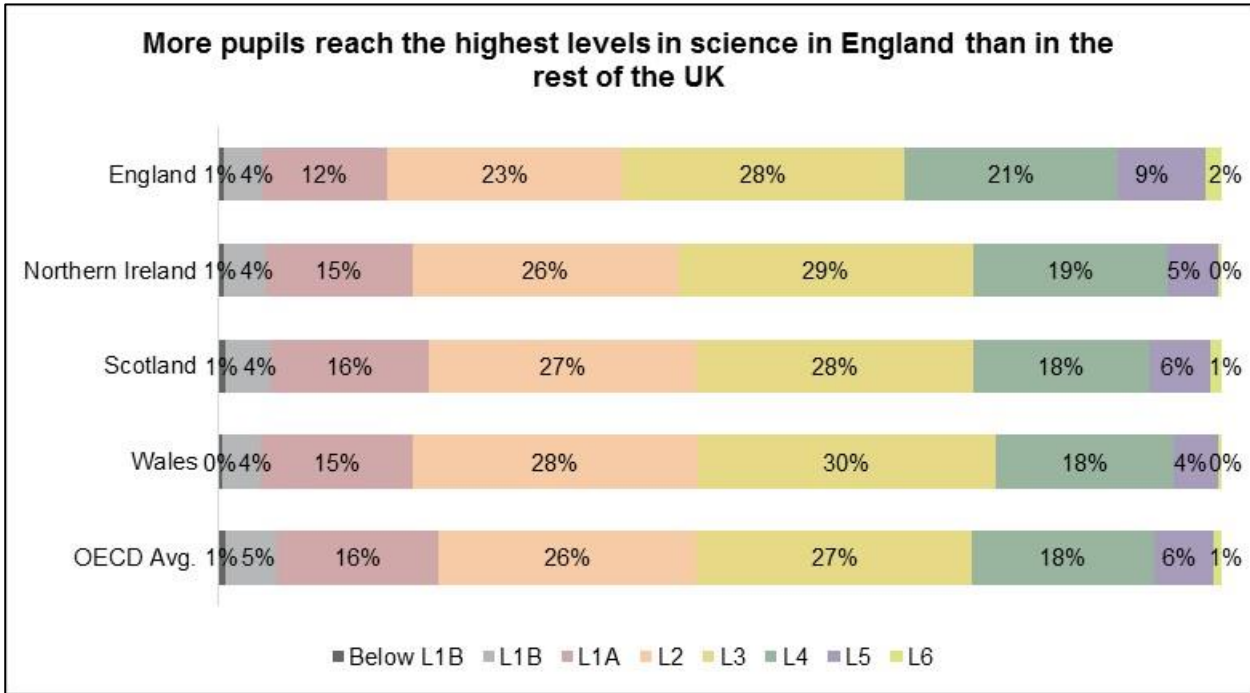
More pupils reach the highest levels in science in England than in the rest of the UK

	Below L1B	L1B	L1A	L2	L3	L4	L5	L6
England	1%	4%	12%	23%	28%	21%	9%	2%
Northern Ireland	1%	4%	15%	26%	29%	19%	5%	0%
Scotland	1%	4%	16%	27%	28%	18%	6%	1%
Wales	0%	4%	15%	28%	30%	18%	4%	0%
OECD Avg.	1%	5%	16%	26%	27%	18%	6%	1%

Full details of the expected skills and performance at each of the PISA science proficiency levels are provided in Appendix A3. It should be noted that the PISA levels are not the same as levels used in any of the educational systems of the UK.

7.2.4   Gender differences in science

Table 7.9 shows the mean scores of boys and girls, and the differences between them. Figure 7.8 further illustrates these differences. Full data can be found in Appendix C.

In the 4 countries of the UK, the only significant difference was in Northern Ireland, where girls outperformed boys by 17 points. Girls also outperformed boys in the OECD with a 2 point difference in the mean score, which was statistically significant.

Figure 7.8   Gender differences in science scores across the UK
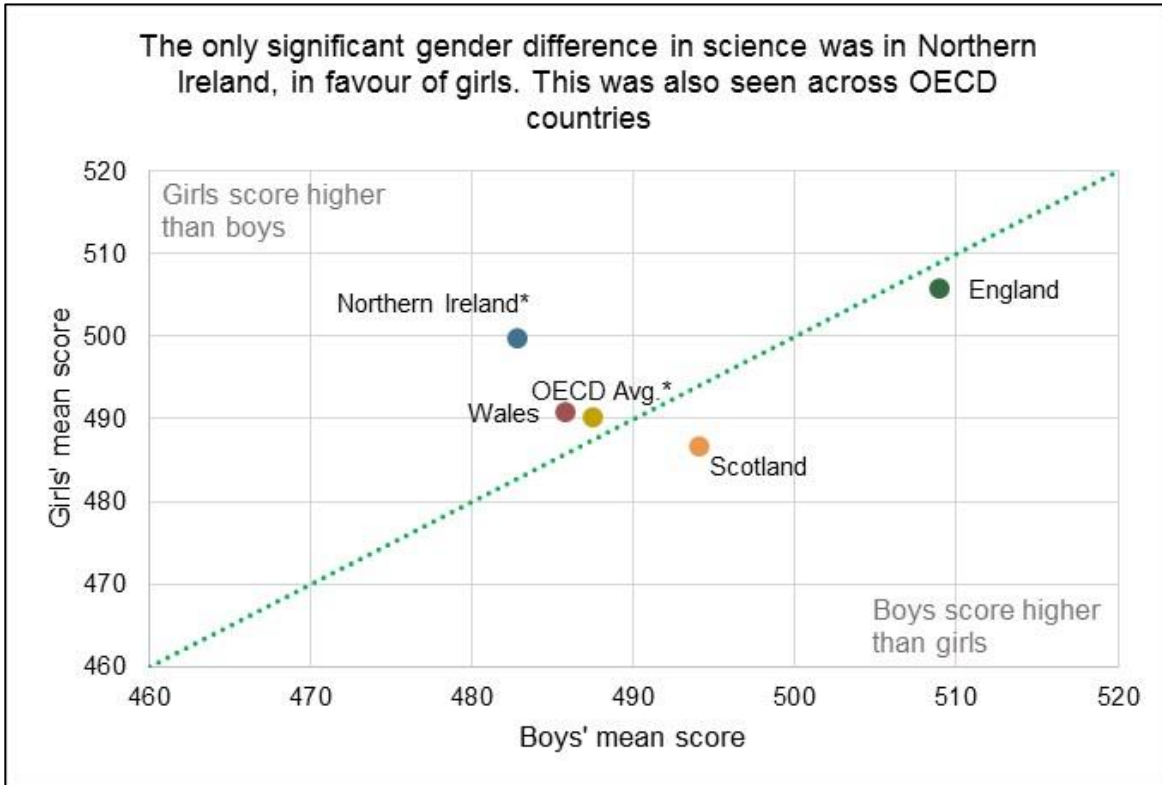
The only significant gender difference in science was in Northern Ireland, in favour of girls. This was also seen across OECD countries

*The difference between girls and boys score is statistically significant

Table 7.9   Gender differences in science in the UK

Country	Overall score	Mean score girls	Mean score boys	Difference girls-boys
England	507	506	509	-3
Northern Ireland	491	500	483	17*
Scotland	490	486	494	-8
Wales	488	491	486	5
OECD Avg.	489	490	488	2*

* The difference is statistically significant

7.3 Mathematics

This section compares the findings outlined in Chapter 5 with the comparable findings for the other countries of the UK. Full data can be found in Appendix D.

7.3.1 Mean scores in mathematics

Figure 7.9 and Table 7.10 below show the mean scores in England, Wales, Northern Ireland and Scotland for mathematics and indicate any statistically significant differences between countries (*S*).

The highest attainment for mathematics was in England, where scores were significantly higher than all other countries of the UK and higher than the OECD average[72]. Scotland, Wales and Northern Ireland were not significantly different from each other or from the OECD average of 489.

Figure 7.9   Mean mathematics scores across the UK

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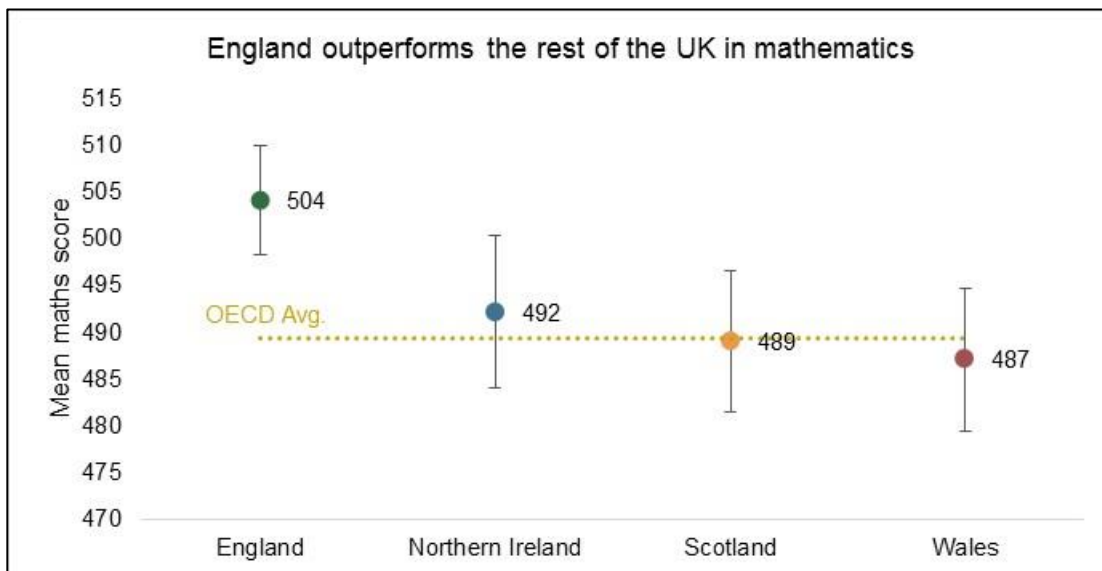
[72] The 2018 OECD average is based upon the 'AV37' results published in the OECD International results Table 1.B1.11.

Table 7.10   Mean scores for mathematics

	Mean	England	Northern Ireland	Scotland	Wales
England	504		**S**	**S**	**S**
Northern Ireland	492	**S**		NS	NS
Scotland	489	**S**	NS		NS
Wales	487	**S**	NS	NS	
OECD average	489	**S**	NS	NS	NS

S Indicates a significant difference between mean mathematics scores
NS Indicates mean mathematics scores are not significantly different

Source: PISA 2018 database

Key Point

There were no significant differences in mathematics between Scotland, Wales, Northern Ireland and the OECD average. The mean score for mathematics in England was significantly higher than the rest of the UK and the OECD average.

7.3.2 Distribution of performance in mathematics

Table 7.11 and Figure 7.10 show the scores of pupils in each UK country at the 10th and the 90th percentiles, along with the OECD average score at each of these percentiles. The table indicates the range of scores in each country and also shows the difference in score points at the 2 percentiles.

Scores in England were highest at both ends of the distribution – at both the 10th and the 90th percentiles. At the 90th percentile, the score was 18 points above the OECD average. Scotland and England had the widest spread of attainment in mathematics, with score point differences of 243 points between the lowest and highest percentiles in Scotland and 240 in England. This compares with the lowest difference of 211 points in Wales, 223 score points in Northern Ireland and an OECD average of 235.

It is clear from the figures presented in Table 7.11 and the further illustration of the attainment gap in Figure 7.10 that, as was the case for science, the higher overall mean score for mathematics in England was mainly due to a larger proportion of high achieving pupils. Scotland has the longest 'tail' of lower-achieving pupils. Wales, in contrast, has the second highest score at the 10th percentile.

Figure 7.10 Attainment gap in mathematics scores across the UK

Scotland and England have the largest gaps between high and low achievers in mathematics

England: 240
Northern Ireland: 223
Scotland: 243
Wales: 211

Difference between the scores at the 10th and 90th percentiles in maths
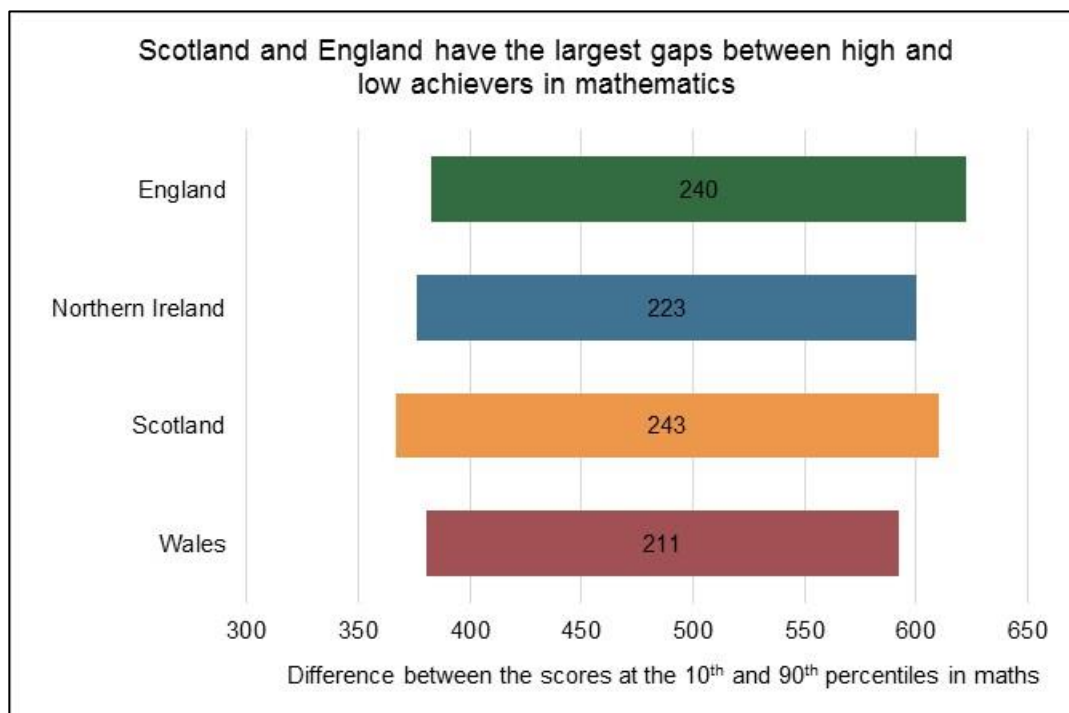
Table 7.11   Mean scores of highest and lowest performing pupils in mathematics

	10th Percentile		90th Percentile		
Country	Maths score	Standard error	Maths score	Standard error	difference
England	383	4.9	623	3.7	240
Northern Ireland	377	6.4	600	5.3	223
Scotland	367	6.0	610	5.7	243
Wales	381	5.4	592	4.4	211
OECD Avg.	370	0.6	605	0.6	235

Performance at each mathematics proficiency level

The distribution of attainment in mathematics can be further illustrated by looking at the percentages at each PISA proficiency level. Figure 7.11 shows the percentages of pupils at each level of mathematics attainment.

England had the largest percentage of pupils (14%[73]) at the 2 highest levels of attainment (Levels 5 and 6), significantly higher than the OECD (11%). Scotland followed with 11%[74], which was not significantly different from the OECD. Both Northern Ireland and Wales had significantly smaller proportions than the OECD average at these levels (8% and 7% respectively). At the other end of the scale, the proportion of pupils performing below PISA Level 2 was 23% in Scotland, 21% in Wales, 20% in Northern Ireland and 19%[75] in England. The OECD average below Level 2 was 24%, significantly different from Wales, Northern Ireland and England.

Figure 7.11 also confirms the findings from the examination of the distribution of scores in the previous section – i.e. that the higher mean score for mathematics in England was mainly due to a larger proportion of high-achieving pupils. There were also smaller proportions of pupils performing at the lowest levels.

Figure 7.11 Percentage of pupils reaching each mathematics level in the UK
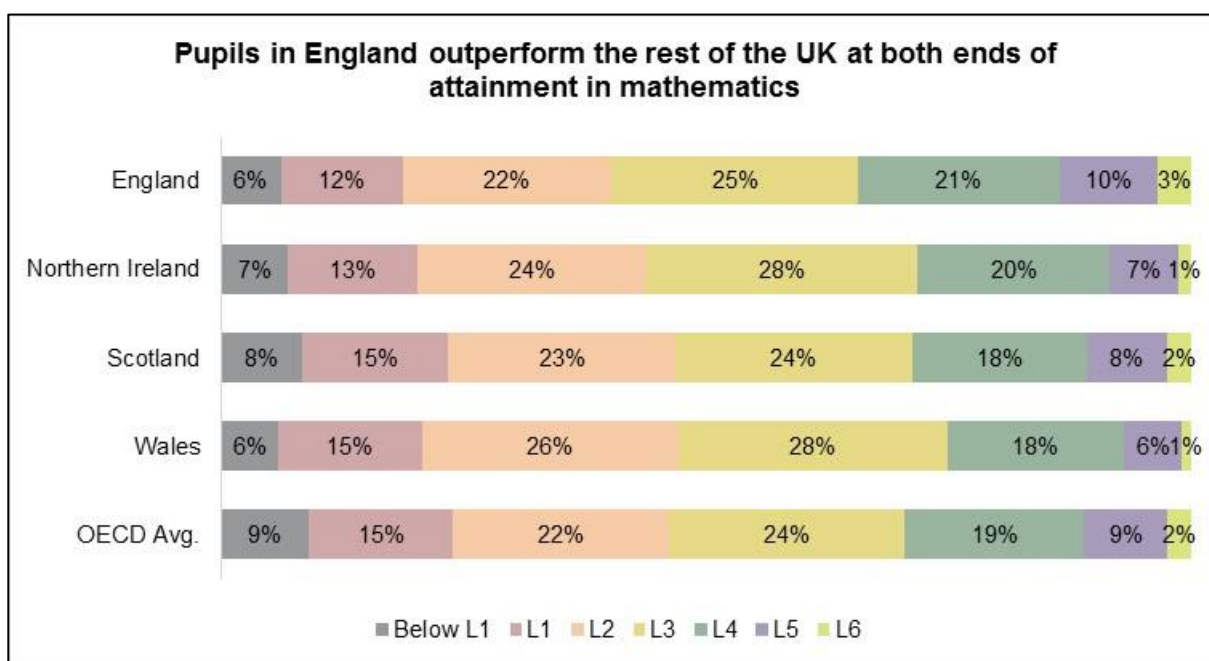
Source: PISA 2018 database

Full details of the expected skills and performance at each of the PISA mathematics proficiency levels are provided in Appendix A3. It should be noted that the PISA levels are not the same as levels used in any of the educational systems of the UK.

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[73] after taking into account the rounding of figures
[74] after taking into account the rounding of figures
[75] after taking into account the rounding of figures

7.3.2 Gender differences in mathematics

Table 7.12 shows the mean scores of boys and girls, and the differences between them. Figure 7.12 further illustrates these differences.

In England and Scotland, the mean score for boys was significantly higher than that for girls in mathematics, while in Northern Ireland and Wales there was no significant difference. Boys also outperformed girls in the OECD countries, with a 5 point difference in the mean score; this was statistically significant. In both England and Scotland, boys outperformed girls by more than the OECD average at 13 points and 16 points respectively.

Figure 7.12 Gender differences in mathematics scores across the UK
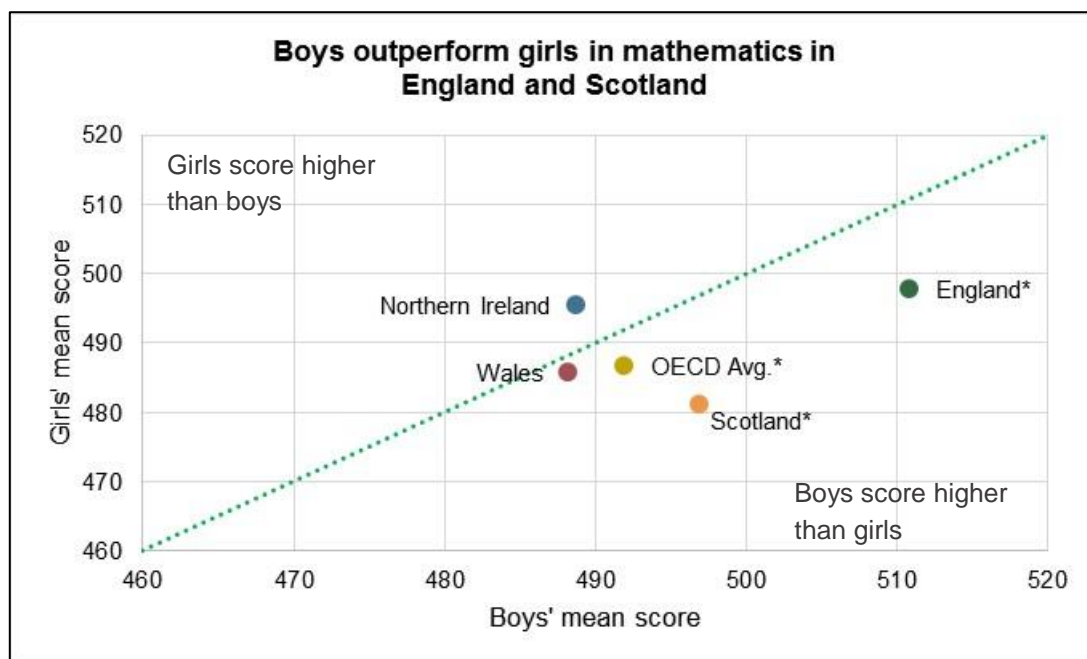
*The difference between girls and boys score is statistically significant

Source: PISA 2018 database

Table 7.12   Gender differences in mathematics in the UK

Country	Overall score	Mean score girls	Mean score boys	Difference girls-boys
England	504	498	511	-13*
Northern Ireland	492	495	489	7
Scotland	489	481	497	-16*
Wales	487	486	488	-2
OECD Avg.	489	487	492	-5*

* The difference is statistically significant

Source: PISA 2018 database

7.4 Trends in performance

This section describes progress made across successive PISA cycles in the UK. Figures 7.13, 7.14 and 7.15 show scores in the 3 subject domains across all PISA cycles since 2006.

In reading, scores have remained stable across successive PISA cycles, with the only statistically significant change being an increase in the mean reading score in Scotland (compared with PISA 2015), following a similarly sized decrease in 2015.

In science, mean scores in 2018 were significantly lower than those in 2006 in Scotland, Wales and Northern Ireland. This accounts for the large gap between England and the rest of the UK. The downwards trend has been especially pronounced in Scotland, where scores for science in earlier PISA cycles were close to those in England.

In mathematics, the picture is more mixed. Scotland shows a decline that is less pronounced than that for science, but has nevertheless been sustained over successive cycles since PISA 2006, when Scotland outperformed the rest of the UK (Bradshaw *et al.*, 2007). Mathematics scores in Wales have improved after a decline in earlier cycles of PISA while scores in Northern Ireland have remained mainly stable. England, however, after successive cycles with stable PISA scores, showed a marked improvement in mathematics in PISA 2018.

Figure 7.13 Trends in reading scores across the UK
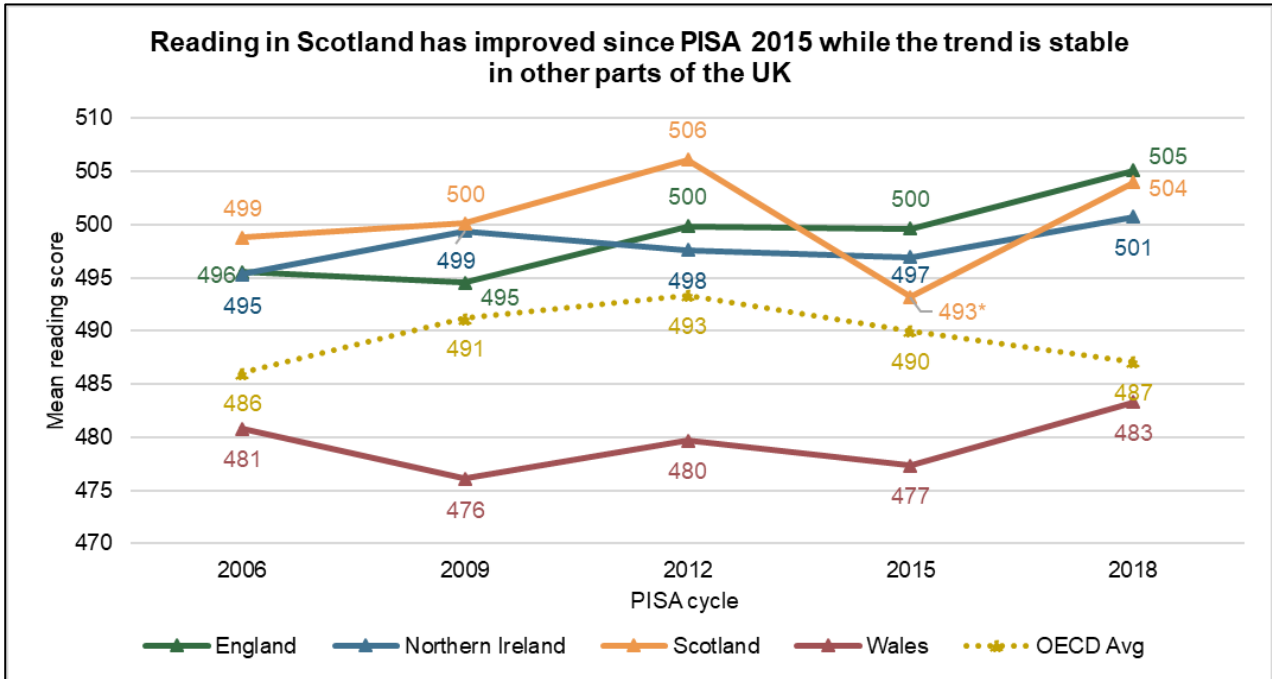
Reading in Scotland has improved since PISA 2015 while the trend is stable in other parts of the UK

*The mean score of that year is statistically different from the mean score in 2018

Source: PISA 2018 database; Bradshaw *et al.*, 2007; Bradshaw *et al.*, 2010; Wheater *et al.*, 2014; Jerrim *et al.*, 2016

Figure 7.14 Trends in science scores across the UK
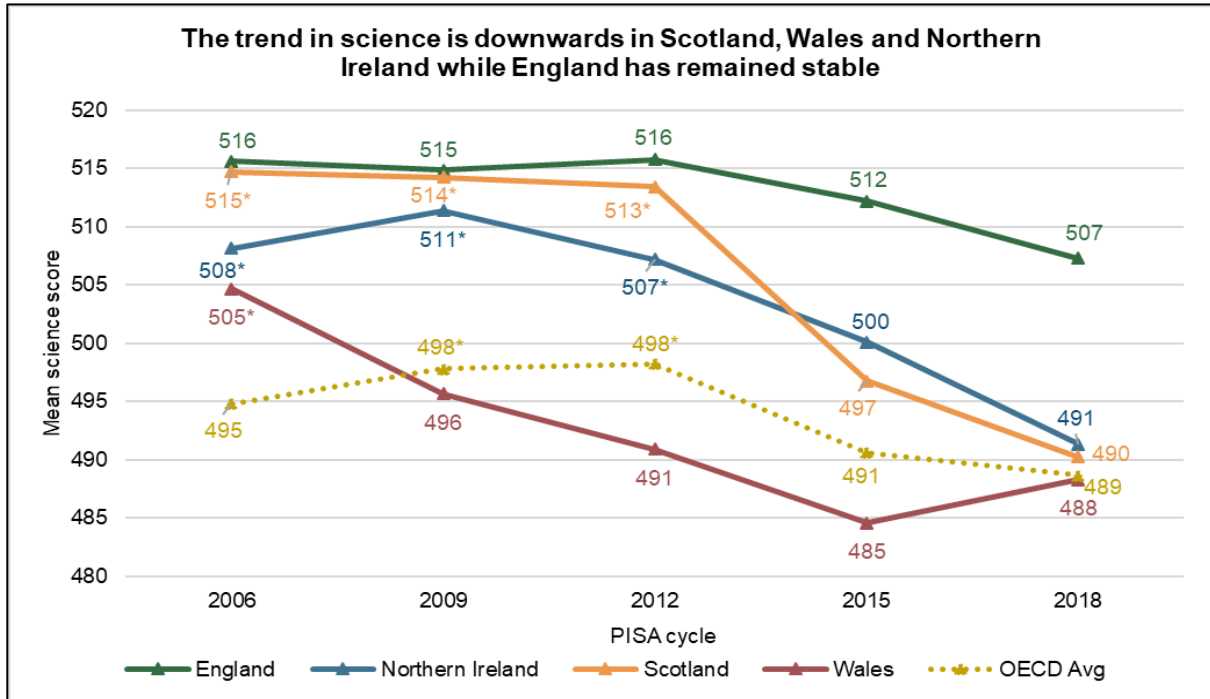
The trend in science is downwards in Scotland, Wales and Northern Ireland while England has remained stable

*The mean score of that year is statistically different from the mean score in 2018

Source: PISA 2018 database; Bradshaw *et al.*, 2007; Bradshaw *et al.*, 2010; Wheater *et al.*, 2014; Jerrim *et* al., 2016

Figure 7.15 Trends in mathematics scores across the UK
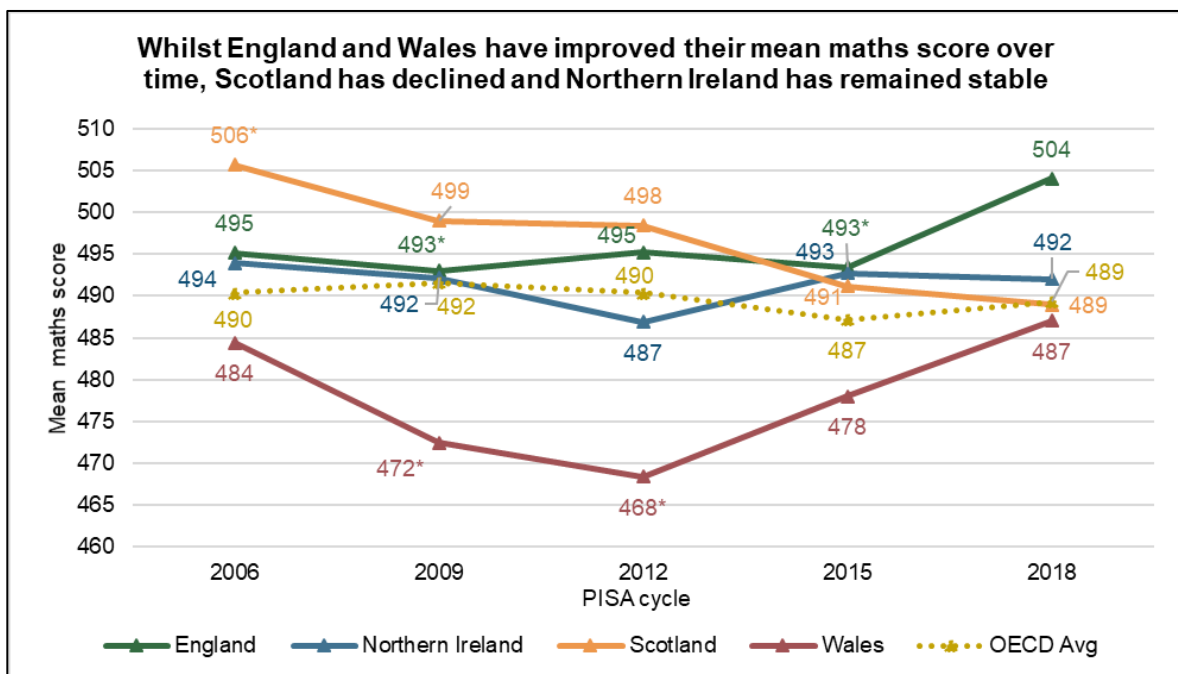
Whilst England and Wales have improved their mean maths score over time, Scotland has declined and Northern Ireland has remained stable

*The mean score of that year is statistically different from the mean score in 2018

Source: PISA 2018 database; Bradshaw *et al.*, 2007; Bradshaw *et al.*, 2010; Wheater *et al.*, 2014; Jerrim *et* al., 2016

7.5 Schools and pupils

This section looks at similarities and differences in findings from the school and pupil questionnaires between England, Wales, Northern Ireland and Scotland.

7.5.1 School differences

There were a number of differences among the UK countries in responses to questions about the purposes for which 15-year-old pupils were assessed. The greatest difference was seen for the purpose of making judgements about teachers' effectiveness. Assessments were used by only 42% of schools in Scotland for this purpose, compared with 83% in Wales, 85% in England and 69% in Northern Ireland. All UK countries tended to agree that assessments were used to guide pupils' learning, to adapt teaching to pupils' needs and to inform parents about their child.

Headteachers in England responded more favourably towards their school's capacity to enhance learning and teaching using digital devices than the other UK nations. For example, the number of digital devices connected to the internet was considered sufficient by 72% in England, compared with 59% in Northern Ireland, 58% in Scotland and 50% in Wales. Headteachers and principals in Scotland and Wales were less likely to report that their internet bandwidth or speed was sufficient than teachers in England and Northern Ireland (England 79%, Northern Ireland 69%, Scotland 47%, Wales 49%).

Headteachers and principals differed in their responses to resource shortages, which can be seen in Table 7.13. Headteachers in Wales reported greater shortages or inadequacies of educational materials (for example, textbooks, IT equipment etc.) than headteachers and principals in Northern Ireland, England and Scotland. Principals in Northern Ireland reported more inadequacies with the physical infrastructure. Nearly half (49%) of headteachers in Scotland reported teaching was hindered by a lack of teaching staff, compared to England (27%), Wales (28%) and Northern Ireland (24%). In England, very few headteachers (19%) reported lack of support staff as a hindrance, compared with 24% in Northern Ireland, 47% in Scotland and 33% in Wales.

Table 7.13   Resource shortages reported by headteachers and principals

Is your school's capacity to provide teaching hindered by any of the following issues?

	To some extent / A lot			
	England	**Northern Ireland**	**Scotland**	**Wales**
A lack of physical infrastructure (e.g. building, grounds, heating/cooling, lighting and acoustic systems)	34%	45%	21%	38%
Inadequate or poor quality physical infrastructure (e.g. building, grounds, heating/cooling, lighting and acoustic systems)	33%	43%	26%	39%
A lack of teaching staff	27%	24%	49%	28%
A lack of educational material (e.g. textbooks, IT equipment, library or laboratory material)	26%	32%	19%	46%
Inadequate or poor quality educational material (e.g. textbooks, IT equipment, library or laboratory material)	22%	25%	19%	41%
A lack of support staff	19%	24%	47%	33%
Inadequate or poorly qualified teaching staff	9%	5%	9%	8%
Inadequate or poorly qualified support staff	6%	10%	17%	16%

Source: PISA 2018 database; School Questionnaire, question SC017

Table 7.14 shows responses of headteachers and principals to questions about hindrances to pupil learning. In Northern Ireland only 8% of principals said that pupil truancy hindered learning to some extent or a lot. Headteachers in Wales, England and Scotland reported that it was a greater problem, with the largest proportion (35%) being reported by headteachers in Scotland. Headteachers in Scotland were also more likely to report problems with pupils not paying attention and pupils lacking respect and disrupting classes than those in the other UK countries. Teacher absenteeism was also reported as more of a problem in Scotland, and more headteachers in Scotland and England reported that learning was hindered by teachers not meeting individual pupils' needs than in Wales and Northern Ireland.

Table 7.14   Hindrances to learning reported by headteachers and principals

In your school, to what extent is the learning of students hindered by the following?

	To some extent / A lot			
	England	**Northern Ireland**	**Scotland**	**Wales**
Pupil behaviours				
Students not paying attention	40%	35%	49%	30%
Student truancy	20%	8%	35%	20%
Students lacking respect for teachers	11%	19%	22%	19%
Students skipping classes	9%	7%	31%	14%
Students intimidating or bullying other students	4%	8%	13%	6%
Student use of alcohol or illegal drugs	3%	3%	5%	7%
Teacher behaviours				
Teachers not meeting individual students' needs	28%	14%	29%	15%
Teacher absenteeism	20%	19%	30%	14%
Staff resisting change	10%	14%	23%	12%
Teachers not being well prepared for classes	5%	3%	3%	9%
Teachers being too strict with students	3%	0%	6%	7%

Source: PISA 2018 database; School Questionnaire, question SC061

7.5.2 Differences in pupils' socio-economic background

On average, pupils in the PISA samples in the UK had a higher socio-economic status than the average across OECD countries, as measured by the economic, social and cultural status (ESCS) Index. The ESCS Index is explained further in Chapter 3

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Figure 7.16 compares the reading performance of pupils in each country of the UK and across the OECD when they are divided into 4 equal groups (quartiles) according to their ESCS score. The gap in achievement between pupils highest and lowest on the ESCS Index was smaller in Wales, Northern Ireland and Scotland compared the OECD average. There was no significant difference between England and the OECD average. Wales had the smallest gap (although not significantly different from Northern Ireland) and this is accounted for by the comparatively poor performance of their most advantaged pupils. Pupils in the top quartile of the index in Wales performed at a similar level to those in the third quartile in the rest of the UK.

Figure 7.16   Reading performance of UK countries and OECD by ESCS quartile
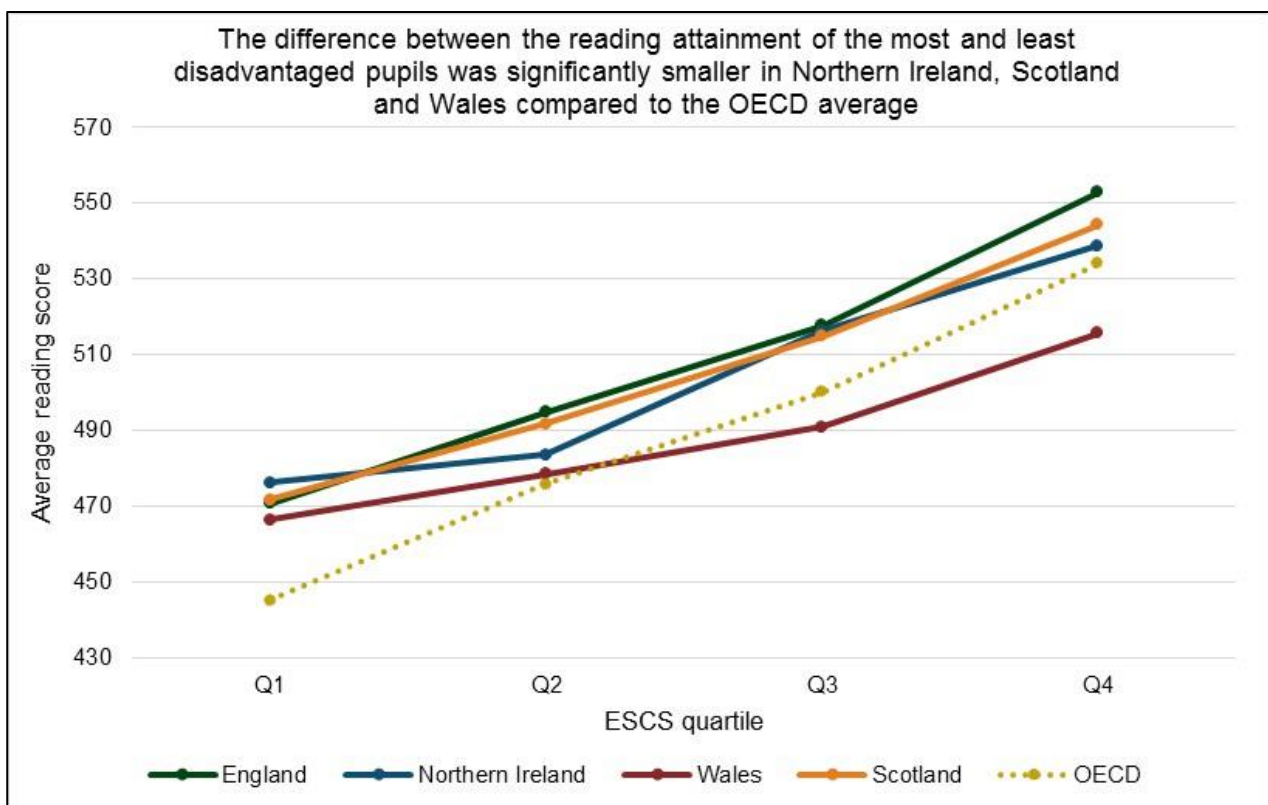
The amount of variance in scores which can be explained by socio-economic background provides further insight into the interaction between reading scores and the ESCS Index, or the **strength of the effect**. This shows the extent to which pupils in each country are able to overcome the effects of socio-economic background. Across the OECD, on average, 12% of the variance in scores can be explained by socio-economic background. In all UK countries, the explained variance was less than the OECD average (England 10%, Scotland 8%, Northern Ireland 7%, Wales 4%) but the difference was not significant in England.

The ESCS reading attainment gap was supported by analysis of reading attainment of pupils eligible and not eligible for free school meals. In England, Wales and Northern Ireland, pupils eligible[76] for free school meals scored significantly below pupils not eligible (FSM data were not available for Scotland).

7.5.3 Differences in pupils' attitudes and aspirations

This section considers some aspects of the pupil attitudes reported in Chapter 3, where there were differences in the 4 countries of the UK, or differences in all countries of the UK compared with the OECD average.

Pupils in England and Wales tended to be more confident in their reading ability than pupils in Scotland and Northern Ireland, and compared with the average in OECD countries. However, pupils in Wales, Scotland and Northern Ireland were less likely to read books than pupils in England and in the OECD. Pupils in England, Wales, Northern Ireland and Scotland had more negative attitudes towards reading than pupils across the OECD.

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[76] 'entitled to' in Northern Ireland

Table 7.15 Pupils' perception of reading competence and difficulty

Percentage of pupils who agree or strongly agree with each statement

	England	Northern Ireland	Scotland	Wales	OECD
I am a good reader.	83	76	78	83	71
I am able to understand difficult texts.	76	71	74	78	67
I read fluently.	78	72	74	78	77
I have always had difficulty with reading.	19	22	22	20	19
I have to read a text several times before I completely understand it.	45	48	47	40	44
I find it difficult to answer questions about a text.	29	33	36	26	26

Note: The percentage point difference column may not equal the difference between Wales and the OECD due to rounding.

Source: PISA 2018 database; Student Questionnaire, question ST161

Table 7.16   Pupils' reading mode preference

Percentage of pupils who read books in each mode

	England	Northern Ireland	Scotland	Wales	OECD
I rarely or never read books.	37	51	42	44	35
I read paper books more often than books on digital devices.	36	28	32	30	36
I read books on digital devices more often than on paper.	16	12	15	16	15
I read paper books <u>and</u> books on digital devices equally often.	12	10	11	10	13

Note: The percentage point difference column may not equal the difference between Wales and the OECD due to rounding

Source: PISA 2018 database; Student Questionnaire, question ST168

Table 7.17   Pupils' reading engagement

Percentage of pupils who agree or strongly agree with each statement

	England	Northern Ireland	Scotland	Wales	OECD
I read only if I have to.	53	62	57	57	49
Reading is one of my favourite hobbies.	28	23	23	24	34
I like talking about books with other people.	31	24	29	28	37
For me, reading is a waste of time.	30	40	32	33	28
I read only to get information that I need.	56	64	57	60	50

Source: PISA 2018 database; Student Questionnaire, question ST160

Pupils in all countries of the UK were less satisfied with their life than pupils in other OECD countries (mean score 7), on average[77]. Pupils in England were least satisfied (mean score 6.1), pupils in Northern Ireland were most satisfied (mean score 6.6), and pupils in Scotland and Wales had mean satisfaction scores of 6.3 and 6.5 respectively. In all countries of the UK, pupils were less likely to strongly agree that their life had meaning and purpose than pupils across the OECD; pupils in Northern Ireland responded most similarly to pupils across the OECD.

Pupils in England, Wales, Northern Ireland and Scotland had lower expectations of their highest level of qualification than pupils across the OECD. Pupils' expectations for a professional career were slightly above the OECD average (44%) in Scotland (47%), Wales (47%), England (51%) and Northern Ireland (50%). As discussed in Chapter 3, a misalignment between expected highest qualification and career is found across the OECD, and this was similar or greater in UK countries.

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[77] This is a scale from 0 (not at all satisfied) to 10 (completely satisfied) in response to the question "how satisfied are you with your life as a whole these days?"

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Appendix A Background to the study

The Programme for International Student Assessment (PISA) is an international comparison study run by the Organisation for Economic Cooperation and Development (OECD). Every three years, 15-year-old pupils from all over the world are assessed in reading, mathematics and science. The assessments are designed to gauge how well pupils can apply what they have learned in key subjects in preparation for real-life situations in the adult world.

Over half a million 15-year-olds from 79 countries and economies took the PISA assessment in 2018. The major domain of the study in 2018 was reading and so this was assessed in greater depth than mathematics and science.

A1 The development of the study

An international consortium, led by Educational Testing Service (ETS), designed and implemented the PISA 2018 study on behalf of the OECD. The 2018 study was the 7th cycle of PISA, and built on the experiences of previous triennial cycles since 2000. By using standardised survey procedures and assessments, the study aims to collect data from around the world that can be compared despite differences in language and culture.

The framework and specification for the study, *PISA 2018 Assessment and Analytical Framework* (OECD 2018a), were agreed internationally by the PISA Governing Board, which comprises representatives from each participating country, and both the international consortium and participating countries submitted assessment questions for inclusion in the study. An expert panel (convened by the international PISA consortium) reviewed the questions, and countries were then invited to comment on their difficulty, cultural appropriateness, and curricular and non-curricular relevance.

Every participating country carried out a field trial in 2017, and the outcomes of this were used to finalise the contents and format of the assessments and questionnaires for the main study in 2018.

In all four UK countries, pupils sat the two-hour field trial assessment in March/April 2017 under test conditions, following the standardised procedures implemented by all countries. As the focus in this round was on reading, around two-thirds of the questions were on reading and new reading questions were introduced to reflect updates to the PISA Assessment Framework[78]. To provide continuity between cycles, a proportion of 'trend' questions, used in previous cycles, were included for each subject to act as a measure of change. The PISA 2018 design built upon the design and methodology innovations

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[78] https://www.oecd-ilibrary.org/education/pisa-2018-assessment-and-analytical-framework_b25efab8-en

introduced for PISA 2015, which increased the content coverage in the minor domains in order to diminish differences across cycles (compared with the paper-based assessment mode). This design also improved scaling and trend analyses across cycles.

In addition, as part of the design for 2018, some multi-stage adaptive testing (MSAT) for reading was included[79]. This method of adaptive testing, made possible by the electronic delivery of PISA, meant that the selection of questions presented to each pupil was determined by their answers to previous questions, ensuring that pupils received questions that were neither too easy nor too difficult. Another technical advantage of this approach was that more refined information could be gathered for higher and lower achieving pupils, thereby improving the accuracy of the measurement scales. The MSAT is discussed in more detail in Chapter 1, Volume 1 of the PISA 2018 International report.

Further details on the assessment administration are included in A4 below.

Strict international quality standards are applied to all stages of the PISA study to ensure equivalence in translation and adaptation of instruments, sampling procedures and study administration in all participating countries.

Further details of the PISA 2018 Technical standards can be found here: https://www.oecd.org/pisa/pisaproducts/PISA-2018-Technical-Standards.pdf.

All international OECD publications, as well as the international database, are available on the OECD PISA website at www.oecd.org/pisa.

A2 What PISA measures – sample questions

PISA is designed not only to assess whether pupils can reproduce knowledge, but also whether they can extrapolate from what they have learned and apply their knowledge in new situations. The PISA 2018 study focused on reading, with mathematics and science as minor domains of assessment[80].

All PISA assessments are based on the *PISA 2018 Assessment and Analytical Framework*. This document presents the theory underlying the assessment in the three core subjects of reading, mathematics and science. It outlines the knowledge content, the processes and the contexts in which pupils can apply their learning, and discusses how each domain is assessed. The document also includes detailed frameworks for the various

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[79] Full technical details of the PISA 2018 Integrated Design can be found at https://www.oecd.org/pisa/pisaproducts/PISA-2018-INTEGRATED-DESIGN.pdf
[80] Some countries also took part in financial literacy and global competence assessments.

questionnaires distributed to pupils and headteachers that gather information on a number of contextual variables.

The OECD definitions for the three core domains are presented in section A2.1 to A2.3 below, followed by some examples of the types of questions pupils might be presented with in a PISA assessment.

PISA uses proficiency levels to describe the types of skills that pupils are likely to demonstrate and the tasks that they are able to complete. The sample questions that follow include their estimated proficiency level, where available.

More information on PISA proficiency levels and PISA scale scores can be found in section A3.

A2.1 Reading

Reading literacy is defined as pupils' capacity to understand, use, evaluate, reflect on and engage with texts in order to achieve one's goals, develop one's knowledge and potential, and participate in society.   OECD 2019

Sample questions: Reading

Cow's Milk

Question 2 / 7

Refer to "Farm to Market Dairy" on the right. Click on a choice to answer the question.

What is the main purpose of this text?

○ To argue that milk products increase weight loss.

○ To compare *Farm to Market Dairy* milk products to other dairy products.

○ To inform the public of the risks associated with heart disease.

○ To support the use of *Farm to Market Dairy* products.

Farm to Market

www.farmtomarketdairy.com

FARM TO MARKET DAIRY

About Us   Products   **Nutrition**

The Nutritional Value of Milk: *Countless Benefits!*

Farm to Market Dairy milk products contain key nutrients: calcium, protein, vitamin D, vitamin B12, riboflavin, and potassium. These vitamins and minerals make *Farm to Market Dairy* milk products an important part of a healthful diet. Consuming *Farm to Market Dairy* milk products every day is a great way to ensure that you get the vitamins and minerals your body needs.

Consuming *Farm to Market Dairy* milk products increases weight loss and helps maintain a healthy weight. Milk increases bone strength and density. It even improves cardiovascular health and helps prevent cancer. One glass of milk is packed with vitamins, minerals, and a wealth of health benefits.

According to Bill Sears, MD, Associate Clinical Professor of Pediatrics at the University of California at Irvine, milk contains many important nutrients in one convenient place. The International Dairy Foods Association (IDFA) supports this idea. In fact, the IDFA suggests that many health professionals and groups would also agree.

Milk contains a complete nutrient package of nine essential nutrients. In addition to being an excellent source of calcium and vitamin D, it is a good source of vitamin A, protein and potassium. Dairy is recommended by doctors. Dairy's role in a healthy diet has long been established by the nutrition and science community. This includes the National Osteoporosis Foundation, the Surgeon General, the National Institutes of Health, the American Medical Association's Council of Scientific Affairs and many other leading health organizations.

International Dairy Foods Association, September 27, 2007

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Cow's Milk
Question 4 / 7

Refer to "Just Say No to Cow's Milk!" on the right. Type your answer to the question.

Dr. Garza presents a few research results which may 'surprise' readers.

State one of them.

Farm to Market | **Just Say No**

www.healtharticlestoday.com/milk

HEALTH ARTICLES TODAY

JUST SAY 'NO' TO COW'S MILK!

By Health Reporter, Dr. R. Garza

Cow's milk is a **big** part of many people's lives in the United States. Babies drink cow's milk in bottles. Children eat cereal drenched in cow's milk. Even adults enjoy a cold glass of milk from time to time. Yes, cow's milk is a huge part of the human diet in many places around the world. However, more and more research is suggesting that milk may not "do a body good" as the popular American advertising slogan claims.

The United States Department of Agriculture, the American Dairy Council, Dairy Management, Inc., and other organizations have worked hard to advocate for milk for many years. They encourage adults to drink at least three glasses of milk a day. However, several studies in the last decade have questioned the bone-strengthening power of milk as well as other claims about the health benefits of milk. The results may surprise you.

One of the most recent and most important studies on the effects of drinking milk was published in the October 2014 issue of the *British Medical Journal*. The findings in this study led to some powerful assertions about the consumption of milk. In this study over 100 000 people in Sweden were followed over periods of 20-30 years. Researchers found that the female milk drinkers suffered more bone fractures. Additionally, both male and female milk drinkers were more likely to suffer from heart disease and cancer. These staggering results are similar to findings from other studies.

The Physicians Committee for Responsible Medicine (PCRM) commented on some of the health problems related to the consumption of milk. It claims that milk and dairy products "have little or no benefit for bones." The PCRM goes further to describe some specific problems associated with milk:

Full Credit

Code 1: Quotes or paraphrases one of the following <u>research results</u> stated in the text:
1. Female milk drinkers suffered more bone fractures.
2. Both male and female milk drinkers were more likely to suffer from heart disease and cancer.
   - Women who drank milk had more broken bones.
   - People who drink milk had more heart disease and cancer.

This item asks the student to identify the research results reported in the article and to state one of them. Here, the student needs to represent the literal meaning of information in the article by identifying one of the findings and providing it. Note that in the coding guide used for the Field Trial, there were only two findings that were allowed for this item because there were only two "surprising" <u>research</u> results described. The coding guide that was used in the Field Trial is provided below. This item was coded with high reliability in the Field Trial.

Item Number	CR557Q10
Cognitive Process	Represent literal meaning
Response Format	Open Response – Human Coded
Estimated Level	3
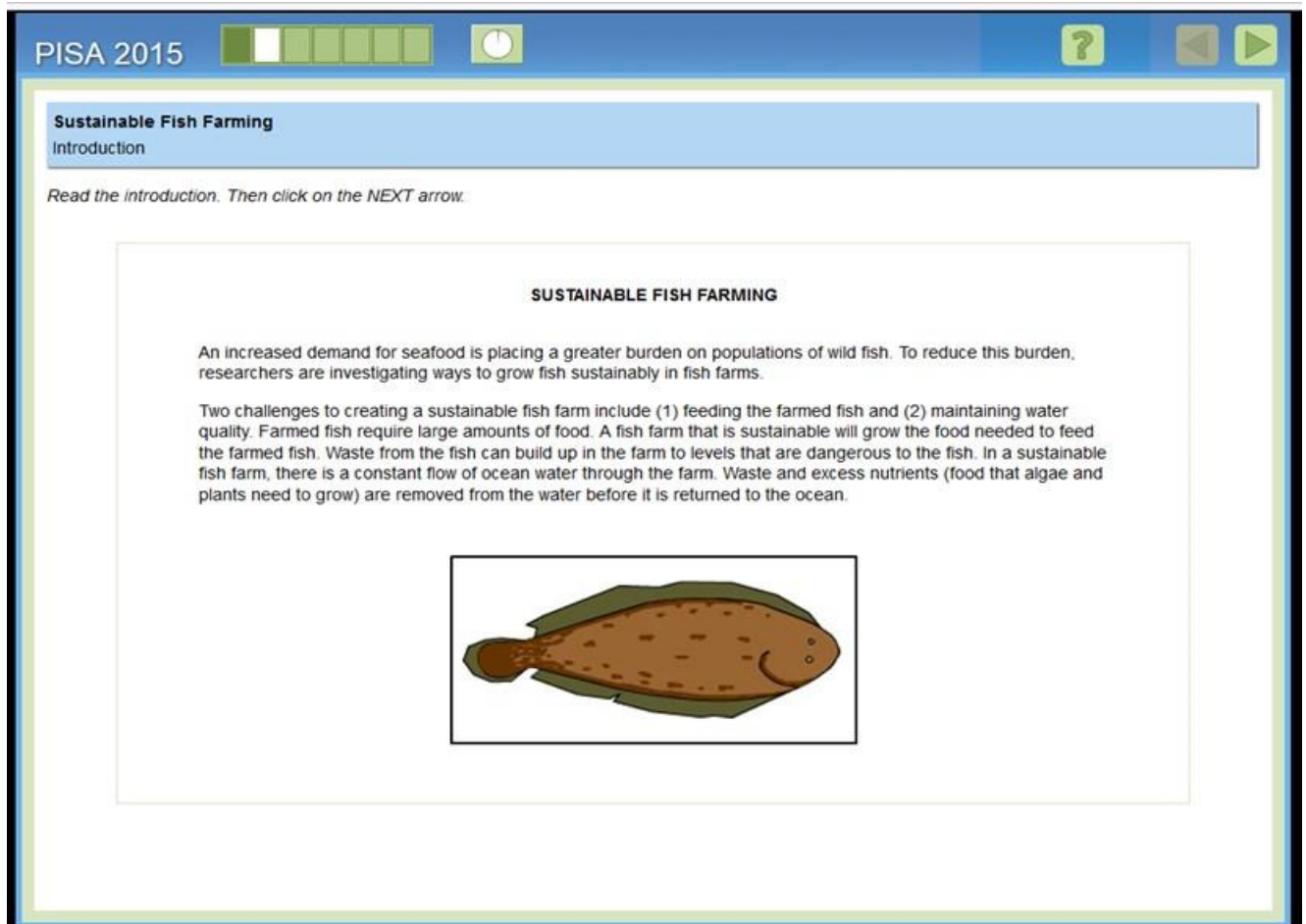
Further examples of released reading items in English can be found at:

Note: The equivalent Welsh language versions of these items have not been released by OECD. However, examples of Welsh language items from previous cycles are available at: https://www.nfer.ac.uk/international/international-comparisons/pisa-cymraeg-2018/cwestiynau-sampl/

A2.2 Science

Science literacy is defined as the ability to engage with science-related issues, and with the ideas of science, as a reflective citizen. A scientifically literate person is willing to engage in reasoned discourse about science and technology, which requires the competencies to explain phenomena scientifically, evaluate and design scientific enquiry, and interpret data and evidence scientifically.   OECD 2019

Sample questions: Science

Sustainable Fish Farming
Question 1 / 3

Refer to the information below. Use drag and drop to answer the question.

The diagram shows a design for an experimental fish farm with three large tanks. Filtered salt water is pumped from the ocean before flowing from tank to tank until it is returned to the ocean. The primary goal of the fish farm is to grow common sole to be harvested in a sustainable way.

- Common Sole: The fish being farmed. Their preferred food is ragworms.

The following organisms will also be used in the farm:

- Microalgae: Microscopic organisms that only need light and nutrients to grow.
- Ragworms: Invertebrates that grow very rapidly on a diet of microalgae.
- Shellfish: Organisms that feed on microalgae and other small organisms in the water.
- Marsh Grass: Grasses that absorb nutrients and wastes from the water.

Water is returned to the ocean.

Water enters the farm from the ocean.

Nutrients are added to this tank.

Filter

Filter

Microalgae

Filter

Filter

Water is cleaned in this tank.

Fish are harvested from this tank.

Filters that allow only microalgae to move through the farm in the flow of water.

The researchers need to decide in which tank each organism should be placed. Drag and drop each of the organisms below to the appropriate tank above to ensure that the Common Sole is fed and that salt water is returned to the ocean unchanged. The microalgae are already in the correct tank.

Common Sole   Ragworms   Shellfish   Marsh Grass

Sustainable Fish Farming
Question 2 / 3

Refer to the information below. Click on a choice to answer the question.

The diagram shows a design for an experimental fish farm with three large tanks. Filtered salt water is pumped from the ocean before flowing from tank to tank until it is returned to the ocean. The primary goal of the fish farm is to grow common sole to be harvested in a sustainable way.

- Common Sole: The fish being farmed. Their preferred food is ragworms.

The following organisms will also be used in the farm:

- Microalgae: Microscopic organisms that only need light and nutrients to grow.
- Ragworms: Invertebrates that grow very rapidly on a diet of microalgae.
- Shellfish: Organisms that feed on microalgae and other small organisms in the water.
- Marsh Grass: Grasses that absorb nutrients and wastes from the water.

Water is returned to the ocean.

Water enters the farm from the ocean.

Nutrients are added to this tank.

Filter

Filter

Filter

Filter

Water is cleaned in this tank.

Fish are harvested from this tank.

Filters that allow only microalgae to move through the farm in the flow of water.

Researchers have noticed that the water that is being returned to the ocean contains a large quantity of nutrients. Adding which of the following to the farm will reduce this problem?

○ More nutrients
○ More ragworms
○ More shellfish
○ More marsh grass

Competency	Explain phenomena scientifically
Knowledge System	Content - Living
Context	Local/ National - Natural Resources
Difficulty	740 - Level 6

For *full* credit the student drags Ragworms and Common Sole into Tank 2 (bottom right) and drags Marsh Grass and Shellfish into Tank 3 (left).

This question requires students to understand a system and the role of several organisms within that system. In order to answer correctly, students must understand the goal of the fish farm, the function of each of the three tanks therein, and which organisms will best fulfill each function. Students must use information provided in the stimulus and the diagram, including a footnote under the diagram. An additional component that adds difficulty is the open-ended nature of the task. Any of the four organisms can be placed in any of the three tanks and there is no restriction on the number of organisms in each tank. As a result, there are multiple ways of getting this incorrect.

OK

Further examples of released science items in English can be found at:
http://www.oecd.org/pisa/pisa-2015-science-assessment-questions.htm

Note: The equivalent Welsh language versions of these items have not been released by OECD. However, examples of Welsh language items from previous cycles are available at: https://www.nfer.ac.uk/international/international-comparisons/pisa-cymraeg-2018/cwestiynau-sampl/

A2.3 Mathematics

Mathematics literacy is defined as pupils' capacity to formulate, employ and interpret mathematics in a variety of contexts. It includes reasoning mathematically and using mathematical concepts, procedures, facts and tools to describe, explain and predict phenomena. OECD 2019

Sample questions: Mathematics

HOLIDAY APARTMENT

Christina finds this holiday apartment for sale on the internet. She is thinking about buying the holiday apartment so that she can rent it out to holiday guests.

Number of rooms:	1 x living and dining room 1 x bedroom 1 x bathroom	Price: 200 000 zeds
Size:	60 square metres (m²)	
Parking spot:	yes	
Travel time to town centre:	10 minutes	
Distance to the beach:	350 metres (m) in a direct line	
Average usage by holiday guests in the last 10 years:	315 days per year	

Question 1: HOLIDAY APARTMENT

To assess the price of the holiday apartment, Christina has asked for an expert's evaluation. To estimate the value of a holiday apartment, the expert uses the following criteria:

Price per m²	Base price:	2500 zeds per m²			
Additional value criteria	Travel time to town centre:	More than 15 minutes: +0 zeds	From 5 to 15 minutes: +10 000 zeds	Less than 5 minutes: +20 000 zeds	
	Distance to beach (in a direct line):	More than 2 km: +0 zeds	From 1 to 2 km: +5000 zeds	From 0.5 to 1 km: +10 000 zeds	Less than 0.5 km: +15 000 zeds
	Parking spot:	No: +0 zeds	Yes: +35 000 zeds		

If the value estimated by the expert is greater than the advertised selling price, the price is considered to be "very good" for Christina as the potential buyer.

Show that based on the expert's criteria, the selling price on offer is "very good" for Christina.

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HOLIDAY APARTMENT SCORING 1

QUESTION INTENT:

Description: Evaluate a number of criteria against the advertised selling price of a holiday apartment

Mathematical content area: Quantity

Context: Societal

Process: Employ

Full Credit

Code 1: A response that shows that the estimated value according to the expert's criteria is 210 000 zeds which is more than 200 000 zeds hence making it a "very good" price. *[The expert's value of 210 000 zeds must be explicitly stated, but the advertised price can be referred to implicitly or explicitly].*

- The expert's total is 210 000 zeds which is greater than the advertised price of 200 000 which means it is a very good price.
- The total of 210 000 zeds is greater than the advertised price.

No Credit

Code 0: Other responses.

Code 9: Missing.

Question 2: HOLIDAY APARTMENT

315 days per year is the average usage of the apartment by holiday guests over the last 10 years.

Decide whether the following statements can be deduced from this information. Circle "Yes" or "No" for each statement.

Statement	Can the statement be deduced from the given data?
It can be said with certainty that the holiday apartment was used on exactly 315 days by holiday guests in at least one of the last 10 years.	Yes / No
Theoretically it is possible that in the last 10 years the apartment was used on more than 315 days every year by holiday guests.	Yes / No
Theoretically it is possible that in one of the last 10 years the apartment was not used at all by holiday guests.	Yes / No

Note: Assume a year has 365 days.

HOLIDAY APARTMENT SCORING 2

QUESTION INTENT:

   Description: Interpret the meaning of a given average value

   Mathematical content area: Uncertainty and data

   Context: Societal

   Process: Interpret

Full Credit

Code 1:   Three correct responses: No, No, Yes, in that order.

No Credit

Code 0:   Other responses.

Further examples of released mathematics items in English can be found at:
https://www.oecd.org/pisa/assessment/PISA%202012%20items%20for%20release_ENGLISH.pdf

Note: The equivalent Welsh language versions of these items have not been released by OECD. However, examples of Welsh language items from previous cycles are available at: https://www.nfer.ac.uk/international/international-comparisons/pisa-cymraeg-2018/cwestiynau-sampl/

A3 What the proficiency levels and PISA scale scores mean

PISA uses proficiency levels to describe the types of skills that pupils are likely to demonstrate and the tasks that they are able to complete. Assessment questions that focus on simple tasks are categorised at lower levels whereas those that are more demanding are categorised at higher levels. The question categorisations are based on both quantitative and qualitative analysis, taking into account question difficulty as well as expert views on the specific cognitive demands of each individual question. All PISA questions have been categorised in this manner.

Pupils described as being at a particular level not only demonstrate the knowledge and skills associated with that level but also the proficiencies required at lower levels. For example, all pupils proficient at Level 3 are also considered to be proficient at Levels 1 and 2. The proficiency level of a pupil is the highest level at which they answer more than half of the questions correctly. Table A1.1 shows the range of score points for each level in each subject.

Table A1.1   PISA proficiency level scale scores

	Reading	Science	Mathematics
Below Level 1c	Below 189		
Level 1c	189-262	Below 260	
Level 1b	262-335	260-335	Below 358
Level 1a	335-407	335-410	358-422
Level 2	407-480	410-484	422-482
Level 3	480-553	484-559	482-545
Level 4	553-626	559-633	545-607
Level 5	626-698	633-708	607-669
Level 6	Above 698	Above 708	Above 669

Source: PISA 2018 database

The mean score for OECD countries for each subject scale was set to 500 in the PISA cycle when the subject was the major domain for the first time. Thus, the reading scale was set to a mean of 500 in its first year in 2000. Similarly, the mathematics scale was set to a mean of 500 in 2003 and the science scale was set to a mean of 500 in 2006. The method by which these scales are derived is explained further in Appendix E and in the PISA Technical Report (OECD, forthcoming).

As with any repeated measurement that uses samples, the mean may vary slightly from cycle to cycle without necessarily indicating any real change in the global level of skills.

Tables A1.2 to A1.4 below describe what pupils can typically do at each proficiency level for the three core subjects: reading, science and mathematics.

Table A1.2   Reading proficiency levels

Level	Percentage of pupils at this level	What pupils can typically do at each level
6	**OECD**: 1% perform tasks at Level 6 **Wales**: 1%	Readers at Level 6 can comprehend lengthy and abstract texts in which the information of interest is deeply embedded and only indirectly related to the task. They can compare, contrast and integrate information representing multiple and potentially conflicting perspectives, using multiple criteria and generating inferences across distant pieces of information to determine how the information may be used. Readers at Level 6 can reflect deeply on the text's source in relation to its content, using criteria external to the text. They can compare and contrast information across texts, identifying and resolving inter-textual discrepancies and conflicts through inferences about the sources of information, their explicit or vested interests, and other cues as to the validity of the information. Tasks at Level 6 typically require the reader to set up elaborate plans, combining multiple criteria and generating inferences to relate the task and the text(s). Materials at this level include one or several complex and abstract text(s), involving multiple and possibly discrepant perspectives. Target information may take the form of details that are deeply embedded within or across texts and potentially obscured by competing information.
5	**OECD**: 9% perform tasks at least at Level 5 **Wales**: 7%	Readers at Level 5 can comprehend lengthy texts, inferring which information in the text is relevant even though the information of interest may be easily overlooked. They can perform causal or other forms of reasoning based on a deep understanding of extended pieces of text. They can also answer indirect questions by inferring the relationship between the

Level	Percentage of pupils at this level	What pupils can typically do at each level
		question and one or several pieces of information distributed within or across multiple texts and sources.
		Reflective tasks require the production or critical evaluation of hypotheses, drawing on specific information. Readers can establish distinctions between content and purpose, and between fact and opinion as applied to complex or abstract statements. They can assess neutrality and bias based on explicit or implicit cues pertaining to both the content and/or source of the information. They can also draw conclusions regarding the reliability of the claims or conclusions offered in a piece of text.
		For all aspects of reading, tasks at Level 5 typically involve dealing with concepts that are abstract or counterintuitive, and going through several steps until the goal is reached. In addition, tasks at this level may require the reader to handle several long texts, switching back and forth across texts in order to compare and contrast information.
4	**OECD**: 28% perform tasks at least at Level 4 **Wales**: 25%	At Level 4, readers can comprehend extended passages in single or multiple-text settings. They interpret the meaning of nuances of language in a section of text by taking into account the text as a whole. In other interpretative tasks, pupils demonstrate understanding and application of ad hoc categories. They can compare perspectives and draw inferences based on multiple sources.
		Readers can search, locate and integrate several pieces of embedded information in the presence of plausible distractors. They can generate inferences based on the task statement in order to assess the relevance of target information. They can handle tasks that require them to memorise prior task context.
		In addition, pupils at this level can evaluate the relationship between specific statements and a person's overall stance or conclusion about a topic. They can reflect on the strategies that authors use to convey their points, based on salient features of texts (e.g. titles and illustrations). They can compare and

Level	Percentage of pupils at this level	What pupils can typically do at each level
		contrast claims explicitly made in several texts and assess the reliability of a source based on salient criteria. Texts at Level 4 are often long or complex, and their content or form may not be standard. Many of the tasks are situated in multiple-text settings. The texts and the tasks contain indirect or implicit cues.
3	**OECD**: 54% perform tasks at least at Level 3 **Wales**: 51%	Readers at Level 3 can represent the literal meaning of single or multiple texts in the absence of explicit content or organisational clues. Readers can integrate content and generate both basic and more advanced inferences. They can also integrate several parts of a piece of text in order to identify the main idea, understand a relationship or construe the meaning of a word or phrase when the required information is featured on a single page. They can search for information based on indirect prompts, and locate target information that is not in a prominent position and/or is in the presence of distractors. In some cases, readers at this level recognise the relationship between several pieces of information based on multiple criteria. Level 3 readers can reflect on a piece of text or a small set of texts, and compare and contrast several authors' viewpoints based on explicit information. Reflective tasks at this level may require the reader to perform comparisons, generate explanations or evaluate a feature of the text. Some reflective tasks require readers to demonstrate a detailed understanding of a piece of text dealing with a familiar topic, whereas others require a basic understanding of less familiar content. Tasks at Level 3 require the reader to take many features into account when comparing, contrasting or categorising information. The required information is often not prominent or there may be a considerable amount of competing information. Texts typical of this level may include other obstacles, such as ideas that are contrary to expectation or negatively worded.

Level	Percentage of pupils at this level	What pupils can typically do at each level
2	**OECD**: 77% perform tasks at least at Level 2 **Wales**: 78%	Readers at Level 2 can identify the main idea in a piece of text of moderate length. They can understand relationships or construe meaning within a limited part of the text when the information is not prominent by producing basic inferences, and/or when the text(s) include some distracting information. They can select and access a page in a set based on explicit though sometimes complex prompts, and locate one or more pieces of information based on multiple, partly implicit criteria. Readers at Level 2 can, when explicitly cued, reflect on the overall purpose, or on the purpose of specific details, in texts of moderate length. They can reflect on simple visual or typographical features. They can compare claims and evaluate the reasons supporting them based on short, explicit statements. Tasks at Level 2 may involve comparisons or contrasts based on a single feature in the text. Typical reflective tasks at this level require readers to make a comparison or several connections between the text and outside knowledge by drawing on personal experience and attitudes.
1a	**OECD**: 92% perform tasks at least at Level 1a **Wales**: 94%	Readers at Level 1a can understand the literal meaning of sentences or short passages. Readers at this level can also recognise the main theme or the author's purpose in a piece of text about a familiar topic, and make a simple connection between several adjacent pieces of information, or between the given information and their own prior knowledge. They can select a relevant page from a small set based on simple prompts, and locate one or more independent pieces of information within short texts. Level 1a readers can reflect on the overall purpose and on the relative importance of information (e.g. the main idea vs. non-essential detail) in simple texts containing explicit cues. Most tasks at this level contain explicit cues regarding what needs to be done, how to do it, and where in the text(s) readers should focus their attention.

Level	Percentage of pupils at this level	What pupils can typically do at each level
1b	**OECD**: 99% perform tasks at least at Level 1b **Wales**: 99%	Readers at Level 1b can evaluate the literal meaning of simple sentences. They can also interpret the literal meaning of texts by making simple connections between adjacent pieces of information in the question and/or the text. Readers at this level can scan for and locate a single piece of prominently placed, explicitly stated information in a single sentence, a short text or a simple list. They can access a relevant page from a small set based on simple prompts when explicit cues are present. Tasks at Level 1b explicitly direct readers to consider relevant factors in the task and in the text. Texts at this level are short and typically provide support to the reader, such as through repetition of information, pictures or familiar symbols. There is minimal competing information.
1c	**OECD**: 100% perform tasks at least at Level 1c **Wales**: 100%	Readers at Level 1c can understand and affirm the meaning of short, syntactically simple sentences on a literal level, and read for a clear and simple purpose within a limited amount of time. Tasks at this level involve simple vocabulary and syntactic structures.

Table A1.3   Science proficiency levels

Level	Percentage of pupils at this level	What pupils can typically do at each level
6	**OECD**: 1% perform tasks at Level 6 **Wales**: 0.2%	At Level 6, pupils can draw on a range of interrelated scientific ideas and concepts from the physical, life, and earth and space sciences and use content, procedural and epistemic knowledge in order to offer explanatory hypotheses of novel scientific phenomena, events and processes or to make predictions. In interpreting data and evidence, they are able to discriminate between relevant and irrelevant information and can draw on knowledge external to the normal school curriculum. They can distinguish between arguments that are based on scientific evidence and theory and those based on other considerations. Level 6 pupils can evaluate competing designs of complex experiments, field studies or simulations and justify their choices.
5	**OECD**: 7% perform tasks at least at Level 5 **Wales**: 4%	At Level 5, pupils can use abstract scientific ideas or concepts to explain unfamiliar and more complex phenomena, events and processes involving multiple causal links. They are able to apply more sophisticated epistemic knowledge to evaluate alternative experimental designs and justify their choices and use theoretical knowledge to interpret information or make predictions. Level 5 pupils can evaluate ways of exploring a given question scientifically and identify limitations in interpretations of data sets including sources and the effects of uncertainty in scientific data.
4	**OECD**: 25% perform tasks at least at Level 4 **Wales**: 22%	At Level 4, pupils can use more complex or more abstract content knowledge, which is either provided or recalled, to construct explanations of more complex or less familiar events and processes. They can conduct experiments involving two or more independent variables in a constrained context. They are able to justify an experimental design, drawing on elements of procedural and epistemic knowledge. Level 4 pupils can interpret data drawn from a moderately complex data set or less familiar context, draw appropriate conclusions that go beyond the data and provide justifications for their choices.

Level	% at this level	What pupils can typically do at each level
3	**OECD**: 52% perform tasks at least at Level 3 **Wales**: 52%	At Level 3, pupils can draw upon moderately complex content knowledge to identify or construct explanations of familiar phenomena. In less familiar or more complex situations, they can construct explanations with relevant cueing or support. They can draw on elements of procedural or epistemic knowledge to carry out a simple experiment in a constrained context. Level 3 pupils are able to distinguish between scientific and non-scientific issues and identify the evidence supporting a scientific claim.
2	**OECD**: 78% perform tasks at least at Level 2 **Wales**: 80%	At Level 2, pupils are able to draw on everyday content knowledge and basic procedural knowledge to identify an appropriate scientific explanation, interpret data, and identify the question being addressed in a simple experimental design. They can use basic or everyday scientific knowledge to identify a valid conclusion from a simple data set. Level 2 pupils demonstrate basic epistemic knowledge by being able to identify questions that can be investigated scientifically.
1a	**OECD**: 94% perform tasks at least at Level 1a **Wales**: 95%	At Level 1a, pupils are able to use basic or everyday content and procedural knowledge to recognise or identify explanations of simple scientific phenomena. With support, they can undertake structured scientific enquiries with no more than two variables. They are able to identify simple causal or correlational relationships and interpret graphical and visual data that require a low level of cognitive demand. Level 1a pupils can select the best scientific explanation for given data in familiar personal, local and global contexts.
1b	**OECD**: 99% perform tasks at least at Level 1b **Wales**: 99%	At Level 1b, pupils can use basic or everyday scientific knowledge to recognise aspects of familiar or simple phenomena. They are able to identify simple patterns in data, recognise basic scientific terms and follow explicit instructions to carry out a scientific procedure.

Table A1.4   Mathematics proficiency levels

Level	Percentage at this level	What pupils can typically do at each level
6	**OECD**: 2% perform tasks at Level 6 **Wales**: 1%	At Level 6, pupils can conceptualise, generalise and utilise information based on their investigations and modelling of complex problem situations, and can use their knowledge in relatively non-standard contexts. They can link different information sources and representations together and flexibly translate amongst them. Pupils at this level are capable of advanced mathematical thinking and reasoning. These pupils can apply this insight and understanding, along with a mastery of symbolic and formal mathematical operations and relationships, to develop new approaches and strategies for attacking novel situations. Pupils at this level can reflect on their actions, and can formulate and precisely communicate their actions and reflections regarding their findings, interpretations, arguments, and the appropriateness of these to the original situation.
5	**OECD**: 11% perform tasks at least at Level 5 **Wales**: 7%	At Level 5, pupils can develop and work with models for complex situations, identifying constraints and specifying assumptions. They can select, compare and evaluate appropriate problem-solving strategies for dealing with complex problems related to these models. Pupils at this level can work strategically using broad, well-developed thinking and reasoning skills, appropriate linked representations, symbolic and formal characterisations, and insight pertaining to these situations. Pupils at this level have begun to develop the ability to reflect on their work and to communicate conclusions and interpretations in written form.

Level	Percentage at this level	What pupils can typically do at each level
4	**OECD**: 29% perform tasks at least at Level 4 **Wales**: 25%	At Level 4, pupils can work effectively with explicit models for complex, concrete situations that may involve constraints or call for making assumptions. They can select and integrate different representations, including symbolic representations, linking them directly to aspects of real-world situations. Pupils at this level can utilise their limited range of skills and can reason with some insight, in straightforward contexts. They can construct and communicate explanations and arguments based on their interpretations, arguments and actions.
3	**OECD**: 54% perform tasks at least at Level 3 **Wales**: 53%	At Level 3, pupils can execute clearly described procedures, including those that require sequential decisions. Their interpretations are sufficiently sound to be a base for building a simple model or for selecting and applying simple problem-solving strategies. Pupils at this level can interpret and use representations based on different information sources and reason directly from them. They typically show some ability to handle percentages, fractions and decimal numbers, and to work with proportional relationships. Their solutions reflect that they have engaged in basic interpretation and reasoning.
2	**OECD**: 76% perform tasks at least at Level 2 **Wales**: 79%	At Level 2, pupils can interpret and recognise situations in contexts that require no more than direct inference. They can extract relevant information from a single source and make use of a single representational mode. Pupils at this level can employ basic algorithms, formulae, procedures or conventions to solve problems involving whole numbers. They are capable of making literal interpretations of results.

Level	Percentage at this level	What pupils can typically do at each level
1	**OECD**: 91% perform tasks at least at Level 1 **Wales**: 94%	At Level 1, pupils can answer questions involving familiar contexts where all relevant information is present and the questions are clearly defined. They are able to identify information and carry out routine procedures according to direct instructions in explicit situations. They can perform actions that are almost always obvious and follow immediately from the given stimuli.

A4 Study administration

The overall administration of PISA 2018 was carried out on behalf of the OECD by an international consortium led by Educational Testing Service (ETS).

National Centre

The international consortium worked with PISA National Centres within each country, through the National Project Manager (NPM). For England, Wales, Northern Ireland and Scotland, the National Foundation for Educational Research (NFER) was the PISA National Centre.

National Centres were responsible for making local adaptations to instruments and manuals, and for translation where necessary. NFER made appropriate adaptations to all PISA instruments and accompanying documentation, ensuring the language and terminology used in the cognitive instruments was appropriate for UK pupils (for example, use of metric measures not imperial, use of British words, spellings or colloquialisms, referring to UK school year groups or study programmes). They also conducted a series of checks and assessments on the electronic Student Delivery System (SDS) to ensure that it functioned as intended. All materials were translated into Welsh and pupils in Wales were assigned assessments and questionnaires according to the relevant language of instruction.

Sampling

School samples were selected by the PISA international consortium, and National Centres were responsible for supplying the information to allow them to select the sample of schools. Samples of pupils within participating schools were selected by NFER using software supplied by the consortium.

Administration in schools

PISA was conducted in schools by study administrators employed and trained by NFER.

During the administration of the study in schools, pupils accessed the computer-based assessments using a unique ID and password. When logging into the electronic student delivery system (SDS), the ID automatically allocated specific clusters of questions to each pupil. As a result, different pupils did not see all the same set of questions. All pupils received reading questions[81], and may also have been presented with science

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[81] Allocated according to the 2018 multi-stage adaptive design described in section A1

and/or mathematics questions so that overall, across the country, full coverage of the assessment framework in each subject was achieved.

In addition to the assessments in the core subjects, there were also school and pupil questionnaires. The pupil questionnaire consisted of a core set of questions asked in all participating countries.

Assessments and questionnaires were generally administered to pupils in a single session, with a two hour period for the assessments and approximately 45 minutes for completion of the pupil questionnaire. The total length of an administration session in school, including set up and close down, was around three and a half hours to 4 hours.

The pupils included in the PISA study are generally described as '15-year-olds'. Specifically, the sample consisted of pupils aged from 15 years and 3 months to 16 years and 2 months at the beginning of the PISA assessment period.

Countries were generally required to carry out the study during an eight-week period between March and August 2018. However, as in previous cycles, England, Wales and Northern Ireland were permitted to test outside this period because of the problems for schools caused by the overlap with GCSE preparation and other examinations. In England, Wales and Northern Ireland the study took place in October 2018 to January 2019[82]. Scotland also tested in November/December, for the first time, in 2018.

A5 The PISA sample in Wales

Countries must follow strict international sampling procedures to ensure comparability of national samples.

In each country participating in PISA, the minimum number of participating schools was 150, and the minimum number of pupils 4,500; in some countries, the numbers exceeded these. In some cases this was due to the need to over-sample some parts of the country. In the case of the UK, for example, larger samples were drawn for Wales, Scotland and Northern Ireland than would be required for a representative UK sample. This was to make it possible to provide separate PISA results for the 4 constituent countries of the UK. In some countries, additional samples were drawn for other purposes, for example, to enable reporting of results for a sub-group such as a separate language group. In very

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[82] A short time extension to the testing window was granted due to technical issues experienced by many schools. This was partly due to anomalies with the diagnostic assessment failing to detect issues with launching the SDS.

small countries with fewer than 150 schools, the study was completed as a school census with all appropriate schools included.

Selecting schools for the sample

To ensure the sample is properly representative of the country as a whole, key characteristics of the total population of schools such as school type, and region, must be taken into account. The first stage of sampling, therefore, was agreement of the school stratification variables to be used for each country. Table A1.5 shows the variables which were used for sampling of schools in Wales for PISA 2018.

Table A1.5   Stratification variables

Stratification Variable	Explicit or Implicit	Level Names
Country	Explicit	Wales
School type	Explicit	• maintained • independent
Region	Explicit	• North Wales/GwE • South West and Mid Wales/ERW • Central South Wales • South East Wales
Gender	Implicit	• male • mixed • female
School performance	Implicit	Five bands: Based on no. of pupils with 5+ A*-C or equivalent GCSEs including English/Welsh or Mathematics (KS4 2016) • Lowest band • 2nd lowest band • 2nd highest band • Highest band Missing data/not applicable
Local authority	Implicit	22 LAs for Wales

Note: Due to some small strata (with 3 or fewer schools), the consortium advised that some strata should be collapsed to avoid strata with no replacement schools and schools which will have almost certainly been selected in previous surveys and would be selected in future surveys if the same strata were maintained.

Countries are allowed to exempt schools from the sampling frame if it is expected that the majority of pupils would not be eligible to participate in PISA. Special schools, hospital schools, secure units and international immersion schools were excluded on this basis.

Following agreement of the sampling plan and the establishment of population estimates in the age group, the list of all eligible schools and their populations was sent to the PISA consortium. The consortium examined and approved the sampling frame then carried out the school sampling.

The PISA study has strict sampling requirements regarding both the acceptable participation rate and the methodology for the replacement of any schools which decline to participate. Within each country, three separate samples are selected, the first being the main sample and the other two back-up samples. In the back-up samples each school is a replacement for a specific school in the main sample. So, if a main sample school declines to participate, there are two other schools which can be used as replacements for that school.

The schools which had been selected in the main sample were invited to participate, and replacement schools were invited as necessary for any schools in the main sample which declined to participate. Information on all eligible pupils, (those who would be within the PISA age range at the time of the PISA assessment period in November/December 2018) was then collected either centrally from the National Pupil Database or, in some cases, directly from schools.

The Keyquest software supplied by the PISA consortium was used to randomly select 40 pupils within each school from those who met the PISA age definition.

School and pupil response rates

According to the PISA sampling rules, 85% of main sample schools are required to participate. If this percentage is achieved, it is not necessary to replace non-participating schools. If the response from the main sample is below 85% but above 65%, it is still possible to achieve an acceptable response rate by using replacement schools from the back-up samples. However, the target then moves upwards – for example, with a main sample response of 70%, the after-replacement target is 93% (rather than 85%).

There is also a response rate requirement for pupils within each school. It is possible for pupils to be excluded from participation and not counted within the total because they have special needs such that they could not participate, because they have limited language skills, or because they are no longer at the school. The remaining pupils are deemed eligible for PISA participation, and at least 50% of these must participate for the school to be counted as a participating school.

The international response rate for the United Kingdom is calculated based on the results for England, Wales, Northern Ireland and Scotland, with weighting according to the population in each country as well as school size.

The weighted school response rate for the UK as a whole[83] was 72.9% of main sample schools, and 86.6% after replacement. Table A1.6 shows the response rates for each country. Table A1.7 gives the numbers of participating schools and pupils across the UK and Table A1.8 shows the response rates by country for the school questionnaire.

Table A1.6   School and pupil response rates by country

	School response rate before replacement	**School response rate after replacement**	**Pupil response rate**
England	71.7%	86.3%	83.2%
Northern Ireland	65.7%	77.1%	83.7%
Wales	78.1%	89.3%	85.5%
Scotland	86.5%	92.2%	80.5%
UK overall	**72.9%**	**86.6%**	**83.1%**

As the figures did not fully meet the PISA 2018 participation requirements, a non-response bias analysis was required to examine whether the final set of participating schools were representative of the overall sample of schools and ensure that no significant differences were found between the balance of stratification variables in the achieved sample and the original, planned sample. The OECD's Technical Advisory Group was satisfied that this analysis demonstrated that no notable bias would result from the non-response. The OECD therefore agreed that the UK data should be included as fully comparable to other countries' data in the international reports.

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[83] Scotland participated in PISA as a separate adjudicated entity and met the sampling requirements.

There was also a requirement for 80% of selected pupils to participate in PISA. Across England, Wales, Northern Ireland and Scotland, the pupil response rate target was met with a final weighted response rate of 83.1%.

Table A1.7   Numbers of participating schools and pupils by country

	Number of participating schools	**Number of participating pupils**
England	170	5,174
Northern Ireland	75	2,360
Wales	107	3,165
Scotland	107	2,969
UK overall	459	13,688

Table A1.8   School questionnaire response rates by country

	Unweighted response rates for the school questionnaire
England	75%
Northern Ireland	83%
Wales	92%
Scotland	81%

Appendix B Reading Tables

Table B1.1 Mean score and variation in reading performance

	Mean score		Standard deviation		10th percentile		Median (50th)		90th percentile	
	Mean	S.E.	S.D.	S.E.	Score	S.E.	Score	S.E.	Score	S.E.
B-S-J-Z (China)	555	(2.7)	87	(1.7)	441	(4.2)	559	(2.9)	666	(3.5)
Singapore	549	(1.6)	109	(1.0)	398	(3.9)	559	(2.1)	684	(2.5)
Macao (China)	525	(1.2)	92	(1.1)	403	(3.2)	530	(1.7)	641	(3.0)
Hong Kong (China)	524	(2.7)	99	(1.5)	390	(5.5)	533	(2.9)	645	(2.5)
Estonia	523	(1.8)	93	(1.2)	402	(3.5)	524	(2.3)	643	(3.1)
Canada	520	(1.8)	100	(0.8)	388	(2.4)	524	(2.2)	646	(2.3)
Finland	520	(2.3)	100	(1.3)	387	(4.2)	527	(2.8)	643	(3.0)
Republic of Ireland	518	(2.2)	91	(1.0)	398	(3.5)	520	(2.4)	635	(2.8)
Korea	514	(2.9)	102	(1.7)	377	(4.9)	522	(3.1)	640	(3.9)
Poland	512	(2.7)	97	(1.4)	384	(3.6)	515	(3.3)	636	(4.0)
Sweden	506	(3.0)	108	(1.5)	360	(5.7)	512	(3.4)	640	(3.5)
New Zealand	506	(2.0)	106	(1.3)	362	(3.7)	511	(2.9)	640	(2.9)
United States	505	(3.6)	108	(1.6)	361	(5.3)	510	(4.1)	643	(3.9)
England	505	(3.0)	101	(1.5)	372	(5.2)	508	(3.2)	634	(4.1)
Scotland	504	(3.0)	95	(1.9)	383	(3.6)	503	(3.7)	627	(4.7)
United Kingdom	504	(2.6)	100	(1.3)	372	(4.3)	506	(2.7)	632	(3.5)
Japan	504	(2.7)	97	(1.7)	374	(4.5)	508	(3.0)	627	(3.7)
Australia	503	(1.6)	109	(0.9)	357	(2.8)	507	(1.9)	640	(2.2)
Chinese Taipei	503	(2.8)	102	(1.5)	367	(3.8)	508	(3.1)	630	(3.8)

	Mean score		Standard deviation		10th percentile		Median (50th)		90th percentile	
	Mean	S.E.	S.D.	S.E.	Score	S.E.	Score	S.E.	Score	S.E.
Denmark	501	(1.8)	92	(1.2)	380	(3.0)	504	(2.2)	618	(2.6)
Northern Ireland	501	(4.0)	98	(2.2)	368	(5.8)	506	(5.0)	623	(5.6)
Norway	499	(2.2)	106	(1.3)	356	(4.3)	506	(2.7)	632	(2.9)
Germany	498	(3.0)	106	(1.5)	354	(4.5)	504	(4.1)	632	(3.5)
Slovenia	495	(1.2)	94	(1.2)	372	(3.0)	499	(1.9)	614	(2.8)
Belgium	493	(2.3)	103	(1.3)	352	(3.8)	498	(2.7)	623	(2.6)
France	493	(2.3)	101	(1.5)	355	(3.5)	497	(3.0)	622	(3.6)
Portugal	492	(2.4)	96	(1.2)	362	(4.0)	497	(2.9)	613	(2.7)
Czech Republic	490	(2.5)	97	(1.6)	362	(4.3)	492	(3.0)	616	(2.8)
OECD Average	487	(0.4)	99	(0.2)	354	(0.7)	490	(0.5)	614	(0.5)
Netherlands	485	(2.7)	105	(1.7)	344	(4.4)	486	(3.7)	621	(3.3)
Austria	484	(2.7)	99	(1.2)	350	(3.7)	488	(3.8)	612	(2.9)
Switzerland	484	(3.1)	103	(1.5)	345	(4.6)	488	(3.6)	615	(4.0)
Wales	483	(4.0)	97	(1.6)	359	(5.8)	484	(4.3)	608	(4.5)
Croatia	479	(2.7)	89	(1.7)	362	(4.6)	480	(3.2)	594	(3.2)
Latvia	479	(1.6)	90	(1.1)	360	(3.2)	480	(2.2)	595	(2.7)
Russian Federation	479	(3.1)	93	(1.8)	357	(4.8)	480	(3.4)	597	(3.6)
Italy	476	(2.4)	97	(1.7)	345	(4.6)	481	(2.9)	598	(3.4)
Hungary	476	(2.3)	98	(1.3)	346	(4.0)	479	(3.1)	602	(3.7)
Lithuania	476	(1.5)	94	(1.0)	351	(2.7)	479	(2.3)	597	(1.8)
Iceland	474	(1.7)	105	(1.3)	332	(4.0)	477	(2.7)	609	(3.3)
Belarus	474	(2.4)	89	(1.3)	355	(3.4)	475	(3.0)	589	(3.1)

	Mean score		Standard deviation		10th percentile		Median (50th)		90th percentile	
	Mean	S.E.	S.D.	S.E.	Score	S.E.	Score	S.E.	Score	S.E.
Israel	470	(3.7)	124	(1.9)	296	(5.9)	479	(4.9)	628	(3.7)
Luxembourg	470	(1.1)	108	(1.0)	325	(2.1)	472	(1.8)	612	(2.8)
Ukraine	466	(3.5)	93	(1.7)	340	(5.2)	472	(3.5)	582	(3.8)
Turkey	466	(2.2)	88	(1.6)	351	(4.1)	466	(2.6)	581	(3.1)
Slovak Republic	458	(2.2)	100	(1.4)	326	(4.0)	458	(2.9)	590	(3.3)
Greece	457	(3.6)	97	(1.6)	326	(4.9)	460	(4.1)	583	(3.9)
Chile	452	(2.6)	92	(1.2)	331	(3.6)	453	(3.2)	572	(3.3)
Mexico	420	(2.7)	84	(1.6)	314	(3.5)	419	(2.9)	530	(4.2)
Colombia	412	(3.3)	89	(1.5)	300	(3.7)	408	(3.8)	532	(4.7)

Source: PISA 2018 database

Table B1.2   Mean score and variation in the cognitive process subscale of reading: 'locate information'

	Mean score		Standard deviation		10th percentile		Median (50th)		90th percentile	
	Mean	S.E.	S.D.	S.E.	Score	S.E.	Score	S.E.	Score	S.E.
Australia	499	(2.2)	107	(1.3)	355	(3.4)	505	(2.5)	634	(3.0)
Austria	480	(2.9)	103	(1.6)	341	(4.9)	485	(3.3)	611	(2.8)
Belarus	480	(2.7)	95	(1.6)	354	(3.9)	483	(3.2)	600	(3.6)
Belgium	498	(2.6)	104	(1.8)	357	(4.1)	504	(3.1)	629	(2.9)
B-S-J-Z (China)	553	(3.1)	93	(2.0)	432	(4.7)	555	(3.4)	670	(4.0)
Canada	517	(2.3)	100	(1.4)	387	(3.0)	521	(2.6)	642	(3.4)
Chinese Taipei	499	(3.2)	106	(1.7)	358	(4.3)	506	(3.6)	631	(4.3)
Colombia	404	(3.6)	95	(1.9)	284	(4.6)	400	(4.1)	530	(4.8)
Croatia	478	(3.0)	98	(2.0)	348	(5.2)	481	(3.5)	603	(3.8)
Czech Republic	492	(2.9)	104	(2.4)	356	(5.6)	495	(3.5)	625	(4.3)
Denmark	501	(2.3)	94	(1.4)	377	(4.1)	505	(2.8)	619	(3.5)
England	507	(3.4)	106	(1.8)	370	(5.6)	511	(3.5)	639	(4.1)
Estonia	529	(2.2)	92	(1.3)	409	(4.1)	530	(2.7)	645	(2.8)
Finland	526	(2.5)	102	(1.9)	389	(5.0)	533	(2.8)	651	(2.9)
France	496	(2.9)	110	(2.0)	348	(4.2)	502	(3.7)	633	(4.6)
Germany	498	(3.4)	113	(1.8)	346	(5.1)	503	(4.0)	642	(4.0)
Greece	458	(3.8)	103	(2.0)	319	(6.5)	464	(4.3)	587	(3.7)
Hong Kong (China)	528	(3.1)	101	(1.6)	391	(6.2)	537	(3.3)	650	(3.5)
Hungary	471	(2.4)	98	(1.4)	338	(3.7)	476	(3.1)	594	(3.3)

	Mean score		Standard deviation		10th percentile		Median (50th)		90th percentile	
	Mean	S.E.	S.D.	S.E.	Score	S.E.	Score	S.E.	Score	S.E.
Iceland	482	(1.9)	106	(1.5)	338	(4.0)	486	(2.6)	616	(4.0)
Israel	461	(4.1)	130	(2.4)	279	(6.9)	471	(5.2)	624	(4.0)
Italy	470	(2.9)	106	(2.1)	329	(5.3)	476	(3.1)	600	(3.9)
Japan	499	(2.8)	98	(1.9)	370	(4.9)	504	(3.3)	621	(3.5)
Korea	521	(3.1)	106	(2.1)	378	(5.5)	529	(3.0)	650	(3.9)
Latvia	483	(2.4)	95	(1.3)	358	(3.1)	484	(2.8)	607	(2.9)
Lithuania	474	(2.0)	98	(1.3)	343	(4.2)	478	(2.4)	598	(3.0)
Luxembourg	470	(1.5)	109	(1.4)	324	(3.3)	474	(2.8)	608	(2.6)
Macao (China)	529	(1.6)	88	(1.2)	413	(3.0)	533	(1.9)	639	(3.4)
Malta	453	(2.2)	116	(1.6)	293	(4.6)	461	(3.0)	597	(3.8)
Mexico	416	(3.1)	88	(1.8)	302	(4.0)	415	(3.4)	530	(4.5)
Netherlands	500	(3.0)	102	(2.1)	363	(5.3)	504	(4.1)	631	(4.3)
New Zealand	506	(2.5)	106	(1.7)	363	(4.6)	512	(3.0)	638	(3.7)
Northern Ireland	505	(5.4)	99	(2.3)	372	(7.6)	510	(5.8)	631	(5.7)
Norway	503	(2.6)	108	(1.6)	356	(4.5)	509	(3.0)	638	(3.7)
Poland	514	(2.8)	101	(1.7)	383	(3.6)	517	(3.1)	641	(4.0)
Portugal	489	(2.9)	102	(1.6)	352	(4.7)	495	(3.5)	616	(3.6)
Republic of Ireland	521	(2.3)	92	(1.4)	398	(3.9)	525	(2.6)	636	(3.3)
Russian Federation	479	(3.6)	101	(2.3)	348	(6.3)	482	(4.0)	608	(4.3)
Scotland	507	(5.3)	104	(4.2)	372	(8.7)	510	(4.9)	639	(9.4)

	Mean score		Standard deviation		10th percentile		Median (50th)		90th percentile	
	Mean	S.E.	S.D.	S.E.	Score	S.E.	Score	S.E.	Score	S.E.
Singapore	553	(1.7)	105	(1.3)	409	(4.1)	563	(1.9)	680	(2.1)
Slovak Republic	461	(2.6)	105	(1.7)	322	(5.2)	465	(3.0)	593	(4.6)
Slovenia	498	(1.6)	101	(1.3)	365	(3.0)	502	(2.8)	624	(2.8)
Sweden	511	(3.1)	108	(1.9)	365	(5.5)	518	(3.6)	645	(3.6)
Switzerland	483	(3.4)	106	(2.0)	340	(5.3)	488	(4.0)	616	(4.4)
Turkey	463	(2.4)	89	(1.9)	346	(4.6)	464	(2.5)	576	(4.2)
United Kingdom	507	(3.0)	105	(1.5)	370	(4.8)	510	(3.0)	638	(3.6)
United States	501	(3.5)	107	(1.9)	357	(5.8)	507	(4.1)	636	(4.6)
Wales	494	(4.4)	96	(1.5)	370	(5.9)	495	(5.1)	617	(5.6)
OECD Average	487	(0.5)	103	(0.3)	350	(0.8)	492	(0.6)	616	(0.6)

Source: PISA 2018 database

Table B1.3   Mean score and variation in the cognitive process subscale of reading: 'understand'

	Mean score		Standard deviation		10th percentile		Median (50th)		90th percentile	
	Mean	S.E.	S.D.	S.E.	Score	S.E.	Score	S.E.	Score	S.E.
Australia	502	(1.7)	112	(0.9)	352	(2.6)	507	(2.1)	643	(2.4)
Austria	481	(2.7)	101	(1.4)	343	(3.7)	485	(3.8)	610	(2.8)
Belarus	477	(2.5)	92	(1.5)	354	(4.2)	480	(3.0)	595	(3.3)
Belgium	492	(2.3)	105	(1.4)	348	(4.0)	497	(2.8)	625	(2.8)
B-S-J-Z (China)	562	(2.8)	87	(1.8)	449	(4.5)	565	(3.2)	670	(3.6)
Canada	520	(1.9)	103	(1.0)	383	(2.8)	523	(2.1)	650	(2.4)
Chile	450	(2.8)	93	(1.4)	327	(3.7)	452	(3.3)	571	(3.2)
Chinese Taipei	506	(3.0)	104	(1.7)	366	(4.2)	512	(3.4)	636	(4.0)
Colombia	413	(3.3)	89	(1.6)	301	(3.7)	408	(4.0)	532	(4.1)
Croatia	478	(2.7)	90	(1.7)	360	(4.3)	480	(3.0)	594	(3.3)
Czech Republic	488	(2.8)	101	(1.7)	354	(4.9)	490	(3.1)	618	(3.4)
Denmark	497	(2.0)	96	(1.2)	371	(3.4)	500	(2.4)	619	(2.9)
England	499	(3.2)	104	(1.7)	363	(4.9)	503	(3.5)	631	(3.6)
Estonia	526	(1.9)	94	(1.4)	403	(3.2)	526	(2.8)	648	(3.3)
Finland	518	(2.4)	103	(1.4)	378	(4.1)	526	(2.9)	645	(2.9)
France	490	(2.5)	105	(1.6)	347	(3.5)	496	(3.3)	623	(3.7)
Germany	494	(3.0)	108	(1.6)	346	(4.5)	500	(3.9)	632	(3.8)
Greece	457	(3.7)	100	(1.7)	322	(5.8)	461	(4.1)	586	(4.0)
Hong Kong (China)	529	(2.9)	102	(1.8)	392	(5.7)	538	(3.0)	653	(2.6)
Hungary	479	(2.4)	99	(1.5)	344	(3.5)	483	(3.4)	606	(3.4)
Iceland	480	(1.8)	104	(1.5)	342	(3.4)	482	(2.8)	615	(3.5)
Israel	469	(3.8)	125	(2.1)	293	(6.7)	476	(5.2)	627	(3.7)
Italy	478	(2.6)	98	(1.9)	345	(5.5)	483	(3.0)	601	(3.3)
Japan	505	(2.8)	101	(1.8)	369	(5.2)	510	(3.4)	632	(3.6)
Korea	522	(3.0)	103	(1.8)	382	(6.3)	530	(3.1)	648	(3.7)

	Mean score		Standard deviation		10th percentile		Median (50th)		90th percentile	
	Mean	S.E.	S.D.	S.E.	Score	S.E.	Score	S.E.	Score	S.E.
Latvia	482	(1.7)	90	(1.0)	364	(3.1)	484	(2.4)	598	(2.8)
Lithuania	475	(1.7)	98	(1.0)	343	(3.2)	479	(2.0)	600	(2.3)
Luxembourg	470	(1.2)	111	(1.1)	321	(2.5)	472	(2.1)	615	(2.9)
Macao (China)	529	(1.6)	92	(1.1)	408	(2.8)	533	(2.0)	644	(2.7)
Mexico	417	(2.8)	84	(1.6)	311	(3.3)	416	(2.9)	527	(4.4)
New Zealand	506	(2.1)	108	(1.6)	359	(3.9)	512	(2.7)	641	(2.7)
Northern Ireland	495	(4.2)	99	(2.2)	361	(6.2)	500	(5.0)	619	(5.5)
Norway	498	(2.3)	108	(1.4)	351	(4.2)	505	(2.9)	635	(2.9)
Poland	514	(2.8)	99	(1.7)	383	(3.6)	517	(3.3)	640	(4.0)
Portugal	489	(2.6)	99	(1.4)	353	(4.4)	496	(3.1)	612	(2.8)
Republic of Ireland	510	(2.4)	93	(1.1)	387	(3.6)	513	(2.6)	628	(3.2)
Russian Federation	480	(3.2)	95	(1.8)	354	(5.3)	483	(3.4)	601	(3.6)
Scotland	499	(3.2)	100	(2.6)	369	(5.4)	499	(3.6)	626	(5.6)
Singapore	548	(1.5)	109	(1.1)	396	(3.7)	558	(1.9)	682	(2.2)
Slovak Republic	458	(2.5)	104	(1.6)	321	(4.1)	458	(2.9)	593	(3.4)
Slovenia	496	(1.2)	95	(1.2)	370	(3.2)	500	(1.8)	615	(2.5)
Sweden	504	(3.1)	107	(1.5)	359	(5.1)	510	(3.5)	639	(3.4)
Switzerland	483	(3.2)	105	(1.5)	342	(4.4)	487	(4.0)	618	(3.7)
Turkey	474	(2.2)	88	(1.6)	358	(3.5)	474	(2.4)	588	(3.6)
United Kingdom	498	(2.7)	103	(1.4)	363	(4.0)	501	(3.0)	629	(3.2)
United States	501	(3.7)	110	(1.5)	353	(5.3)	505	(4.6)	641	(4.4)
Wales	479	(4.2)	97	(1.5)	352	(6.0)	479	(4.6)	603	(5.1)
OECD Average	487	(0.4)	101	(0.2)	351	(0.7)	490	(0.5)	616	(0.6)

Source: PISA 2018 database

Table B1.4 Mean score and variation in the cognitive process subscale of reading: 'evaluate and reflect'

	Mean score		Standard deviation		10th percentile		Median (50th)		90th percentile	
	Mean	S.E.	S.D.	S.E.	Score	S.E.	Score	S.E.	Score	S.E.
Australia	513	(2.1)	117	(1.2)	357	(3.3)	517	(2.6)	660	(2.6)
Belarus	473	(2.7)	93	(1.5)	349	(4.0)	475	(3.0)	592	(4.1)
Belgium	497	(2.8)	110	(1.6)	347	(5.0)	504	(3.4)	634	(3.2)
B-S-J-Z (China)	565	(3.1)	93	(2.1)	443	(5.1)	570	(3.5)	681	(3.9)
Canada	527	(2.2)	108	(1.4)	384	(3.6)	533	(2.6)	662	(3.2)
Chile	456	(3.4)	100	(1.5)	324	(4.0)	456	(3.9)	586	(3.9)
Chinese Taipei	504	(3.1)	104	(1.8)	365	(4.8)	509	(3.6)	636	(4.2)
Colombia	417	(3.7)	98	(1.8)	294	(4.1)	411	(4.5)	550	(5.1)
Croatia	474	(2.9)	95	(1.8)	349	(4.6)	474	(3.4)	597	(3.6)
Czech Republic	489	(2.8)	100	(1.9)	358	(4.9)	490	(3.2)	620	(3.5)
Denmark	505	(2.1)	93	(1.3)	381	(4.0)	508	(2.5)	622	(3.0)
England	513	(3.4)	108	(1.9)	370	(5.1)	516	(3.8)	651	(4.8)
Estonia	521	(2.4)	96	(1.4)	396	(3.4)	523	(2.9)	644	(3.4)
Finland	517	(2.5)	102	(1.6)	381	(3.8)	522	(3.0)	645	(3.3)
France	491	(2.9)	106	(1.8)	348	(4.1)	496	(3.5)	625	(4.2)
Germany	497	(3.3)	110	(2.0)	346	(5.0)	502	(4.4)	635	(3.6)
Greece	462	(4.0)	104	(2.0)	322	(6.1)	465	(4.4)	594	(4.2)
Hong Kong (China)	532	(3.3)	101	(1.7)	393	(5.4)	541	(3.2)	654	(4.0)
Hungary	477	(2.6)	101	(1.5)	343	(3.6)	479	(4.0)	609	(4.3)
Iceland	475	(2.0)	101	(1.3)	337	(3.3)	478	(2.9)	607	(3.0)
Israel	481	(4.2)	128	(2.1)	302	(6.5)	491	(5.3)	642	(4.1)
Italy	482	(2.7)	103	(2.0)	344	(5.0)	487	(3.3)	612	(3.8)
Japan	502	(3.0)	108	(1.9)	357	(5.1)	506	(3.6)	640	(4.0)
Korea	522	(3.5)	109	(2.1)	373	(6.4)	530	(3.6)	655	(4.7)
Latvia	477	(1.7)	91	(1.5)	357	(3.2)	478	(2.2)	595	(3.3)

	Mean score		Standard deviation		10th percentile		Median (50th)		90th percentile	
	Mean	S.E.	S.D.	S.E.	Score	S.E.	Score	S.E.	Score	S.E.
Lithuania	474	(2.0)	99	(1.3)	344	(3.1)	475	(2.8)	603	(3.2)
Luxembourg	468	(1.4)	115	(1.5)	315	(3.2)	469	(2.1)	620	(3.4)
Macao (China)	534	(1.6)	95	(1.4)	407	(3.5)	539	(2.0)	652	(2.8)
Mexico	426	(3.1)	89	(2.0)	314	(3.6)	423	(3.4)	542	(5.2)
Netherlands	476	(3.7)	123	(3.1)	308	(7.8)	486	(4.2)	628	(4.2)
New Zealand	509	(2.6)	113	(1.4)	355	(4.5)	514	(3.1)	651	(3.0)
Northern Ireland	504	(5.8)	102	(2.4)	367	(7.7)	509	(6.8)	633	(7.2)
Norway	502	(2.6)	106	(1.5)	359	(5.0)	507	(3.0)	637	(3.0)
Poland	514	(2.9)	99	(1.9)	384	(4.1)	517	(3.6)	640	(4.5)
Portugal	494	(2.6)	102	(2.0)	356	(4.8)	499	(3.1)	623	(4.3)
Republic of Ireland	519	(2.5)	97	(1.2)	391	(3.5)	520	(3.0)	645	(3.1)
Russian Federation	479	(3.3)	95	(1.8)	356	(4.9)	480	(3.5)	602	(4.4)
Scotland	503	(4.7)	107	(3.9)	364	(7.4)	504	(4.9)	639	(7.9)
Singapore	561	(2.1)	117	(1.4)	400	(4.1)	570	(2.4)	705	(2.7)
Slovak Republic	457	(2.6)	103	(2.0)	322	(4.8)	459	(3.0)	591	(3.9)
Slovenia	494	(1.5)	96	(1.6)	367	(3.5)	497	(2.0)	618	(3.6)
Sweden	512	(3.4)	111	(1.8)	362	(5.3)	516	(4.0)	653	(3.6)
Switzerland	482	(3.4)	106	(1.7)	340	(4.5)	485	(4.3)	621	(4.5)
Turkey	475	(2.5)	96	(1.9)	348	(4.2)	475	(2.9)	600	(4.5)
United Kingdom	511	(2.9)	108	(1.8)	369	(4.4)	513	(3.2)	648	(4.2)
United States	511	(4.2)	114	(2.0)	355	(5.9)	516	(4.6)	656	(4.9)
Wales	492	(4.5)	100	(2.1)	361	(5.6)	493	(4.8)	620	(5.5)
OECD Average	489	(0.5)	105	(0.3)	349	(0.8)	493	(0.6)	623	(0.6)

Source: PISA 2018 database

Table B1.5   Mean score and variation in the text structure subscale of reading: 'single'

	Mean score		Standard deviation		10th percentile		Median (50th)		90th percentile	
	Mean	S.E.	S.D.	S.E.	Score	S.E.	Score	S.E.	Score	S.E.
Australia	502	(1.8)	113	(1.1)	350	(2.8)	507	(2.1)	644	(2.3)
Austria	478	(2.7)	104	(1.4)	338	(3.5)	483	(3.5)	611	(3.4)
Belarus	474	(2.5)	93	(1.4)	349	(3.6)	478	(3.3)	591	(3.4)
Belgium	491	(2.4)	105	(1.4)	348	(3.9)	497	(2.9)	624	(2.6)
B-S-J-Z (China)	556	(3.0)	90	(1.8)	440	(4.9)	560	(3.2)	669	(3.6)
Canada	521	(1.9)	103	(1.1)	385	(2.9)	524	(2.1)	650	(2.8)
Chinese Taipei	501	(2.9)	105	(1.7)	360	(4.0)	507	(3.4)	632	(4.2)
Colombia	411	(3.4)	92	(1.5)	296	(3.6)	408	(4.0)	534	(4.5)
Croatia	475	(2.7)	90	(1.8)	356	(4.6)	477	(3.0)	591	(3.3)
Czech Republic	484	(2.8)	101	(1.9)	348	(5.2)	487	(3.0)	613	(3.0)
Denmark	496	(2.0)	96	(1.2)	370	(3.6)	500	(2.6)	618	(3.3)
England	500	(3.2)	105	(1.9)	361	(5.2)	503	(3.4)	632	(4.3)
Estonia	522	(1.9)	92	(1.3)	402	(3.6)	523	(2.3)	640	(3.3)
Finland	518	(2.5)	103	(1.4)	378	(4.1)	525	(2.9)	646	(3.3)
France	486	(2.6)	109	(1.6)	338	(4.0)	493	(3.1)	623	(3.6)
Germany	494	(3.2)	111	(1.7)	343	(5.0)	501	(4.0)	633	(3.6)
Greece	459	(3.8)	103	(1.9)	320	(6.5)	464	(4.1)	589	(3.9)
Hong Kong (China)	529	(3.0)	99	(1.8)	394	(5.9)	539	(3.4)	649	(3.2)
Hungary	474	(2.3)	97	(1.5)	341	(3.4)	479	(3.1)	596	(3.5)
Iceland	479	(1.8)	106	(1.3)	337	(4.1)	482	(2.7)	616	(3.1)
Israel	469	(3.9)	128	(2.1)	290	(6.9)	480	(5.1)	630	(3.4)
Italy	474	(2.6)	99	(1.8)	341	(5.0)	480	(2.8)	598	(3.3)
Japan	499	(2.8)	101	(1.9)	363	(5.0)	504	(3.1)	626	(3.5)
Korea	518	(3.1)	106	(1.8)	374	(6.1)	527	(3.3)	646	(3.9)
Latvia	479	(1.6)	89	(1.1)	361	(2.8)	481	(2.3)	592	(2.5)

	Mean score		Standard deviation		10th percentile		Median (50th)		90th percentile	
	Mean	S.E.	S.D.	S.E.	Score	S.E.	Score	S.E.	Score	S.E.
Lithuania	474	(1.7)	99	(1.1)	340	(3.2)	479	(2.2)	599	(2.3)
Luxembourg	464	(1.2)	113	(1.2)	312	(2.5)	467	(2.0)	612	(3.6)
Macao (China)	529	(1.3)	92	(1.1)	408	(3.1)	534	(2.0)	644	(3.0)
Mexico	419	(2.9)	86	(1.8)	311	(3.5)	417	(3.1)	531	(4.5)
Netherlands	488	(2.8)	106	(1.9)	346	(5.4)	491	(3.6)	624	(3.2)
New Zealand	504	(2.2)	110	(1.3)	353	(4.3)	510	(2.6)	641	(3.0)
Northern Ireland	495	(4.7)	98	(2.3)	361	(5.9)	500	(5.7)	619	(6.9)
Norway	498	(2.4)	109	(1.3)	350	(5.1)	505	(2.7)	633	(3.0)
Poland	512	(2.8)	100	(1.7)	380	(3.8)	516	(3.3)	638	(4.4)
Portugal	487	(2.6)	101	(1.5)	349	(4.3)	495	(3.1)	613	(3.2)
Republic of Ireland	513	(2.5)	95	(1.1)	387	(4.0)	516	(2.6)	633	(3.5)
Russian Federation	477	(3.4)	97	(2.1)	348	(5.8)	479	(3.8)	600	(4.0)
Scotland	497	(3.9)	101	(2.6)	366	(5.2)	497	(4.2)	626	(6.1)
Singapore	554	(1.5)	111	(1.1)	398	(3.5)	564	(2.1)	689	(2.1)
Slovak Republic	453	(2.3)	104	(1.5)	316	(3.9)	454	(2.9)	587	(3.1)
Slovenia	495	(1.2)	94	(1.3)	369	(2.9)	500	(1.8)	612	(2.9)
Sweden	503	(3.1)	107	(1.5)	358	(5.3)	509	(3.4)	636	(3.4)
Switzerland	477	(3.2)	107	(1.7)	331	(5.0)	481	(3.9)	613	(4.1)
Turkey	473	(2.3)	88	(1.5)	357	(4.1)	474	(2.5)	587	(3.4)
United Kingdom	498	(2.7)	104	(1.6)	361	(4.4)	502	(2.9)	630	(3.7)
United States	502	(3.7)	112	(1.6)	351	(5.7)	507	(4.6)	644	(4.2)
Wales	480	(4.2)	97	(1.6)	353	(6.1)	481	(4.6)	605	(4.9)
OECD Average	485	(0.4)	102	(0.3)	348	(0.7)	489	(0.5)	615	(0.6)

Source: PISA 2018 database

Table B1.6   Mean score and variation in the text structure subscale of reading: 'multiple'

	Mean score		Standard deviation		10th percentile		Median (50th)		90th percentile	
	Mean	S.E.	S.D.	S.E.	Score	S.E.	Score	S.E.	Score	S.E.
Australia	507	(1.8)	110	(1.0)	360	(2.8)	512	(2.1)	647	(3.0)
Austria	484	(2.7)	100	(1.3)	350	(3.9)	486	(3.7)	614	(3.2)
Belarus	478	(2.4)	92	(1.4)	355	(3.7)	480	(2.9)	597	(3.0)
Belgium	500	(2.4)	101	(1.3)	365	(3.9)	504	(2.9)	629	(2.7)
B-S-J-Z (China)	564	(2.8)	87	(1.9)	450	(4.3)	568	(2.9)	673	(4.1)
Canada	522	(2.0)	102	(1.0)	387	(2.8)	526	(2.5)	650	(2.2)
Chile	451	(2.8)	95	(1.5)	326	(3.7)	451	(3.3)	574	(3.2)
Chinese Taipei	506	(2.9)	103	(1.6)	369	(4.1)	512	(3.2)	636	(3.7)
Colombia	412	(3.4)	91	(1.6)	297	(3.8)	406	(4.1)	535	(4.7)
Croatia	478	(2.8)	92	(1.7)	357	(4.2)	480	(3.1)	597	(3.4)
Czech Republic	494	(2.7)	100	(1.8)	362	(4.6)	496	(3.2)	625	(3.1)
Denmark	503	(1.8)	93	(1.1)	380	(3.0)	506	(2.4)	620	(2.6)
England	509	(3.2)	103	(1.7)	374	(5.7)	512	(3.3)	640	(4.7)
Estonia	529	(1.9)	93	(1.2)	407	(3.4)	529	(2.5)	649	(2.9)
Finland	520	(2.4)	100	(1.2)	385	(3.9)	526	(2.9)	644	(2.8)
France	495	(2.5)	104	(1.6)	355	(4.1)	500	(3.1)	628	(3.4)
Germany	497	(3.2)	107	(1.5)	353	(4.6)	502	(3.9)	633	(3.7)
Greece	458	(3.6)	100	(1.7)	324	(5.5)	460	(4.1)	587	(3.8)
Hong Kong (China)	529	(2.9)	103	(1.6)	389	(5.9)	538	(3.0)	654	(3.0)
Hungary	480	(2.6)	101	(1.4)	344	(3.5)	482	(3.3)	611	(3.7)
Iceland	479	(1.7)	99	(1.2)	348	(3.8)	480	(2.3)	608	(3.2)
Israel	471	(4.0)	127	(1.9)	294	(6.6)	478	(5.3)	634	(4.1)
Italy	481	(2.6)	100	(1.9)	347	(4.9)	486	(3.0)	607	(3.8)
Japan	506	(2.8)	102	(1.8)	370	(4.7)	510	(3.1)	636	(3.6)
Korea	525	(3.1)	104	(1.9)	385	(5.5)	533	(3.1)	653	(4.0)

	Mean score		Standard deviation		10th percentile		Median (50th)		90th percentile	
	Mean	S.E.	S.D.	S.E.	Score	S.E.	Score	S.E.	Score	S.E.
Latvia	483	(1.7)	92	(1.1)	362	(2.7)	484	(2.3)	602	(3.6)
Lithuania	475	(1.7)	98	(1.0)	344	(3.0)	477	(2.3)	600	(2.7)
Luxembourg	475	(1.4)	110	(1.1)	329	(2.5)	476	(2.2)	618	(3.2)
Macao (China)	530	(1.5)	91	(1.3)	411	(3.0)	535	(2.2)	645	(3.1)
Mexico	419	(2.8)	84	(1.7)	312	(3.9)	417	(3.0)	530	(4.7)
Netherlands	495	(2.5)	100	(1.7)	364	(4.0)	496	(3.0)	626	(3.3)
New Zealand	509	(2.1)	106	(1.3)	365	(4.1)	515	(2.7)	643	(2.6)
Northern Ireland	502	(4.5)	99	(2.4)	368	(5.6)	507	(5.4)	627	(6.2)
Norway	502	(2.3)	105	(1.3)	360	(4.3)	508	(3.0)	635	(2.9)
Poland	514	(2.7)	98	(1.7)	386	(3.8)	517	(3.3)	638	(4.5)
Portugal	494	(2.5)	99	(1.4)	360	(3.8)	499	(3.1)	617	(3.1)
Republic of Ireland	517	(2.4)	94	(1.0)	391	(3.7)	519	(2.9)	637	(3.3)
Russian Federation	482	(3.1)	95	(1.8)	358	(5.4)	484	(3.6)	604	(3.6)
Scotland	506	(3.1)	97	(2.1)	380	(4.9)	507	(3.9)	631	(5.5)
Singapore	553	(1.7)	109	(1.1)	402	(3.9)	562	(2.4)	686	(2.1)
Slovak Republic	465	(2.2)	101	(1.6)	334	(4.3)	466	(2.8)	596	(3.8)
Slovenia	497	(1.5)	96	(1.2)	372	(3.3)	499	(2.0)	619	(3.6)
Sweden	511	(3.1)	109	(1.6)	364	(5.4)	517	(3.7)	649	(3.1)
Switzerland	489	(3.2)	103	(1.6)	350	(3.8)	492	(3.8)	621	(4.0)
Turkey	471	(2.4)	91	(1.7)	352	(3.8)	471	(2.8)	589	(4.0)
United Kingdom	508	(2.7)	102	(1.4)	373	(4.6)	510	(2.9)	638	(4.0)
United States	505	(3.7)	110	(1.5)	357	(5.3)	509	(4.4)	645	(4.7)
Wales	489	(3.8)	98	(1.6)	362	(5.2)	490	(4.6)	615	(4.6)
OECD Average	490	(0.4)	101	(0.2)	356	(0.7)	493	(0.5)	619	(0.6)

Source: PISA 2018 database

Table B1.7 Percentage of pupils at each proficiency level in reading

	Below Level 1c (less than 189.33 score points)		Level 1c (from 189.33 to less than 262.04 score points)		Level 1b (from 262.04 to less than 334.75 score points)		Level 1a (from 334.75 to less than 407.47 score points)		Level 2 (from 407.47 to less than 480.18 score points)		Level 3 (from 480.18 to less than 552.89 score points)		Level 4 (from 552.89 to less than 625.61 score points)		Level 5 (from 625.61 to less than 698.32 score points)		Level 6 (above 698.32 score points)	
	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.
Australia	0.1	(0.1)	1.4	(0.2)	5.6	(0.3)	12.5	(0.4)	21.1	(0.5)	25.4	(0.5)	20.9	(0.5)	10.3	(0.4)	2.7	(0.2)
Austria	0.0	(0.0)	0.9	(0.2)	6.4	(0.6)	16.3	(0.8)	23.5	(0.8)	26.2	(0.9)	19.3	(0.8)	6.7	(0.5)	0.7	(0.1)
Belarus	0.0	(0.0)	0.8	(0.2)	5.8	(0.5)	16.8	(0.8)	28.7	(0.8)	28.0	(1.0)	16.0	(0.7)	3.7	(0.4)	0.3	(0.1)
Belgium	0.1	(0.1)	1.2	(0.2)	6.0	(0.4)	14.0	(0.6)	22.4	(0.7)	26.5	(0.7)	20.4	(0.7)	8.3	(0.5)	1.3	(0.2)
B-S-J-Z (China)	0.0	(0.0)	0.1	(0.1)	0.7	(0.2)	4.3	(0.5)	14.3	(0.8)	27.9	(1.0)	30.8	(1.0)	17.5	(0.9)	4.2	(0.6)
Canada	0.0	(0.0)	0.7	(0.1)	3.1	(0.2)	10.0	(0.4)	20.1	(0.6)	27.2	(0.5)	24.0	(0.5)	12.2	(0.5)	2.8	(0.2)
Chile	0.1	(0.1)	1.7	(0.2)	8.9	(0.6)	21.0	(0.9)	29.5	(0.9)	24.4	(0.9)	11.8	(0.6)	2.4	(0.3)	0.2	(0.1)
Chinese Taipei	0.1	(0.1)	1.2	(0.2)	4.5	(0.4)	12.0	(0.6)	21.8	(0.7)	27.4	(0.8)	22.0	(0.9)	9.3	(0.7)	1.6	(0.3)
Colombia	0.2	(0.1)	3.6	(0.4)	15.8	(0.9)	30.3	(1.0)	27.7	(1.0)	15.8	(0.9)	5.7	(0.5)	0.9	(0.2)	0.0	(0.0)
Croatia	0.0	(0.0)	0.7	(0.2)	5.0	(0.5)	15.9	(0.8)	28.3	(0.9)	29.0	(1.0)	16.4	(0.8)	4.3	(0.4)	0.4	(0.1)
Czech Republic	0.1	(0.1)	0.7	(0.2)	5.0	(0.5)	15.0	(0.8)	25.0	(0.9)	26.9	(0.9)	19.1	(0.8)	7.2	(0.5)	1.1	(0.2)

	Below Level 1c (less than 189.33 score points)		Level 1c (from 189.33 to less than 262.04 score points)		Level 1b (from 262.04 to less than 334.75 score points)		Level 1a (from 334.75 to less than 407.47 score points)		Level 2 (from 407.47 to less than 480.18 score points)		Level 3 (from 480.18 to less than 552.89 score points)		Level 4 (from 552.89 to less than 625.61 score points)		Level 5 (from 625.61 to less than 698.32 score points)		Level 6 (above 698.32 score points)	
	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.
Denmark	0.0	(0.0)	0.5	(0.1)	3.5	(0.3)	11.9	(0.5)	23.9	(0.8)	30.1	(0.9)	21.6	(0.8)	7.3	(0.5)	1.1	(0.2)
England	0.0	(0.0)	0.8	(0.2)	4.2	(0.5)	12.1	(0.8)	22.6	(0.8)	27.1	(0.8)	21.2	(1.0)	9.8	(0.7)	2.1	(0.3)
Estonia	0.0	c	0.3	(0.1)	2.1	(0.2)	8.7	(0.5)	21.2	(0.9)	29.9	(0.9)	24.0	(0.8)	11.1	(0.6)	2.8	(0.3)
Finland	0.0	(0.0)	0.8	(0.2)	3.3	(0.4)	9.4	(0.6)	19.2	(0.7)	27.6	(0.8)	25.4	(0.8)	11.9	(0.7)	2.4	(0.3)
France	0.0	(0.0)	1.1	(0.2)	5.7	(0.4)	14.0	(0.7)	22.8	(0.8)	26.6	(0.8)	20.5	(0.7)	8.1	(0.6)	1.1	(0.2)
Germany	0.1	(0.1)	1.3	(0.3)	5.7	(0.5)	13.6	(0.8)	21.1	(0.8)	25.4	(0.8)	21.5	(0.9)	9.5	(0.6)	1.8	(0.2)
Greece	0.1	(0.1)	2.1	(0.3)	9.3	(0.7)	19.0	(0.9)	27.3	(0.8)	25.2	(1.0)	13.3	(0.8)	3.3	(0.4)	0.3	(0.1)
Hong Kong (China)	0.1	(0.1)	0.9	(0.2)	3.5	(0.4)	8.1	(0.6)	17.8	(0.7)	27.7	(0.7)	27.1	(0.8)	12.5	(0.6)	2.3	(0.3)
Hungary	0.0	(0.1)	1.2	(0.2)	7.0	(0.6)	17.0	(0.8)	25.2	(0.9)	26.3	(0.9)	17.5	(0.8)	5.2	(0.5)	0.5	(0.1)
Iceland	0.1	(0.1)	2.3	(0.3)	8.0	(0.7)	15.9	(0.8)	24.6	(0.9)	25.1	(0.8)	16.9	(0.7)	6.2	(0.6)	0.9	(0.2)
Israel	0.7	(0.2)	5.0	(0.5)	10.4	(0.7)	15.0	(0.9)	19.4	(0.7)	21.6	(0.8)	17.5	(0.8)	8.4	(0.6)	2.0	(0.3)

	Below Level 1c (less than 189.33 score points)		Level 1c (from 189.33 to less than 262.04 score points)		Level 1b (from 262.04 to less than 334.75 score points)		Level 1a (from 334.75 to less than 407.47 score points)		Level 2 (from 407.47 to less than 480.18 score points)		Level 3 (from 480.18 to less than 552.89 score points)		Level 4 (from 552.89 to less than 625.61 score points)		Level 5 (from 625.61 to less than 698.32 score points)		Level 6 (above 698.32 score points)	
	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.
Italy	0.1	(0.1)	1.7	(0.3)	6.7	(0.6)	14.8	(0.7)	26.3	(0.9)	28.2	(0.9)	16.9	(0.7)	4.9	(0.4)	0.5	(0.1)
Japan	0.1	(0.0)	0.7	(0.2)	4.1	(0.4)	12.0	(0.7)	22.5	(0.9)	28.6	(1.0)	21.9	(0.8)	8.6	(0.6)	1.7	(0.3)
Korea	0.1	(0.1)	1.1	(0.2)	4.3	(0.4)	9.6	(0.7)	19.6	(0.7)	27.6	(0.8)	24.6	(0.8)	10.8	(0.6)	2.3	(0.4)
Latvia	0.0	(0.0)	0.6	(0.1)	5.2	(0.4)	16.6	(0.6)	27.4	(0.8)	28.8	(0.8)	16.6	(0.7)	4.4	(0.4)	0.4	(0.1)
Lithuania	0.0	(0.0)	1.0	(0.2)	6.3	(0.4)	17.0	(0.6)	26.1	(0.8)	27.7	(0.7)	16.9	(0.6)	4.5	(0.4)	0.4	(0.1)
Luxembourg	0.2	(0.1)	2.4	(0.2)	9.2	(0.4)	17.6	(0.6)	23.7	(0.7)	23.5	(0.7)	15.9	(0.6)	6.4	(0.4)	1.3	(0.2)
Macao (China)	0.0	(0.0)	0.3	(0.1)	2.2	(0.2)	8.2	(0.6)	19.4	(0.8)	29.8	(0.8)	26.1	(0.7)	11.7	(0.6)	2.1	(0.3)
Mexico	0.0	(0.1)	2.5	(0.4)	13.1	(0.8)	29.1	(1.1)	31.7	(1.0)	17.5	(0.9)	5.3	(0.6)	0.7	(0.2)	0.0	(0.0)
Netherlands	0.1	(0.1)	1.3	(0.2)	7.0	(0.6)	15.6	(0.7)	23.7	(0.8)	24.3	(1.0)	18.8	(0.8)	7.9	(0.6)	1.2	(0.2)
New Zealand	0.1	(0.1)	1.0	(0.2)	5.2	(0.5)	12.7	(0.6)	20.8	(0.7)	24.6	(0.7)	22.5	(0.7)	10.7	(0.6)	2.4	(0.3)
Northern Ireland	0.0	(0.1)	0.7	(0.2)	4.5	(0.7)	12.6	(1.0)	22.1	(1.4)	28.6	(1.3)	21.9	(1.4)	8.1	(0.9)	1.3	(0.4)
Norway	0.1	(0.1)	1.7	(0.2)	5.6	(0.4)	11.9	(0.6)	21.5	(0.7)	26.4	(0.9)	21.6	(0.8)	9.6	(0.6)	1.6	(0.2)

	Below Level 1c (less than 189.33 score points)		Level 1c (from 189.33 to less than 262.04 score points)		Level 1b (from 262.04 to less than 334.75 score points)		Level 1a (from 334.75 to less than 407.47 score points)		Level 2 (from 407.47 to less than 480.18 score points)		Level 3 (from 480.18 to less than 552.89 score points)		Level 4 (from 552.89 to less than 625.61 score points)		Level 5 (from 625.61 to less than 698.32 score points)		Level 6 (above 698.32 score points)	
	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.
Poland	0.0	(0.0)	0.5	(0.1)	3.3	(0.3)	10.8	(0.6)	22.4	(0.8)	27.7	(0.8)	23.0	(0.8)	10.1	(0.7)	2.1	(0.3)
Portugal	0.0	(0.0)	0.9	(0.2)	5.0	(0.5)	14.3	(0.7)	23.3	(0.7)	28.2	(0.8)	21.0	(0.9)	6.5	(0.6)	0.8	(0.2)
Republic of Ireland	0.0	(0.0)	0.2	(0.1)	2.1	(0.3)	9.5	(0.6)	21.7	(0.8)	30.3	(0.9)	24.1	(0.8)	10.3	(0.6)	1.8	(0.3)
Russian Federation	0.0	(0.0)	1.0	(0.2)	5.6	(0.6)	15.5	(0.9)	28.1	(0.8)	28.0	(0.8)	16.4	(0.7)	4.8	(0.5)	0.6	(0.1)
Scotland	0.0	(0.0)	0.5	(0.2)	3.2	(0.4)	11.8	(0.8)	25.3	(1.1)	28.2	(1.0)	20.7	(0.9)	8.7	(0.8)	1.7	(0.4)
Singapore	0.0	(0.0)	0.5	(0.1)	3.0	(0.3)	7.7	(0.4)	14.2	(0.5)	22.3	(0.7)	26.4	(0.6)	18.5	(0.7)	7.3	(0.4)
Slovak Republic	0.1	(0.1)	2.3	(0.3)	9.2	(0.7)	19.8	(0.8)	26.9	(0.9)	23.5	(0.9)	13.6	(0.7)	4.1	(0.4)	0.5	(0.2)
Slovenia	0.0	(0.1)	0.6	(0.2)	4.3	(0.4)	12.9	(0.5)	24.5	(0.8)	29.5	(0.9)	20.3	(0.7)	6.8	(0.5)	1.0	(0.2)
Sweden	0.2	(0.1)	1.5	(0.2)	5.1	(0.5)	11.6	(0.7)	20.6	(0.8)	25.5	(0.8)	22.3	(0.8)	10.9	(0.7)	2.4	(0.3)
Switzerland	0.1	(0.1)	1.3	(0.3)	7.1	(0.6)	15.1	(0.7)	23.4	(0.9)	26.3	(0.8)	18.5	(0.8)	6.9	(0.6)	1.2	(0.2)
Turkey	0.0	(0.0)	0.7	(0.2)	6.3	(0.6)	19.1	(0.7)	30.2	(0.9)	26.9	(1.0)	13.5	(0.6)	3.1	(0.5)	0.2	(0.1)

	Below Level 1c (less than 189.33 score points)		Level 1c (from 189.33 to less than 262.04 score points)		Level 1b (from 262.04 to less than 334.75 score points)		Level 1a (from 334.75 to less than 407.47 score points)		Level 2 (from 407.47 to less than 480.18 score points)		Level 3 (from 480.18 to less than 552.89 score points)		Level 4 (from 552.89 to less than 625.61 score points)		Level 5 (from 625.61 to less than 698.32 score points)		Level 6 (above 698.32 score points)	
	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.
Ukraine	0.2	(0.1)	1.8	(0.3)	7.2	(0.7)	16.7	(0.9)	27.7	(0.8)	28.5	(1.0)	14.5	(0.8)	3.2	(0.4)	0.2	(0.1)
United Kingdom	0.0	(0.0)	0.8	(0.2)	4.2	(0.4)	12.3	(0.7)	23.0	(0.7)	27.2	(0.7)	21.0	(0.8)	9.5	(0.6)	2.0	(0.2)
United States	0.1	(0.1)	1.1	(0.2)	5.4	(0.5)	12.7	(0.8)	21.1	(0.8)	24.7	(0.8)	21.4	(0.8)	10.7	(0.7)	2.8	(0.4)
Wales	0.1	(0.1)	1.1	(0.3)	5.2	(0.6)	15.6	(1.1)	26.5	(0.9)	26.7	(1.0)	17.8	(1.0)	5.9	(0.7)	1.1	(0.2)
OECD Average	0.1	(0.0)	1.4	(0.0)	6.2	(0.1)	15.0	(0.1)	23.7	(0.1)	26.0	(0.1)	18.9	(0.1)	7.4	(0.1)	1.3	(0.0)

Notes:

c: There are too few observations or no observation to provide reliable estimates (i.e. there are fewer than 30 pupils or fewer than 5 schools with valid data).

Source: PISA 2018 database

Table B1.8   Reading performance by gender

	Boys		Girls		Gender differences (girls - boys)	
	Mean score		Mean score		Mean score	
	Mean score	S.E.	Mean score	S.E.	Score dif.	S.E.
Australia	487	(2.2)	519	(2.0)	31	(2.6)
Austria	471	(3.7)	499	(3.7)	28	(5.2)
Belarus	463	(2.8)	486	(2.8)	23	(2.9)
Belgium	482	(2.9)	504	(2.8)	22	(3.2)
B-S-J-Z (China)	549	(3.1)	562	(2.8)	13	(2.4)
Canada	506	(2.1)	535	(2.0)	29	(2.1)
Chile	442	(3.4)	462	(2.9)	20	(3.6)
Chinese Taipei	492	(4.1)	514	(3.9)	22	(5.7)
Colombia	407	(4.0)	417	(3.3)	10	(3.3)
Croatia	462	(3.3)	495	(2.9)	33	(3.7)
Czech Republic	474	(3.1)	507	(2.9)	33	(3.1)
Denmark	486	(2.3)	516	(2.3)	29	(3.0)
England	495	(3.8)	515	(3.6)	20	(4.2)
Estonia	508	(2.4)	538	(2.2)	31	(2.6)
Finland	495	(2.9)	546	(2.3)	52	(2.7)
France	480	(2.8)	505	(2.8)	25	(3.1)
Germany	486	(3.4)	512	(3.2)	26	(3.0)
Greece	437	(4.2)	479	(3.7)	42	(3.5)
Hong Kong (China)	507	(3.5)	542	(2.8)	35	(3.3)
Hungary	463	(2.8)	489	(3.2)	26	(4.1)
Iceland	454	(2.5)	494	(2.6)	41	(3.8)
Israel	445	(5.6)	493	(3.7)	48	(5.8)
Italy	464	(3.1)	489	(2.7)	25	(3.1)

	Boys		Girls		Gender differences (girls - boys)	
	Mean score		Mean score		Mean score	
	Mean score	S.E.	Mean score	S.E.	Score dif.	S.E.
Japan	493	(3.8)	514	(3.0)	20	(4.3)
Korea	503	(4.0)	526	(3.6)	24	(4.9)
Latvia	462	(2.2)	495	(2.0)	33	(2.7)
Lithuania	457	(1.8)	496	(1.8)	39	(2.2)
Luxembourg	456	(1.5)	485	(1.6)	29	(2.2)
Macao (China)	514	(1.9)	536	(1.8)	22	(2.8)
Mexico	415	(3.1)	426	(3.0)	11	(2.5)
Netherlands	470	(3.5)	499	(2.6)	29	(3.2)
New Zealand	491	(2.7)	520	(2.7)	29	(3.7)
Northern Ireland	482	(6.2)	519	(4.5)	36	(7.3)
Norway	476	(2.6)	523	(2.6)	47	(2.9)
Poland	495	(3.0)	528	(2.9)	33	(2.6)
Portugal	480	(2.8)	504	(2.9)	24	(2.8)
Republic of Ireland	506	(3.0)	530	(2.5)	23	(3.3)
Russian Federation	466	(3.2)	491	(3.3)	25	(2.2)
Scotland	497	(3.7)	511	(3.6)	15	(4.1)
Singapore	538	(2.0)	561	(1.9)	23	(2.3)
Slovak Republic	441	(2.7)	475	(3.0)	34	(3.4)
Slovenia	475	(1.7)	517	(1.9)	42	(2.6)
Sweden	489	(3.2)	523	(3.4)	34	(2.8)
Switzerland	469	(3.4)	500	(3.2)	31	(2.9)
Turkey	453	(3.0)	478	(2.7)	25	(3.8)
Ukraine	450	(4.2)	484	(3.6)	33	(3.9)
United Kingdom	494	(3.2)	514	(3.1)	20	(3.6)
United States	494	(4.2)	517	(3.6)	24	(3.5)

	Boys		Girls		Gender differences (girls - boys)	
	Mean score		Mean score		Mean score	
	Mean score	S.E.	Mean score	S.E.	Score dif.	S.E.
Wales	470	(4.3)	497	(4.3)	26	(3.4)
OECD Average	472	(0.5)	502	(0.5)	30	(0.5)

Source: PISA 2018 database

Table B1.9   Socio-economic status and reading performance

	Reading performance		Socio-economic gradients				Reading performance, by socio-economic status (ESCS)										
							National quarter of ESCS										
	Score, unadjusted		Strength: Percentage of variance in reading performance explained by ESCS (R²)		Slope: Score-point difference in reading performance associated with a one-unit increase in ESCS		Bottom quarter of ESCS		Second quarter of ESCS		Third quarter of ESCS		Top quarter of ESCS		Top - Bottom quarter	
	Mean	S.E.	%	S.E.	dif.	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	dif.	S.E.
B-S-J-Z (China)	555	(2.7)	12.6	(1.3)	**29**	(1.8)	519	(3.9)	545	(3.2)	558	(3.3)	600	(4.6)	**82**	(5.7)
Singapore	549	(1.6)	13.2	(0.9)	**43**	(1.5)	495	(3.0)	535	(2.9)	570	(3.0)	599	(3.3)	**104**	(4.2)
Macao (China)	525	(1.2)	1.7	(0.4)	**13**	(1.6)	511	(2.6)	524	(3.1)	524	(3.2)	542	(3.1)	**31**	(4.3)
Hong Kong (China)	524	(2.7)	5.1	(1.1)	**21**	(2.2)	497	(3.9)	523	(3.6)	529	(3.7)	555	(4.9)	**59**	(6.1)
Estonia	523	(1.8)	6.2	(0.8)	**29**	(2.1)	497	(3.7)	509	(3.6)	531	(2.9)	558	(2.9)	**61**	(4.8)
Canada	520	(1.8)	6.7	(0.6)	**32**	(1.6)	485	(2.4)	512	(2.5)	539	(3.0)	553	(2.5)	**68**	(3.3)
Finland	520	(2.3)	9.2	(1.0)	**38**	(2.2)	483	(3.2)	509	(3.3)	533	(4.1)	562	(3.6)	**79**	(4.7)

	Reading performance		Socio-economic gradients				Reading performance, by socio-economic status (ESCS)									
							National quarter of ESCS									
	Score, unadjusted		Strength: Percentage of variance in reading performance explained by ESCS (R²)		Slope: Score-point difference in reading performance associated with a one-unit increase in ESCS		Bottom quarter of ESCS		Second quarter of ESCS		Third quarter of ESCS		Top quarter of ESCS		Top - Bottom quarter	
	Mean	S.E.	%	S.E.	dif.	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	dif.	S.E.
Republic of Ireland	518	(2.2)	10.7	(1.1)	**34**	(1.7)	482	(3.4)	511	(3.8)	527	(2.9)	557	(3.5)	**75**	(4.7)
Korea	514	(2.9)	8.0	(1.1)	**37**	(2.8)	477	(4.2)	503	(4.1)	525	(3.8)	552	(4.7)	**75**	(6.0)
Poland	512	(2.7)	11.6	(1.4)	**39**	(2.6)	469	(3.1)	504	(3.4)	518	(4.6)	560	(4.8)	**90**	(5.7)
Sweden	506	(3.0)	10.7	(1.2)	**39**	(2.2)	460	(4.4)	501	(4.6)	526	(4.1)	549	(4.3)	**89**	(6.2)
New Zealand	506	(2.0)	12.9	(1.0)	**39**	(1.6)	462	(3.6)	490	(3.2)	525	(3.2)	558	(3.4)	**96**	(4.9)
United States	505	(3.6)	12.0	(1.4)	**36**	(2.1)	460	(5.4)	488	(4.7)	517	(5.4)	558	(4.9)	**99**	(6.8)
England	505	(3.0)	9.8	(1.2)	**34**	(2.1)	471	(3.8)	495	(4.3)	517	(4.4)	553	(4.6)	**82**	(5.7)
Vietnam	505	(3.6)	m	m	m	m	m	m	m	m	m	m	m	m	m	m

	Reading performance		Socio-economic gradients				Reading performance, by socio-economic status (ESCS)									
							National quarter of ESCS									
	Score, unadjusted		Strength: Percentage of variance in reading performance explained by ESCS (R^2)		Slope: Score-point difference in reading performance associated with a one-unit increase in ESCS		Bottom quarter of ESCS		Second quarter of ESCS		Third quarter of ESCS		Top quarter of ESCS		Top - Bottom quarter	
	Mean	S.E.	%	S.E.	dif.	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	dif.	S.E.
Scotland	504	(3.0)	8.3	(1.4)	**32**	(2.8)	472	(4.8)	492	(4.6)	515	(5.8)	544	(5.3)	**72**	(6.9)
United Kingdom	504	(2.6)	9.3	(1.0)	**33**	(1.8)	471	(3.1)	493	(3.5)	516	(3.9)	550	(4.0)	**80**	(4.7)
Japan	504	(2.7)	8.0	(1.2)	**38**	(2.8)	465	(4.5)	499	(3.8)	517	(3.6)	537	(3.8)	**72**	(5.9)
Australia	503	(1.6)	10.1	(0.6)	**38**	(1.2)	460	(2.6)	490	(2.5)	519	(3.0)	549	(2.4)	**89**	(2.9)
Chinese Taipei	503	(2.8)	11.4	(1.1)	**37**	(2.0)	461	(3.3)	492	(2.8)	510	(4.6)	550	(4.8)	**89**	(5.0)
Denmark	501	(1.8)	9.9	(0.9)	**38**	(1.8)	462	(3.0)	493	(3.3)	514	(3.4)	540	(2.8)	**78**	(3.8)
Northern Ireland	501	(4.0)	6.9	(1.1)	**29**	(2.6)	476	(4.8)	483	(6.3)	516	(7.1)	539	(6.6)	**62**	(6.8)
Norway	499	(2.2)	7.5	(0.9)	**35**	(2.0)	459	(3.6)	496	(3.9)	520	(3.6)	532	(3.5)	**73**	(4.7)
Germany	498	(3.0)	17.2	(1.4)	**42**	(1.7)	450	(5.1)	492	(3.8)	518	(4.6)	564	(4.3)	**113**	(5.9)

	Reading performance		Socio-economic gradients				Reading performance, by socio-economic status (ESCS)									
							National quarter of ESCS									
	Score, unadjusted		Strength: Percentage of variance in reading performance explained by ESCS (R^2)		Slope: Score-point difference in reading performance associated with a one-unit increase in ESCS		Bottom quarter of ESCS		Second quarter of ESCS		Third quarter of ESCS		Top quarter of ESCS		Top - Bottom quarter	
	Mean	S.E.	%	S.E.	dif.	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	dif.	S.E.
Slovenia	495	(1.2)	12.1	(1.0)	**41**	(1.8)	462	(2.5)	476	(3.0)	506	(3.0)	541	(3.0)	**80**	(3.9)
Belgium	493	(2.3)	17.2	(0.8)	**46**	(1.3)	440	(3.0)	477	(3.5)	512	(3.6)	550	(2.6)	**109**	(3.2)
France	493	(2.3)	17.5	(1.3)	**47**	(2.0)	443	(2.8)	474	(3.7)	509	(3.9)	550	(4.2)	**107**	(5.3)
Portugal	492	(2.4)	13.5	(1.2)	**31**	(1.4)	448	(4.3)	480	(3.6)	501	(4.1)	543	(3.5)	**95**	(4.8)
Czech Republic	490	(2.5)	16.5	(1.4)	**45**	(2.1)	439	(4.7)	481	(3.9)	498	(3.4)	544	(3.3)	**105**	(5.7)
Netherlands	485	(2.7)	10.5	(1.3)	**39**	(2.5)	448	(5.1)	470	(4.2)	495	(3.7)	536	(4.4)	**88**	(6.4)
Austria	484	(2.7)	13.0	(1.2)	**40**	(1.9)	440	(3.9)	475	(4.5)	496	(3.6)	533	(4.1)	**93**	(5.3)
Switzerland	484	(3.1)	15.6	(1.6)	**43**	(2.3)	435	(4.5)	469	(3.7)	499	(4.4)	539	(5.7)	**104**	(7.0)
Wales	483	(4.0)	4.0	(0.8)	**22**	(2.4)	466	(4.7)	478	(5.6)	491	(5.9)	515	(5.8)	**49**	(6.6)

	Reading performance		Socio-economic gradients				Reading performance, by socio-economic status (ESCS)									
							National quarter of ESCS										
	Score, unadjusted		Strength: Percentage of variance in reading performance explained by ESCS (R²)		Slope: Score-point difference in reading performance associated with a one-unit increase in ESCS		Bottom quarter of ESCS		Second quarter of ESCS		Third quarter of ESCS		Top quarter of ESCS		Top - Bottom quarter	
	Mean	S.E.	%	S.E.	dif.	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	dif.	S.E.
Croatia	479	(2.7)	7.7	(0.8)	**32**	(1.8)	455	(3.4)	463	(3.3)	480	(3.5)	518	(3.8)	**63**	(4.2)
Latvia	479	(1.6)	7.2	(0.8)	**29**	(1.7)	447	(2.9)	470	(3.1)	490	(3.0)	512	(3.0)	**65**	(4.0)
Russian Federation	479	(3.1)	7.3	(1.0)	**34**	(2.6)	443	(4.5)	469	(3.7)	493	(4.4)	510	(4.2)	**67**	(5.3)
Italy	476	(2.4)	8.9	(1.0)	**32**	(1.9)	436	(3.7)	474	(3.1)	487	(3.3)	511	(4.1)	**75**	(5.2)
Hungary	476	(2.3)	19.1	(1.7)	**46**	(2.2)	420	(4.1)	463	(3.8)	489	(3.7)	534	(4.1)	**113**	(5.9)
Lithuania	476	(1.5)	13.2	(1.0)	**40**	(1.6)	432	(2.9)	464	(2.9)	488	(3.0)	522	(2.6)	**89**	(3.8)
Iceland	474	(1.7)	6.6	(1.0)	**33**	(2.7)	437	(3.7)	463	(4.2)	495	(3.5)	510	(4.1)	**72**	(5.7)
Belarus	474	(2.4)	19.8	(1.5)	**51**	(2.2)	423	(3.3)	458	(4.0)	489	(3.4)	525	(3.7)	**102**	(5.0)

	Reading performance		Socio-economic gradients				Reading performance, by socio-economic status (ESCS)									
							National quarter of ESCS									
	Score, unadjusted		Strength: Percentage of variance in reading performance explained by ESCS (R^2)		Slope: Score-point difference in reading performance associated with a one-unit increase in ESCS		Bottom quarter of ESCS		Second quarter of ESCS		Third quarter of ESCS		Top quarter of ESCS		Top - Bottom quarter	
	Mean	S.E.	%	S.E.	dif.	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	dif.	S.E.
Israel	470	(3.7)	14.0	(1.0)	**47**	(1.9)	407	(4.4)	455	(5.8)	507	(4.7)	529	(4.4)	**121**	(5.5)
Luxembourg	470	(1.1)	17.8	(1.0)	**40**	(1.2)	415	(2.7)	445	(2.6)	488	(2.8)	537	(3.0)	**122**	(4.4)
Ukraine	466	(3.5)	14.0	(1.4)	**45**	(2.5)	422	(4.8)	456	(4.7)	476	(4.5)	511	(3.9)	**90**	(5.9)
Turkey	466	(2.2)	11.4	(1.8)	**25**	(1.8)	437	(3.8)	452	(3.1)	461	(2.9)	513	(5.2)	**76**	(7.2)
Slovak Republic	458	(2.2)	17.5	(1.5)	**46**	(2.0)	404	(4.3)	449	(3.4)	468	(3.2)	511	(4.1)	**106**	(5.9)
Greece	457	(3.6)	10.9	(1.2)	**35**	(2.1)	417	(4.5)	444	(4.0)	468	(4.8)	502	(4.5)	**84**	(5.3)
Chile	452	(2.6)	12.7	(1.1)	**32**	(1.5)	415	(3.4)	443	(3.7)	455	(3.5)	502	(3.9)	**87**	(4.7)
OECD Average	487	(0.4)	12.0	(0.2)	**37**	(0.3)	445	(0.6)	476	(0.6)	500	(0.6)	534	(0.7)	**89**	(0.9)

Notes: ESCS refers to the PISA index of economic, social and cultural status.

Values that are statistically significant are indicated in **bold**.

Source: PISA 2018 database

Table B1.10 Mean reading performance and academic resilience, by immigrant background (Based on pupils' reports)

	Percentage of immigrant pupils		Reading performance									
			Average performance		Non-immigrant pupils		Immigrant pupils		Second-generation immigrant pupils		First-generation immigrant pupils	
	%	S.E.	Mean score	S.E.	Mean score	S.E.	Mean score	S.E.	Mean score	S.E.	Mean score	S.E.
Vietnam	0.1	(0.0)	m	m	m	m	m	m	m	m	m	m
B-S-J-Z (China)	0.2	(0.1)	555	(2.7)	556	(2.7)	c	c	c	c	c	c
Singapore	24.8	(0.7)	549	(1.6)	546	(1.5)	565	(4.3)	587	(4.0)	554	(6.0)
Macao (China)	62.9	(0.7)	525	(1.2)	512	(2.2)	533	(1.8)	528	(2.5)	540	(2.8)
Hong Kong (China)	37.9	(1.3)	524	(2.7)	529	(2.9)	522	(4.7)	533	(4.3)	502	(6.9)
Estonia	10.4	(0.5)	523	(1.8)	528	(1.9)	489	(4.5)	492	(4.9)	453	(16.8)
Canada	35.0	(1.4)	520	(1.8)	525	(1.6)	522	(3.0)	535	(3.9)	508	(3.6)
Finland	5.8	(0.5)	520	(2.3)	527	(2.1)	435	(7.5)	456	(10.3)	420	(9.0)
Republic of Ireland	17.9	(0.9)	518	(2.2)	522	(2.3)	508	(3.8)	509	(5.3)	508	(5.3)
Korea	0.2	(0.1)	514	(2.9)	515	(2.9)	c	c	c	c	c	c
Poland	0.6	(0.2)	512	(2.7)	514	(2.7)	c	c	c	c	c	c
Sweden	20.5	(1.3)	506	(3.0)	525	(2.7)	443	(5.8)	471	(6.4)	410	(6.9)
New Zealand	26.5	(1.3)	506	(2.0)	510	(2.3)	508	(3.5)	518	(5.3)	500	(4.0)
United States	23.0	(1.5)	505	(3.6)	510	(3.6)	503	(6.0)	512	(6.1)	479	(8.3)
England	21.8	(1.4)	505	(3.0)	513	(3.2)	490	(4.4)	492	(5.9)	488	(7.6)
Scotland	8.4	(0.9)	504	(3.0)	506	(2.8)	514	(10.7)	521	(13.7)	509	(13.6)
United Kingdom	19.8	(1.2)	504	(2.6)	511	(2.7)	491	(4.2)	493	(5.7)	488	(6.9)
Japan	0.6	(0.1)	504	(2.7)	w	w	w	w	w	w	w	w
Australia	27.7	(0.8)	503	(1.6)	504	(2.0)	511	(3.3)	523	(4.5)	501	(3.9)
Chinese Taipei	0.7	(0.2)	503	(2.8)	504	(2.8)	428	(49.1)	c	c	c	c

	Percentage of immigrant pupils		Reading performance									
			Average performance		Non-immigrant pupils		Immigrant pupils		Second-generation immigrant pupils		First-generation immigrant pupils	
Denmark	10.7	(0.4)	501	(1.8)	509	(1.9)	444	(3.5)	447	(3.7)	435	(7.4)
Northern Ireland	9.7	(0.8)	501	(4.0)	508	(4.1)	465	(9.9)	508	(23.4)	455	(10.4)
Norway	12.4	(0.8)	499	(2.2)	509	(2.1)	457	(4.7)	463	(7.0)	451	(5.5)
Germany	22.2	(1.1)	498	(3.0)	519	(3.3)	456	(6.5)	477	(6.6)	405	(11.8)
Slovenia	8.9	(0.3)	495	(1.2)	502	(1.3)	439	(6.0)	464	(7.3)	422	(8.2)
Belgium	18.1	(0.9)	493	(2.3)	506	(2.4)	445	(3.8)	459	(4.7)	427	(5.2)
France	14.3	(0.9)	493	(2.3)	502	(2.7)	449	(5.3)	461	(5.7)	425	(7.5)
Portugal	7.0	(0.6)	492	(2.4)	495	(2.6)	463	(7.8)	483	(10.1)	436	(9.1)
Czech Republic	4.1	(0.4)	490	(2.5)	493	(2.5)	440	(9.7)	459	(10.5)	421	(14.4)
Netherlands	13.8	(1.2)	485	(2.7)	498	(2.9)	426	(6.2)	433	(6.7)	399	(13.0)
Austria	22.7	(1.2)	484	(2.7)	500	(2.6)	437	(4.2)	446	(4.3)	421	(5.5)
Switzerland	33.9	(1.4)	484	(3.1)	503	(3.2)	451	(4.3)	453	(4.6)	448	(6.3)
Wales	7.0	(0.9)	483	(4.0)	487	(4.0)	490	(6.8)	500	(9.3)	481	(10.9)
Croatia	9.1	(0.5)	479	(2.7)	481	(2.6)	471	(5.5)	473	(5.7)	464	(11.8)
Latvia	4.4	(0.3)	479	(1.6)	480	(1.6)	476	(8.7)	467	(9.2)	515	(19.9)
Russian Federation	5.8	(0.3)	479	(3.1)	480	(3.1)	478	(6.3)	491	(6.9)	457	(8.4)
Italy	10.0	(0.5)	476	(2.4)	482	(2.6)	440	(4.9)	445	(5.9)	433	(7.1)
Hungary	2.6	(0.3)	476	(2.3)	477	(2.3)	490	(9.8)	510	(11.1)	468	(16.5)
Lithuania	1.6	(0.1)	476	(1.5)	478	(1.5)	457	(11.1)	454	(11.5)	469	(27.3)
Iceland	5.6	(0.4)	474	(1.7)	481	(1.8)	407	(7.6)	412	(10.9)	402	(9.5)
Belarus	4.1	(0.3)	474	(2.4)	475	(2.5)	457	(7.3)	461	(6.7)	447	(16.3)
Israel	16.4	(1.1)	470	(3.7)	481	(3.5)	470	(6.6)	493	(6.1)	398	(10.4)
Luxembourg	54.9	(0.6)	470	(1.1)	491	(1.9)	455	(1.7)	450	(2.9)	461	(2.9)

	Percentage of immigrant pupils		Reading performance									
			Average performance		Non-immigrant pupils		Immigrant pupils		Second-generation immigrant pupils		First-generation immigrant pupils	
Ukraine	2.3	(0.2)	466	(3.5)	468	(3.4)	443	(9.9)	456	(11.7)	419	(18.7)
Turkey	0.9	(0.1)	466	(2.2)	467	(2.2)	462	(12.7)	474	(15.1)	c	c
Slovak Republic	1.2	(0.2)	458	(2.2)	460	(2.2)	407	(13.6)	424	(17.8)	387	(17.3)
Greece	11.7	(0.7)	457	(3.6)	465	(3.4)	414	(6.1)	420	(6.9)	397	(9.2)
Chile	3.4	(0.4)	452	(2.6)	456	(2.7)	438	(7.5)	447	(18.3)	435	(8.5)
OECD Average	13.1	(0.1)	487	(0.4)	494	(0.4)	452	(1.3)	465	(1.6)	440	(2.1)

Notes:

Symbols for missing data:

c: There were too few observations to provide reliable estimates (i.e. there were fewer than 30 pupils or fewer than 5 schools with valid data).

m: Data are not available. There was no observation in the sample; these data were not collected by the country; or these data were collected but subsequently removed from the publication for technical reasons.

w: Results were withdrawn at the request of the country concerned.

Source: PISA 2018 database

Table B1.11 (continued): Mean reading performance and academic resilience, by immigrant background (Based on pupils' reports)

	Score-point difference in reading performance associated with immigrant background				Academic resilience	
	Before accounting for gender, and pupils' and schools' socio-economic profile[1]		After accounting for gender, and pupils' and schools' socio-economic profile		Academically resilient immigrant pupils[2]	
	Score dif.	S.E.	Score dif.	S.E.	%	S.E.
Vietnam	m	m	m	m	m	m
B-S-J-Z (China)	c	c	c	c	m	m
Singapore	**19**	(4.5)	**-9**	(4.2)	28.9	(1.5)
Macao (China)	**22**	(3.0)	**26**	(3.1)	27.3	(0.9)
Hong Kong (China)	-7	(5.0)	**9**	(4.2)	24.0	(1.3)
Estonia	**-39**	(4.6)	**-35**	(4.5)	13.6	(1.5)
Canada	-3	(2.9)	-1	(2.6)	26.2	(1.2)
Finland	**-92**	(7.3)	**-74**	(6.7)	7.9	(1.8)
Republic of Ireland	**-14**	(3.8)	**-9**	(3.2)	21.6	(1.5)
Korea	c	c	c	c	m	m
Poland	c	c	c	c	m	m
Sweden	**-83**	(5.9)	**-54**	(4.7)	10.3	(1.5)
New Zealand	-2	(4.0)	**-8**	(3.3)	26.5	(1.3)
United States	-7	(5.9)	**16**	(4.5)	24.5	(2.2)
England	**-22**	(4.8)	-5	(4.4)	20.4	(1.7)
Scotland	8	(9.9)	7	(8.4)	26.2	(4.8)
United Kingdom	**-20**	(4.4)	-4	(4.1)	20.5	(1.6)
Japan	w	w	w	w	w	w
Australia	**8**	(3.5)	**7**	(3.0)	29.1	(1.3)
Chinese Taipei	-76	(49.0)	-82	(59.4)	17.3	(8.8)
Denmark	**-65**	(3.8)	**-34**	(3.7)	9.3	(1.2)
Northern Ireland	**-43**	(9.2)	**-28**	(7.6)	17.6	(3.4)

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	Score-point difference in reading performance associated with immigrant background				Academic resilience	
	Before accounting for gender, and pupils' and schools' socio-economic profile[1]		After accounting for gender, and pupils' and schools' socio-economic profile		Academically resilient immigrant pupils[2]	
	Score dif.	S.E.	Score dif.	S.E.	%	S.E.
Norway	**-52**	(4.4)	**-33**	(4.5)	13.9	(1.5)
Germany	**-63**	(6.8)	**-17**	(5.6)	16.0	(1.7)
Slovenia	**-63**	(6.3)	**-28**	(6.2)	8.8	(1.8)
Belgium	**-61**	(4.1)	**-21**	(4.0)	12.0	(1.2)
France	**-52**	(6.2)	**-13**	(5.0)	13.4	(1.7)
Portugal	**-32**	(8.2)	**-26**	(6.2)	17.1	(2.8)
Czech Republic	**-53**	(9.4)	**-34**	(7.3)	12.3	(2.5)
Netherlands	**-72**	(7.1)	**-23**	(6.5)	8.9	(1.7)
Austria	**-63**	(4.5)	**-33**	(3.6)	11.2	(1.2)
Switzerland	**-52**	(4.7)	**-25**	(3.6)	15.7	(1.3)
Wales	3	(7.5)	7	(6.9)	19.1	(2.8)
Croatia	-10	(5.2)	-3	(4.1)	21.2	(2.6)
Latvia	-4	(8.8)	-7	(8.1)	27.5	(3.8)
Russian Federation	-2	(5.4)	-7	(5.1)	25.8	(2.8)
Italy	**-43**	(5.1)	**-22**	(4.0)	14.1	(1.6)
Hungary	13	(9.7)	-7	(9.4)	31.0	(5.3)
Lithuania	-21	(11.2)	**-27**	(9.0)	20.3	(4.2)
Iceland	**-74**	(8.0)	**-55**	(7.9)	7.0	(2.6)
Belarus	**-19**	(7.2)	-9	(6.5)	22.6	(2.9)
Israel	-11	(6.4)	6	(5.3)	24.3	(1.8)
Luxembourg	**-35**	(2.8)	**-17**	(2.8)	21.8	(0.7)
Ukraine	**-25**	(8.7)	**-25**	(8.4)	15.3	(4.0)
Turkey	-5	(12.6)	**-27**	(12.2)	25.1	(7.0)
Slovak Republic	**-53**	(13.7)	**-40**	(12.7)	12.6	(4.6)

	Score-point difference in reading performance associated with immigrant background				Academic resilience	
	Before accounting for gender, and pupils' and schools' socio-economic profile[1]		After accounting for gender, and pupils' and schools' socio-economic profile		Academically resilient immigrant pupils[2]	
	Score dif.	S.E.	Score dif.	S.E.	%	S.E.
Greece	**-51**	(5.3)	**-22**	(5.1)	12.1	(1.7)
Chile	**-18**	(7.1)	**-14**	(6.9)	18.6	(2.9)
OECD Average	**-41**	(1.3)	**-24**	(1.2)	16.8	(0.5)

Notes:

[1] The socio-economic profile is measured by the PISA index of economic, social and cultural status (ESCS).

[2] Immigrant pupils who scored in the top quarter of performance in reading amongst pupils in their own country.

Values that are statistically significant are indicated in **bold**.

Symbols for missing data:

c: There were too few observations to provide reliable estimates (i.e. there were fewer than 30 pupils or fewer than 5 schools with valid data).

m: Data are not available. There was no observation in the sample; these data were not collected by the country; or these data were collected but subsequently removed from the publication for technical reasons.

w: Results were withdrawn at the request of the country concerned.

Source: PISA 2018 database

Appendix C Science Tables

Table C1.1   Mean science scores and variations in science performance

	Mean score		Standard deviation		10th percentile		Median (50th)		90th percentile	
	Mean	S.E.	S.D.	S.E.	Score	S.E.	Score	S.E.	Score	S.E.
B-S-J-Z (China)	590	(2.7)	83	(1.7)	482	(4.0)	594	(2.8)	695	(3.7)
Singapore	551	(1.5)	97	(1.0)	416	(3.2)	560	(2.1)	670	(1.8)
Macao (China)	544	(1.5)	83	(1.0)	434	(3.0)	547	(1.8)	648	(2.2)
Estonia	530	(1.9)	88	(1.2)	417	(3.5)	531	(2.4)	644	(2.7)
Japan	529	(2.6)	92	(1.6)	405	(4.4)	534	(2.9)	646	(3.5)
Finland	522	(2.5)	96	(1.3)	393	(4.1)	526	(2.9)	643	(2.9)
Korea	519	(2.8)	98	(1.7)	388	(4.1)	524	(3.3)	642	(3.8)
Canada	518	(2.2)	96	(1.0)	393	(2.3)	520	(2.6)	640	(2.5)
Hong Kong (China)	517	(2.5)	86	(1.2)	401	(4.3)	522	(2.7)	623	(3.3)
Chinese Taipei	516	(2.9)	99	(1.5)	382	(3.9)	521	(3.2)	641	(4.0)
Poland	511	(2.6)	92	(1.4)	392	(3.4)	511	(3.0)	630	(4.0)
New Zealand	508	(2.1)	102	(1.4)	371	(3.7)	512	(2.7)	640	(2.9)
England	507	(3.0)	100	(1.6)	375	(4.6)	509	(3.2)	635	(3.8)
Slovenia	507	(1.3)	88	(1.1)	390	(3.4)	510	(1.9)	621	(2.8)
United Kingdom	505	(2.6)	99	(1.4)	374	(3.8)	507	(2.7)	632	(3.2)
Netherlands	503	(2.8)	104	(1.9)	364	(5.2)	508	(3.7)	636	(3.5)
Germany	503	(2.9)	103	(1.6)	363	(4.0)	508	(3.9)	633	(3.3)
Australia	503	(1.8)	101	(1.1)	369	(2.6)	506	(2.3)	631	(2.7)
United States	502	(3.3)	99	(1.6)	371	(4.9)	505	(3.9)	629	(3.9)
Sweden	499	(3.1)	98	(1.5)	368	(5.1)	503	(3.4)	624	(3.3)
Belgium	499	(2.2)	99	(1.3)	363	(4.0)	505	(2.6)	624	(2.3)
Czech Republic	497	(2.5)	94	(1.6)	373	(4.0)	497	(3.1)	620	(2.9)
Republic of Ireland	496	(2.2)	88	(1.2)	380	(3.5)	498	(2.6)	610	(3.2)
Switzerland	495	(3.0)	97	(1.4)	367	(3.5)	497	(3.8)	622	(4.6)
France	493	(2.2)	96	(1.4)	364	(3.5)	497	(3.1)	615	(3.2)

	Mean score		Standard deviation		10th percentile		Median (50th)		90th percentile	
	Mean	S.E.	S.D.	S.E.	Score	S.E.	Score	S.E.	Score	S.E.
Denmark	493	(1.9)	91	(1.3)	372	(3.4)	496	(2.5)	609	(3.1)
Portugal	492	(2.8)	92	(1.3)	368	(4.3)	494	(3.0)	609	(3.5)
Northern Ireland	491	(4.6)	92	(2.1)	370	(5.7)	494	(5.4)	609	(6.2)
Norway	490	(2.3)	98	(1.2)	357	(3.9)	495	(2.5)	616	(2.9)
Scotland	490	(4.0)	98	(2.9)	366	(5.7)	490	(5.0)	617	(5.9)
Austria	490	(2.8)	96	(1.2)	361	(3.1)	493	(3.5)	614	(3.3)
OECD Average	489	(0.4)	94	(0.2)	365	(0.6)	491	(0.5)	609	(0.5)
Wales	488	(3.8)	89	(1.5)	371	(5.3)	490	(4.5)	603	(4.6)
Latvia	487	(1.8)	84	(1.2)	377	(3.3)	489	(2.2)	595	(2.7)
Spain	483	(1.6)	89	(0.8)	365	(2.4)	485	(1.7)	598	(2.2)
Lithuania	482	(1.6)	90	(1.0)	364	(2.9)	483	(2.2)	599	(2.3)
Hungary	481	(2.3)	94	(1.4)	356	(3.9)	484	(3.1)	602	(3.6)
Russian Federation	478	(2.9)	84	(1.7)	369	(4.1)	478	(3.2)	586	(3.7)
Luxembourg	477	(1.2)	98	(1.2)	347	(2.6)	477	(1.7)	606	(2.9)
Iceland	475	(1.8)	91	(1.0)	354	(3.1)	476	(2.6)	594	(3.1)
Croatia	472	(2.8)	90	(1.6)	356	(4.0)	471	(3.2)	590	(3.5)
Belarus	471	(2.4)	85	(1.3)	361	(3.5)	472	(2.9)	581	(2.7)
Ukraine	469	(3.3)	91	(1.8)	351	(4.4)	469	(3.8)	588	(4.5)
Turkey	468	(2.0)	84	(1.6)	361	(3.1)	466	(2.3)	579	(3.9)
Italy	468	(2.4)	90	(1.7)	348	(3.9)	470	(3.0)	583	(3.7)
Slovak Republic	464	(2.3)	96	(1.5)	338	(3.5)	464	(2.9)	589	(3.5)
Israel	462	(3.6)	111	(1.9)	314	(5.0)	464	(5.0)	607	(3.8)
Chile	444	(2.4)	83	(1.4)	336	(3.1)	442	(2.9)	553	(3.3)
Mexico	419	(2.6)	74	(1.6)	326	(3.9)	416	(2.7)	518	(4.3)
Colombia	413	(3.1)	82	(1.4)	311	(3.7)	409	(3.6)	524	(4.1)

Source: PISA 2018 database

Table C1.2   Percentage of pupils at each proficiency level in science

	All pupils															
	Below Level 1b (below 260.54 score points)		Level 1b (from 260.54 to less than 334.94 score points)		Level 1a (from 334.94 to less than 409.54 score points)		Level 2 (from 409.54 to less than 484.14 score points)		Level 3 (from 484.14 to less than 558.73 score points)		Level 4 (from 558.73 to less than 633.33 score points)		Level 5 (from 633.33 to less than 707.93 score points)		Level 6 (above 707.93 score points)	
	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.
Australia	0.6	(0.1)	4.5	(0.3)	13.7	(0.5)	23.0	(0.6)	27.5	(0.6)	21.2	(0.6)	7.9	(0.4)	1.6	(0.2)
Austria	0.6	(0.2)	4.8	(0.5)	16.5	(0.9)	25.0	(0.8)	27.6	(0.8)	19.2	(0.8)	5.8	(0.6)	0.5	(0.1)
Belarus	0.5	(0.2)	5.0	(0.5)	18.7	(0.9)	31.3	(0.9)	28.8	(0.8)	13.1	(0.8)	2.5	(0.4)	0.1	(0.1)
Belgium	0.6	(0.1)	5.3	(0.5)	14.2	(0.6)	22.2	(0.7)	28.4	(0.8)	21.3	(0.7)	7.3	(0.4)	0.7	(0.2)
B-S-J-Z (China)	0.0	(0.0)	0.3	(0.1)	1.8	(0.3)	8.4	(0.6)	23.4	(0.9)	34.6	(1.0)	24.3	(1.1)	7.2	(0.7)
Canada	0.4	(0.1)	2.6	(0.2)	10.5	(0.4)	22.4	(0.6)	29.3	(0.6)	23.5	(0.7)	9.5	(0.5)	1.8	(0.2)
Chile	1.0	(0.2)	8.8	(0.7)	25.5	(1.0)	33.1	(1.0)	22.6	(1.0)	7.9	(0.6)	1.0	(0.2)	0.0	(0.0)
Chinese Taipei	0.7	(0.2)	3.3	(0.3)	11.2	(0.6)	21.1	(0.9)	28.5	(0.9)	23.5	(0.8)	10.0	(0.8)	1.6	(0.3)
Colombia	2.1	(0.3)	15.3	(1.1)	33.0	(1.1)	29.6	(1.2)	15.4	(0.8)	4.2	(0.4)	0.4	(0.1)	0.0	(0.0)
Croatia	0.6	(0.2)	5.6	(0.5)	19.1	(0.9)	30.0	(0.8)	26.9	(0.9)	14.2	(0.7)	3.3	(0.4)	0.3	(0.1)
Czech Republic	0.4	(0.1)	3.9	(0.4)	14.5	(0.8)	25.9	(1.0)	28.7	(1.0)	19.1	(0.8)	6.6	(0.5)	1.0	(0.2)
Denmark	0.7	(0.2)	4.1	(0.3)	13.9	(0.6)	26.6	(0.7)	30.1	(0.9)	19.1	(0.8)	5.0	(0.5)	0.5	(0.2)
England	0.6	(0.2)	3.8	(0.5)	12.5	(0.7)	23.5	(1.0)	28.0	(0.9)	21.3	(0.9)	8.7	(0.7)	1.6	(0.3)
Estonia	0.1	(0.1)	1.1	(0.2)	7.5	(0.5)	21.5	(0.7)	32.1	(0.9)	25.4	(0.8)	10.2	(0.5)	2.0	(0.2)
Finland	0.4	(0.1)	2.8	(0.3)	9.7	(0.6)	21.1	(0.7)	28.9	(0.8)	24.9	(0.8)	10.5	(0.6)	1.8	(0.3)
France	0.6	(0.2)	5.0	(0.4)	14.9	(0.8)	24.6	(0.9)	28.3	(0.7)	20.0	(0.9)	5.9	(0.5)	0.6	(0.1)
Germany	0.8	(0.2)	5.0	(0.5)	13.8	(0.7)	22.0	(0.9)	26.9	(0.9)	21.5	(1.0)	8.5	(0.6)	1.5	(0.2)
Hong Kong (China)	0.2	(0.1)	2.4	(0.3)	8.9	(0.6)	21.7	(0.8)	33.8	(0.9)	25.0	(0.9)	7.1	(0.6)	0.7	(0.2)
Hungary	0.6	(0.2)	5.7	(0.6)	17.8	(0.9)	26.1	(1.0)	28.1	(0.9)	17.0	(0.7)	4.3	(0.5)	0.4	(0.1)
Iceland	0.5	(0.2)	5.9	(0.5)	18.6	(0.8)	28.3	(0.9)	27.7	(1.0)	15.2	(0.8)	3.6	(0.4)	0.2	(0.1)

	All pupils															
	Below Level 1b (below 260.54 score points)		Level 1b (from 260.54 to less than 334.94 score points)		Level 1a (from 334.94 to less than 409.54 score points)		Level 2 (from 409.54 to less than 484.14 score points)		Level 3 (from 484.14 to less than 558.73 score points)		Level 4 (from 558.73 to less than 633.33 score points)		Level 5 (from 633.33 to less than 707.93 score points)		Level 6 (above 707.93 score points)	
	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.
Israel	3.2	(0.4)	10.7	(0.7)	19.2	(0.9)	23.1	(0.9)	22.9	(0.8)	15.1	(0.8)	5.2	(0.4)	0.7	(0.1)
Italy	1.1	(0.2)	6.6	(0.5)	18.2	(0.9)	30.2	(1.0)	27.8	(1.1)	13.4	(0.7)	2.6	(0.4)	0.2	(0.1)
Japan	0.2	(0.1)	1.8	(0.3)	8.9	(0.6)	19.9	(0.8)	29.7	(1.1)	26.5	(0.9)	11.4	(0.7)	1.6	(0.3)
Korea	0.5	(0.1)	3.1	(0.3)	10.6	(0.7)	21.0	(0.8)	28.6	(0.9)	24.5	(0.9)	10.0	(0.6)	1.8	(0.3)
Latvia	0.3	(0.1)	3.4	(0.4)	14.8	(0.7)	29.5	(0.8)	31.5	(1.1)	16.8	(0.8)	3.5	(0.4)	0.3	(0.1)
Lithuania	0.5	(0.2)	4.7	(0.4)	17.0	(0.8)	28.4	(0.8)	28.7	(0.8)	16.3	(0.6)	4.0	(0.3)	0.5	(0.1)
Luxembourg	0.8	(0.2)	6.8	(0.4)	19.2	(0.6)	25.7	(0.8)	25.6	(0.8)	16.6	(0.6)	4.9	(0.5)	0.5	(0.2)
Macao (China)	0.1	(0.1)	0.8	(0.2)	5.1	(0.5)	17.2	(0.7)	32.3	(1.0)	30.8	(0.9)	11.9	(0.6)	1.7	(0.3)
Mexico	1.0	(0.3)	11.6	(1.0)	34.2	(1.3)	33.9	(0.9)	15.5	(0.9)	3.5	(0.5)	0.3	(0.1)	0.0	c
Netherlands	0.9	(0.2)	4.8	(0.5)	14.4	(0.8)	22.4	(0.8)	24.9	(1.1)	22.1	(1.0)	9.1	(0.7)	1.5	(0.3)
New Zealand	0.6	(0.2)	4.3	(0.4)	13.1	(0.6)	22.0	(0.6)	26.8	(0.7)	21.8	(0.7)	9.5	(0.6)	1.8	(0.3)
Northern Ireland	0.6	(0.2)	4.2	(0.7)	14.6	(1.3)	26.4	(1.5)	29.4	(1.2)	19.3	(1.5)	5.1	(1.0)	0.4	(0.2)
Norway	1.1	(0.2)	5.7	(0.4)	14.1	(0.8)	25.0	(0.9)	28.6	(0.7)	18.7	(0.7)	6.1	(0.5)	0.7	(0.1)
Poland	0.2	(0.1)	2.5	(0.3)	11.1	(0.7)	24.9	(0.8)	30.0	(1.0)	22.0	(0.8)	8.1	(0.7)	1.2	(0.2)
Portugal	0.4	(0.1)	4.4	(0.6)	14.7	(0.9)	26.2	(0.9)	29.4	(1.0)	19.2	(0.9)	5.1	(0.5)	0.5	(0.2)
Republic of Ireland	0.3	(0.1)	3.3	(0.3)	13.4	(0.7)	26.9	(0.9)	31.3	(0.9)	19.0	(0.7)	5.4	(0.5)	0.5	(0.2)
Russian Federation	0.4	(0.2)	4.1	(0.5)	16.7	(0.9)	31.7	(0.9)	30.0	(0.9)	14.0	(0.8)	2.9	(0.4)	0.2	(0.1)
Scotland	0.9	(0.3)	4.4	(0.6)	15.8	(1.0)	26.6	(1.4)	27.5	(1.2)	17.6	(1.2)	6.1	(0.7)	1.1	(0.3)
Singapore	0.2	(0.1)	1.8	(0.2)	7.1	(0.4)	15.1	(0.7)	25.4	(0.7)	29.7	(0.7)	17.0	(0.5)	3.8	(0.3)
Slovak Republic	1.4	(0.2)	7.9	(0.6)	19.9	(0.7)	28.5	(0.9)	25.3	(0.8)	13.2	(0.6)	3.4	(0.3)	0.3	(0.1)
Slovenia	0.2	(0.1)	2.5	(0.3)	11.9	(0.6)	24.6	(0.8)	31.8	(1.0)	21.8	(0.9)	6.7	(0.5)	0.6	(0.2)
Spain	0.6	(0.1)	4.5	(0.3)	16.2	(0.5)	28.4	(0.5)	29.4	(0.5)	16.8	(0.4)	3.9	(0.2)	0.3	(0.1)

	All pupils															
	Below Level 1b (below 260.54 score points)		Level 1b (from 260.54 to less than 334.94 score points)		Level 1a (from 334.94 to less than 409.54 score points)		Level 2 (from 409.54 to less than 484.14 score points)		Level 3 (from 484.14 to less than 558.73 score points)		Level 4 (from 558.73 to less than 633.33 score points)		Level 5 (from 633.33 to less than 707.93 score points)		Level 6 (above 707.93 score points)	
	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.
Sweden	0.6	(0.2)	4.6	(0.5)	13.8	(0.7)	24.0	(0.7)	28.0	(0.8)	20.7	(0.9)	7.3	(0.5)	1.0	(0.2)
Switzerland	0.4	(0.1)	4.6	(0.5)	15.2	(0.8)	24.9	(0.9)	27.8	(0.9)	19.3	(1.0)	6.9	(0.7)	0.9	(0.2)
Turkey	0.3	(0.1)	4.7	(0.4)	20.1	(0.8)	32.8	(1.0)	27.3	(1.0)	12.3	(0.7)	2.3	(0.4)	0.1	(0.1)
Ukraine	1.0	(0.2)	6.3	(0.6)	19.2	(0.9)	30.0	(1.1)	26.7	(1.1)	13.4	(0.8)	3.2	(0.5)	0.3	(0.1)
United Kingdom	0.6	(0.2)	3.9	(0.4)	12.9	(0.6)	24.0	(0.8)	28.1	(0.8)	20.8	(0.7)	8.2	(0.6)	1.5	(0.2)
United States	0.5	(0.2)	4.4	(0.5)	13.7	(0.8)	23.6	(0.9)	27.5	(0.9)	21.1	(0.9)	7.9	(0.7)	1.3	(0.2)
Wales	0.4	(0.1)	4.0	(0.6)	15.2	(1.1)	28.3	(1.1)	29.7	(1.1)	17.7	(1.1)	4.4	(0.6)	0.4	(0.2)
OECD Average	0.7	(0.0)	5.2	(0.1)	16.0	(0.1)	25.8	(0.1)	27.4	(0.1)	18.1	(0.1)	5.9	(0.1)	0.8	(0.0)

Source: PISA 2018 database

Table C1.3   Science performance by gender

	Boys		Girls		Gender differences (girls - boys)	
	Mean score		Mean score		Mean score	
	Mean score	S.E.	Mean score	S.E.	Score dif.	S.E.
Australia	504	(2.4)	502	(2.0)	-2	(2.6)
Austria	491	(3.8)	489	(3.6)	-2	(5.0)
Belarus	473	(3.0)	470	(2.8)	-3	(3.0)
Belgium	501	(2.6)	496	(2.7)	-5	(3.0)
B-S-J-Z (China)	596	(2.9)	584	(2.9)	-12	(2.2)
Canada	516	(2.7)	520	(2.5)	3	(2.9)
Chile	445	(3.2)	442	(2.6)	-3	(3.3)
Chinese Taipei	516	(4.1)	515	(4.1)	-1	(5.9)
Colombia	420	(3.8)	407	(2.9)	-12	(2.9)
Croatia	470	(3.5)	474	(3.4)	4	(4.0)
Czech Republic	496	(3.2)	498	(3.1)	2	(3.7)
Denmark	492	(2.5)	494	(2.2)	2	(2.8)
England	509	(3.6)	506	(3.7)	-3	(4.2)
Estonia	528	(2.3)	533	(2.3)	5	(2.5)
Finland	510	(2.9)	534	(2.9)	24	(3.0)
France	493	(2.7)	493	(2.8)	1	(3.1)
Germany	502	(3.2)	504	(3.3)	1	(3.0)
Hong Kong (China)	512	(3.4)	521	(2.8)	9	(3.6)
Hungary	484	(3.1)	478	(3.1)	-6	(4.0)
Iceland	471	(2.3)	479	(2.8)	8	(3.6)
Israel	452	(5.3)	471	(3.5)	19	(5.3)
Italy	470	(3.0)	466	(2.6)	-3	(2.9)
Japan	531	(3.5)	528	(3.0)	-3	(4.0)
Korea	521	(3.9)	517	(3.6)	-4	(5.0)
Latvia	483	(2.2)	491	(2.4)	8	(3.0)

	Boys		Girls		Gender differences (girls - boys)	
	Mean score		Mean score		Mean score	
	Mean score	S.E.	Mean score	S.E.	Score dif.	S.E.
Lithuania	479	(2.3)	485	(2.1)	6	(3.0)
Luxembourg	475	(1.7)	479	(1.7)	5	(2.3)
Macao (China)	543	(2.1)	545	(2.0)	2	(2.9)
Mexico	424	(2.8)	415	(2.9)	-9	(2.4)
Netherlands	499	(3.6)	508	(3.1)	8	(3.6)
New Zealand	509	(2.9)	508	(2.8)	-2	(3.9)
Northern Ireland	483	(6.5)	500	(5.3)	17	(7.4)
Norway	485	(2.6)	496	(2.8)	11	(2.9)
Poland	511	(2.8)	511	(3.1)	0	(2.7)
Portugal	494	(3.0)	489	(3.3)	-5	(3.1)
Republic of Ireland	495	(3.0)	497	(2.6)	1	(3.4)
Russian Federation	477	(3.0)	478	(3.2)	1	(2.3)
Scotland	494	(5.5)	486	(4.4)	-8	(5.8)
Singapore	553	(2.0)	549	(1.9)	-4	(2.5)
Slovak Republic	461	(2.8)	467	(3.0)	6	(3.7)
Slovenia	502	(1.6)	512	(2.0)	10	(2.6)
Spain	484	(1.9)	482	(1.8)	-2	(2.1)
Sweden	496	(3.2)	503	(3.7)	8	(3.1)
Switzerland	495	(3.3)	495	(3.3)	0	(2.8)
Turkey	465	(2.9)	472	(2.5)	7	(3.6)
Ukraine	470	(3.9)	468	(3.6)	-2	(3.7)
United Kingdom	506	(3.1)	503	(3.2)	-2	(3.6)
United States	503	(3.9)	502	(3.5)	-1	(3.3)
Wales	486	(4.5)	491	(3.7)	5	(3.2)
OECD Average	488	(0.5)	490	(0.5)	2	(0.5)

Source: PISA 2018 database

Appendix D Mathematics Tables

Table D1.1 Mean scores and variation in mathematics performance

	Mean score		Standard deviation		10th percentile		Median (50th)		90th percentile	
	Mean	S.E.	S.D.	S.E.	Score	S.E.	Score	S.E.	Score	S.E.
B-S-J-Z (China)	591	(2.5)	80	(1.8)	486	(4.2)	596	(2.7)	691	(3.2)
Singapore	569	(1.6)	94	(1.2)	441	(2.9)	576	(2.0)	684	(2.7)
Macao (China)	558	(1.5)	81	(1.5)	452	(3.6)	561	(2.3)	659	(2.6)
Hong Kong (China)	551	(3.0)	94	(1.9)	426	(5.4)	557	(3.1)	667	(3.5)
Chinese Taipei	531	(2.9)	100	(1.7)	397	(3.9)	537	(3.1)	656	(4.4)
Japan	527	(2.5)	86	(1.6)	413	(3.9)	530	(2.9)	637	(3.8)
Korea	526	(3.1)	100	(2.0)	393	(4.4)	530	(3.4)	651	(4.6)
Estonia	523	(1.7)	82	(1.1)	419	(2.9)	524	(2.0)	628	(2.7)
Netherlands	519	(2.6)	93	(1.8)	394	(4.8)	524	(3.0)	638	(3.6)
Poland	516	(2.6)	90	(1.7)	398	(3.8)	517	(2.8)	631	(4.2)
Switzerland	515	(2.9)	94	(1.4)	391	(3.5)	518	(3.7)	636	(4.3)
Canada	512	(2.4)	92	(1.1)	392	(3.0)	513	(2.6)	629	(2.7)
Denmark	509	(1.7)	82	(1.0)	401	(2.6)	512	(2.3)	613	(2.8)
Slovenia	509	(1.4)	89	(1.4)	392	(3.0)	511	(1.8)	622	(2.8)
Belgium	508	(2.3)	95	(1.7)	377	(4.1)	514	(2.5)	628	(3.4)
Finland	507	(2.0)	82	(1.2)	399	(3.4)	510	(2.5)	612	(2.5)
England	504	(3.0)	93	(1.7)	383	(4.9)	506	(3.2)	623	(3.7)
Sweden	502	(2.7)	91	(1.4)	383	(4.6)	505	(3.2)	618	(3.3)
United Kingdom	502	(2.6)	93	(1.4)	381	(4.0)	504	(2.7)	620	(3.3)
Norway	501	(2.2)	90	(1.3)	381	(3.9)	504	(2.8)	617	(3.1)
Germany	500	(2.6)	95	(1.5)	373	(4.2)	504	(3.5)	621	(3.2)
Republic of Ireland	500	(2.2)	78	(1.0)	397	(3.3)	502	(2.5)	599	(3.0)
Czech Republic	499	(2.5)	93	(1.7)	378	(4.6)	501	(2.7)	619	(3.1)
Austria	499	(3.0)	93	(1.5)	374	(4.4)	503	(3.7)	618	(3.3)
Latvia	496	(2.0)	80	(1.1)	393	(3.2)	497	(2.4)	599	(3.1)

	Mean score		Standard deviation		10th percentile		Median (50th)		90th percentile	
	Mean	S.E.	S.D.	S.E.	Score	S.E.	Score	S.E.	Score	S.E.
France	495	(2.3)	93	(1.5)	370	(3.4)	502	(3.0)	611	(3.3)
Iceland	495	(2.0)	90	(1.2)	374	(4.2)	499	(2.7)	609	(3.0)
New Zealand	494	(1.7)	93	(1.1)	372	(3.0)	496	(2.3)	614	(2.2)
Portugal	492	(2.7)	96	(1.3)	362	(3.8)	497	(3.2)	614	(3.6)
Northern Ireland	492	(4.2)	85	(2.5)	377	(6.4)	496	(4.4)	600	(5.3)
Australia	491	(1.9)	92	(1.2)	371	(3.0)	492	(2.1)	609	(2.7)
OECD Average	489	(0.4)	91	(0.2)	370	(0.6)	492	(0.5)	605	(0.6)
Scotland	489	(3.9)	95	(2.9)	367	(6.0)	490	(4.3)	610	(5.7)
Russian Federation	488	(3.0)	86	(1.9)	376	(4.3)	489	(3.1)	597	(3.9)
Wales	487	(3.9)	82	(1.5)	381	(5.4)	488	(4.4)	592	(4.4)
Italy	487	(2.8)	94	(1.8)	363	(4.7)	490	(3.5)	605	(3.9)
Slovak Republic	486	(2.6)	100	(1.7)	353	(5.4)	492	(3.0)	610	(3.1)
Luxembourg	483	(1.1)	98	(1.3)	353	(2.9)	485	(2.0)	611	(2.4)
Spain	481	(1.5)	88	(1.0)	365	(2.4)	484	(1.6)	593	(2.2)
Lithuania	481	(2.0)	91	(1.1)	362	(3.6)	483	(2.3)	598	(2.8)
Hungary	481	(2.3)	91	(1.6)	360	(4.0)	484	(2.9)	597	(3.7)
United States	478	(3.2)	92	(1.5)	357	(4.6)	479	(3.8)	598	(4.3)
Belarus	472	(2.7)	93	(1.4)	351	(3.4)	473	(3.0)	592	(3.5)
Malta	472	(1.9)	102	(1.4)	334	(3.4)	478	(2.7)	599	(3.5)
Croatia	464	(2.5)	87	(1.7)	354	(3.9)	463	(2.9)	577	(3.9)
Israel	463	(3.5)	108	(1.9)	315	(5.5)	468	(4.0)	600	(3.9)
Turkey	454	(2.3)	88	(1.8)	343	(3.8)	450	(2.4)	571	(4.0)
Ukraine	453	(3.6)	94	(1.9)	331	(4.4)	454	(4.1)	573	(5.0)
Greece	451	(3.1)	89	(1.8)	334	(4.7)	454	(3.3)	565	(3.8)
Cyprus	451	(1.4)	95	(1.1)	325	(2.8)	454	(1.9)	571	(2.4)
Chile	417	(2.4)	85	(1.4)	311	(3.5)	416	(2.9)	528	(3.5)
Mexico	409	(2.5)	78	(1.6)	311	(3.6)	408	(2.7)	510	(3.6)
Colombia	391	(3.0)	81	(2.0)	290	(3.9)	387	(3.5)	499	(4.5)

Source: PISA 2018 database

Table D1.2   Percentage of pupils at each proficiency level in mathematics

	All pupils													
	Below Level 1 (below 357.77 score points)		Level 1 (from 357.77 to less than 420.07 score points)		Level 2 (from 420.07 to less than 482.38 score points)		Level 3 (from 482.38 to less than 544.68 score points)		Level 4 (from 544.68 to less than 606.99 score points)		Level 5 (from 606.99 to less than 669.30 score points)		Level 6 (above 669.30 score points)	
	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.
Australia	7.6	(0.5)	14.8	(0.5)	23.4	(0.5)	25.6	(0.5)	18.2	(0.5)	8.0	(0.4)	2.5	(0.3)
Austria	7.3	(0.7)	13.8	(0.8)	20.8	(1.0)	24.9	(0.9)	20.6	(0.8)	10.0	(0.7)	2.5	(0.3)
Belarus	11.4	(0.7)	18.0	(0.7)	24.7	(0.9)	23.4	(0.7)	15.2	(0.7)	6.1	(0.5)	1.2	(0.2)
Belgium	6.9	(0.7)	12.8	(0.6)	18.6	(0.7)	23.8	(0.8)	22.2	(0.7)	12.5	(0.6)	3.2	(0.4)
B-S-J-Z (China)	0.5	(0.1)	1.9	(0.3)	6.9	(0.5)	17.5	(0.8)	28.9	(1.0)	27.8	(1.0)	16.5	(1.1)
Canada	5.0	(0.4)	11.3	(0.5)	20.8	(0.6)	25.9	(0.6)	21.7	(0.7)	11.3	(0.5)	4.0	(0.3)
Chile	24.7	(1.1)	27.2	(0.9)	25.5	(0.9)	15.6	(0.8)	5.7	(0.5)	1.1	(0.2)	0.1	(0.0)
Chinese Taipei	5.0	(0.4)	9.0	(0.5)	16.1	(0.7)	23.2	(0.8)	23.5	(0.8)	15.6	(0.8)	7.6	(0.8)
Colombia	35.5	(1.7)	29.9	(1.2)	21.1	(0.9)	10.0	(0.7)	3.1	(0.4)	0.5	(0.1)	0.0	(0.0)
Croatia	11.0	(0.8)	20.2	(0.8)	27.4	(0.9)	23.3	(0.8)	13.0	(0.8)	4.3	(0.5)	0.8	(0.2)
Cyprus	17.2	(0.6)	19.7	(0.7)	24.7	(0.9)	22.0	(0.8)	12.1	(0.5)	3.7	(0.4)	0.7	(0.1)
Czech Republic	6.6	(0.7)	13.8	(0.7)	22.1	(0.8)	25.2	(0.9)	19.6	(0.7)	9.5	(0.5)	3.1	(0.3)
Denmark	3.7	(0.4)	10.9	(0.6)	22.0	(0.9)	28.8	(0.8)	23.0	(0.8)	9.5	(0.6)	2.1	(0.3)

	All pupils												
	Below Level 1 (below 357.77 score points)		Level 1 (from 357.77 to less than 420.07 score points)		Level 2 (from 420.07 to less than 482.38 score points)		Level 3 (from 482.38 to less than 544.68 score points)		Level 4 (from 544.68 to less than 606.99 score points)		Level 5 (from 606.99 to less than 669.30 score points)		Level 6 (above 669.30 score points)	
	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.
England	6.2	(0.6)	12.5	(0.8)	21.6	(0.9)	25.3	(0.8)	20.8	(0.8)	10.2	(0.7)	3.4	(0.4)
Estonia	2.1	(0.3)	8.1	(0.6)	20.8	(0.8)	29.0	(0.8)	24.6	(0.8)	11.8	(0.7)	3.7	(0.4)
Finland	3.8	(0.4)	11.1	(0.6)	22.3	(0.9)	28.9	(1.0)	22.7	(0.8)	9.3	(0.5)	1.8	(0.3)
France	8.0	(0.5)	13.2	(0.6)	21.1	(0.8)	25.6	(0.8)	21.0	(0.8)	9.2	(0.6)	1.8	(0.3)
Germany	7.6	(0.7)	13.5	(0.8)	20.7	(0.9)	24.0	(0.8)	20.8	(0.8)	10.5	(0.7)	2.8	(0.3)
Greece	15.3	(1.1)	20.5	(0.9)	26.8	(0.9)	22.5	(1.0)	11.1	(0.6)	3.2	(0.4)	0.5	(0.2)
Hong Kong (China)	2.8	(0.4)	6.4	(0.6)	13.5	(0.7)	22.1	(0.7)	26.3	(0.9)	19.5	(0.8)	9.5	(0.8)
Hungary	9.6	(0.7)	16.1	(0.8)	23.6	(0.9)	25.2	(1.0)	17.5	(0.8)	6.5	(0.5)	1.4	(0.3)
Iceland	7.4	(0.5)	13.3	(0.7)	22.0	(1.0)	26.7	(1.0)	20.2	(0.9)	8.5	(0.6)	1.9	(0.3)
Israel	17.7	(1.1)	16.4	(0.8)	20.7	(0.7)	21.0	(0.8)	15.4	(0.8)	7.0	(0.6)	1.8	(0.3)
Italy	9.1	(0.8)	14.8	(0.9)	22.9	(1.0)	25.6	(0.9)	18.1	(0.8)	7.5	(0.6)	2.0	(0.3)
Japan	2.9	(0.4)	8.6	(0.6)	18.7	(0.8)	26.4	(0.9)	25.1	(1.0)	14.0	(0.8)	4.3	(0.5)
Korea	5.4	(0.5)	9.6	(0.6)	17.3	(0.8)	23.4	(0.7)	22.9	(0.8)	14.4	(0.7)	6.9	(0.8)
Latvia	4.4	(0.5)	12.9	(0.8)	25.8	(0.9)	29.4	(1.0)	19.0	(0.8)	7.1	(0.5)	1.4	(0.2)

	All pupils												
	Below Level 1 (below 357.77 score points)		Level 1 (from 357.77 to less than 420.07 score points)		Level 2 (from 420.07 to less than 482.38 score points)		Level 3 (from 482.38 to less than 544.68 score points)		Level 4 (from 544.68 to less than 606.99 score points)		Level 5 (from 606.99 to less than 669.30 score points)		Level 6 (above 669.30 score points)	
	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.
Lithuania	9.3	(0.6)	16.4	(0.7)	24.2	(0.7)	25.2	(0.9)	16.5	(0.8)	6.8	(0.5)	1.7	(0.2)
Luxembourg	10.9	(0.6)	16.4	(0.6)	21.7	(0.8)	22.6	(0.7)	17.7	(0.7)	8.6	(0.5)	2.3	(0.3)
Macao (China)	1.0	(0.2)	4.0	(0.4)	12.3	(0.8)	24.8	(0.9)	30.3	(1.2)	20.0	(0.8)	7.7	(0.6)
Malta	14.3	(0.7)	15.9	(0.8)	21.5	(1.0)	23.2	(1.1)	16.6	(0.7)	6.7	(0.6)	1.8	(0.3)
Mexico	26.0	(1.2)	30.3	(0.9)	26.4	(0.9)	13.1	(0.8)	3.7	(0.5)	0.5	(0.1)	0.0	(0.0)
Netherlands	4.5	(0.6)	11.2	(0.7)	19.0	(1.0)	23.2	(1.1)	23.6	(0.9)	14.2	(0.8)	4.3	(0.5)
New Zealand	7.6	(0.5)	14.2	(0.6)	22.8	(0.8)	25.0	(0.7)	18.9	(0.7)	8.8	(0.4)	2.7	(0.3)
Northern Ireland	6.9	(1.1)	13.4	(1.0)	23.7	(1.4)	27.8	(1.3)	19.9	(1.7)	7.0	(1.1)	1.3	(0.3)
Norway	6.5	(0.5)	12.4	(0.6)	21.8	(0.8)	26.5	(0.8)	20.6	(0.9)	9.8	(0.6)	2.4	(0.4)
Poland	4.2	(0.5)	10.5	(0.6)	20.7	(0.8)	26.5	(0.8)	22.3	(0.7)	11.7	(0.7)	4.1	(0.5)
Portugal	9.3	(0.6)	14.0	(0.8)	20.9	(0.8)	24.5	(1.1)	19.7	(0.8)	9.1	(0.6)	2.5	(0.3)
Republic of Ireland	3.8	(0.5)	11.9	(0.7)	24.7	(0.8)	30.5	(0.8)	20.8	(0.8)	7.2	(0.6)	1.0	(0.2)
Russian Federation	6.8	(0.7)	14.9	(0.8)	25.0	(0.9)	27.5	(0.9)	17.8	(0.8)	6.6	(0.6)	1.5	(0.2)
Scotland	8.5	(1.0)	15.0	(1.2)	23.4	(1.1)	24.5	(1.2)	18.0	(1.1)	8.2	(0.8)	2.5	(0.6)

	All pupils												
	Below Level 1 (below 357.77 score points)		Level 1 (from 357.77 to less than 420.07 score points)		Level 2 (from 420.07 to less than 482.38 score points)		Level 3 (from 482.38 to less than 544.68 score points)		Level 4 (from 544.68 to less than 606.99 score points)		Level 5 (from 606.99 to less than 669.30 score points)		Level 6 (above 669.30 score points)	
	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.
Singapore	1.8	(0.2)	5.3	(0.4)	11.1	(0.5)	19.1	(0.7)	25.8	(0.8)	23.2	(0.7)	13.8	(0.8)
Slovak Republic	10.7	(0.9)	14.4	(0.6)	21.4	(0.9)	24.2	(0.9)	18.6	(0.9)	8.4	(0.6)	2.3	(0.3)
Slovenia	4.8	(0.6)	11.7	(0.7)	21.6	(0.9)	26.4	(0.9)	22.0	(0.8)	10.5	(0.8)	3.1	(0.4)
Spain	8.7	(0.4)	16.0	(0.5)	24.4	(0.4)	26.0	(0.6)	17.5	(0.5)	6.2	(0.3)	1.1	(0.1)
Sweden	6.0	(0.6)	12.8	(0.8)	21.9	(0.9)	25.7	(0.8)	21.0	(0.8)	10.0	(0.7)	2.6	(0.3)
Switzerland	4.8	(0.4)	12.0	(0.8)	19.5	(0.9)	24.4	(1.0)	22.3	(0.9)	12.1	(0.7)	4.9	(0.5)
Turkey	13.8	(0.9)	22.9	(0.8)	27.3	(0.8)	20.4	(0.8)	10.9	(0.5)	3.9	(0.4)	0.9	(0.3)
Ukraine	15.6	(1.2)	20.3	(1.0)	26.2	(1.0)	21.5	(1.0)	11.5	(0.8)	4.0	(0.5)	1.0	(0.3)
United Kingdom	6.4	(0.5)	12.8	(0.6)	22.0	(0.8)	25.5	(0.7)	20.4	(0.7)	9.8	(0.6)	3.1	(0.4)
United States	10.2	(0.8)	16.9	(0.9)	24.2	(1.0)	24.1	(1.0)	16.3	(0.9)	6.8	(0.7)	1.5	(0.3)
Wales	5.9	(0.7)	14.9	(1.2)	26.4	(1.3)	27.7	(1.3)	18.2	(1.2)	6.1	(0.8)	0.8	(0.2)
OECD Average	9.1	(0.1)	14.8	(0.1)	22.2	(0.1)	24.4	(0.1)	18.5	(0.1)	8.5	(0.1)	2.4	(0.1)

Source: PISA 2018 database

Table D1.3   Mathematics performance by gender

	Boys		Girls		Gender differences (girls - boys)	
	Mean score		Mean score		Mean score	
	Mean score	S.E.	Mean score	S.E.	Score dif.	S.E.
Australia	494	(2.4)	488	(2.5)	-6	(3.0)
Austria	505	(3.9)	492	(3.8)	-13	(5.1)
Belarus	475	(3.2)	469	(3.1)	-6	(3.3)
Belgium	514	(2.9)	502	(2.7)	-12	(3.3)
B-S-J-Z (China)	597	(2.9)	586	(2.6)	-11	(2.4)
Canada	514	(2.5)	510	(2.7)	-5	(2.3)
Chile	421	(3.3)	414	(2.7)	-7	(3.6)
Chinese Taipei	533	(4.3)	529	(4.1)	-4	(6.1)
Colombia	401	(3.8)	381	(3.1)	-20	(3.5)
Croatia	469	(3.0)	460	(3.4)	-9	(3.8)
Cyprus	447	(1.9)	455	(1.7)	8	(2.3)
Czech Republic	501	(2.9)	498	(3.2)	-4	(3.6)
Denmark	511	(2.3)	507	(2.3)	-4	(2.9)
England	495	(3.8)	515	(3.6)	20	(4.2)
Estonia	528	(2.2)	519	(2.0)	-8	(2.5)
Finland	504	(2.5)	510	(2.2)	6	(2.6)
France	499	(2.7)	492	(2.8)	-6	(2.9)
Germany	503	(3.0)	496	(3.1)	-7	(2.9)
Greece	452	(3.9)	451	(3.2)	0	(3.6)
Hong Kong (China)	548	(3.6)	554	(3.4)	6	(3.6)
Hungary	486	(3.0)	477	(3.2)	-9	(4.1)
Iceland	490	(2.5)	500	(2.9)	10	(3.7)
Israel	458	(5.2)	467	(3.5)	9	(5.4)
Italy	494	(3.3)	479	(3.1)	-16	(3.5)
Japan	532	(3.4)	522	(2.9)	-10	(3.9)
Korea	528	(4.1)	524	(4.0)	-4	(5.3)
Latvia	500	(2.2)	493	(2.5)	-7	(2.6)

| | Boys | | Girls | | Gender differences (girls - boys) | |
| | Mean score | | Mean score | | Mean score | |
	Mean score	S.E.	Mean score	S.E.	Score dif.	S.E.
Lithuania	480	(2.4)	482	(2.7)	2	(3.3)
Luxembourg	487	(1.5)	480	(1.7)	-7	(2.3)
Macao (China)	560	(2.2)	556	(2.2)	-4	(3.1)
Malta	466	(2.4)	478	(2.7)	13	(3.5)
Mexico	415	(2.9)	403	(2.7)	-12	(2.6)
Netherlands	520	(3.5)	519	(2.7)	-1	(3.3)
New Zealand	499	(2.5)	490	(2.3)	-9	(3.3)
Northern Ireland	482	(6.2)	519	(4.5)	36	(7.3)
Norway	497	(2.5)	505	(2.6)	7	(2.6)
Poland	516	(2.9)	515	(3.1)	-1	(3.0)
Portugal	497	(3.0)	488	(3.1)	-9	(3.1)
Republic of Ireland	503	(2.9)	497	(2.7)	-6	(3.4)
Russian Federation	490	(3.2)	485	(3.1)	-5	(2.2)
Scotland	497	(3.7)	511	(3.6)	15	(4.1)
Singapore	571	(1.6)	567	(2.3)	-4	(2.3)
Slovak Republic	488	(3.2)	484	(3.2)	-5	(3.9)
Slovenia	509	(1.9)	509	(1.8)	-1	(2.5)
Spain	485	(2.1)	478	(1.5)	-6	(2.1)
Sweden	502	(3.1)	503	(3.1)	1	(3.1)
Switzerland	519	(3.0)	512	(3.5)	-7	(2.9)
Turkey	456	(3.2)	451	(2.9)	-5	(4.0)
Ukraine	456	(4.3)	449	(3.9)	-7	(3.8)
United Kingdom	508	(3.2)	496	(3.0)	-12	(3.6)
United States	482	(3.9)	474	(3.3)	-9	(3.2)

|	Boys		Girls		Gender differences (girls - boys)	
	Mean score		Mean score		Mean score	
	Mean score	S.E.	Mean score	S.E.	Score dif.	S.E.
Wales	470	(4.3)	497	(4.3)	26	(3.4)
OECD Average	492	(0.5)	487	(0.5)	-5	(0.6)

Source: PISA 2018 database

Appendix E Notes on PISA International Scale Scores

A key purpose of the PISA study is to provide data for monitoring and exploring the effectiveness of a country's education system. It is imperative, therefore, that rigorous scaling procedures are used to ensure that results, in PISA score points, are comparable with the results of previous PISA assessments and across countries.

PISA defines an international reporting scale for each subject. Each scale is based on the PISA assessment framework (OECD 2018a). The development of the PISA reporting scales is covered in detail in Chapter 2 of the OECD PISA 2018 International Report (OECD 2019b), and summarised briefly below.

When each subject was first run as a major focus, the 'OECD population' was defined as having a normal distribution with a mean of 500 and standard deviation of 100[84]. This is illustrated in the 'bell-shaped' curve below. In a normal distribution, 68% of pupils fall within one standard deviation of the mean – so in this case would score between 400 and 600 score points. Changes in the overall PISA population each cycle mean that the subject means can change slightly, but remain close to 500.

PISA score
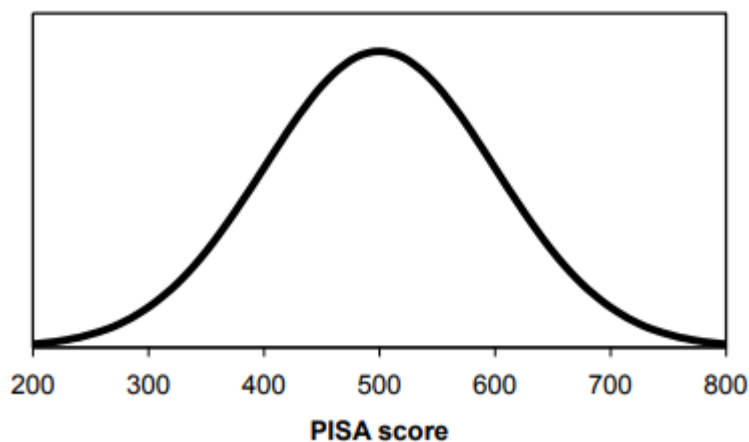
The OECD defines the population as follows:

1. The representative sample of pupils within each OECD country is selected;

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[84] This means that the mean of 500 and the standard deviation of 100 for OECD countries relates to the year 2000 for Reading, 2003 for Mathematics and 2006 for Science.

2. Their results are weighted in such a way that each country[85] in the study has an equal importance (weight);

3. Pupils' scores are adjusted to have the above distribution within this hypothetical population.

Thus the important unit is the country, not the pupil – Russian Federation and Hong Kong have the same weights in that they provide the same amount of information for constructing the scale, despite differences in size.

PISA scores are thus defined on a scale which does not relate directly to any other test measure. In particular, there is no easy or valid way to relate them to 'months of progress' or any measure of individual development.

However, PISA scales are divided into proficiency levels which define the kinds of knowledge and skills needed to complete tasks successfully at each level. (See Appendices B, C and D). Each proficiency level corresponds to a range of about 80 score points. Hence, score-point differences of 80 points can be interpreted as the difference in described skills and knowledge between successive proficiency levels.

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[85] PISA refers to the UK as a whole country and does not treat England, Scotland, Wales and Northern Ireland as separate entities.

Appendix F Effort Thermometer

Because of the low-stakes nature of the PISA tests, pupils may make less effort than in high-stakes examinations such as GCSEs or equivalent.

For this reason, at the end of the PISA assessments, pupils were asked to indicate how much effort they had invested in the PISA test, and how much they would have invested in it if the scores were going to be counted in their school marks, and therefore of importance to their future education or career.

Table F1.1 shows these results and the percentage of pupils in each country that reported that they invested less effort in the PISA test than if their scores were going to be counted in their school marks.

Table F1.1   Effort invested in the PISA assessments (Pupil reports)

	Average effort invested in the PISA test (1-10) (10 indicates the effort invested in something that is highly important to pupils personally)		Average effort pupils would have invested in the PISA test (1-10) if scores on the test were going to be counted in their school marks		Percentage of pupils indicating that they invested less effort in the PISA test than if their scores were going to be counted in their school marks	
	Mean	S.E.	Mean	S.E.	%	S.E.
Australia	7.43	0.03	9.17	0.02	73.37	0.47
Austria	7.15	0.03	9.02	0.03	76.08	0.59
Belarus	8.35	0.03	8.96	0.03	45.45	0.90
Belgium	7.28	0.02	8.91	0.02	76.24	0.62
B-S-J-Z (China)	8.98	0.03	9.63	0.02	38.10	1.04
Canada	7.47	0.02	9.37	0.01	78.76	0.40
Chile	8.00	0.03	9.35	0.02	65.87	0.87
Chinese Taipei	8.29	0.04	9.05	0.03	44.89	0.77
Colombia	8.47	0.04	9.07	0.04	47.44	1.13
Croatia	7.61	0.04	8.94	0.03	64.78	0.72
Czech Republic	7.27	0.03	8.79	0.03	72.18	0.96
Denmark	7.50	0.03	9.41	0.02	79.01	0.69
England	7.43	0.04	9.28	0.02	76.21	0.84
Estonia	7.72	0.03	9.04	0.02	67.97	0.62
Finland	7.98	0.03	9.30	0.02	69.68	0.73
France	7.16	0.04	8.92	0.03	73.70	0.83
Germany	7.17	0.04	9.14	0.03	80.17	0.66
Greece	7.50	0.03	8.89	0.03	68.81	0.85
Hong Kong (China)	7.40	0.03	8.91	0.03	66.84	0.80
Hungary	7.70	0.04	9.02	0.03	66.73	0.92
Iceland	7.66	0.04	9.08	0.03	61.93	0.82

	Average effort invested in the PISA test (1-10) (10 indicates the effort invested in something that is highly important to pupils personally)		Average effort pupils would have invested in the PISA test (1-10) if scores on the test were going to be counted in their school marks		Percentage of pupils indicating that they invested less effort in the PISA test than if their scores were going to be counted in their school marks	
	Mean	S.E.	Mean	S.E.	%	S.E.
Israel	7.87	0.04	9.28	0.03	62.76	0.75
Italy	7.95	0.03	9.19	0.03	68.35	0.87
Japan	7.14	0.04	8.43	0.03	59.80	1.00
Korea	8.26	0.03	9.10	0.03	45.52	0.84
Latvia	7.73	0.03	8.76	0.03	61.09	0.83
Lithuania	7.98	0.02	9.07	0.02	62.07	0.77
Luxembourg	6.98	0.03	8.88	0.02	76.20	0.60
Macao (China)	8.11	0.02	8.82	0.03	53.24	0.84
Mexico	8.63	0.02	9.33	0.02	54.86	0.90
Netherlands	7.45	0.04	9.08	0.03	75.40	0.91
New Zealand	7.56	0.03	9.18	0.02	73.34	0.72
Northern Ireland	7.45	0.06	9.17	0.04	75.64	1.03
Norway	7.38	0.04	9.24	0.03	74.93	0.83
Poland	7.44	0.04	8.96	0.02	68.47	0.83
Portugal	7.50	0.03	9.26	0.02	75.32	0.77
Republic of Ireland	7.98	0.03	9.35	0.02	70.58	0.76
Russian Federation	7.79	0.05	8.78	0.04	51.90	0.89
Scotland	7.69	0.04	9.41	0.03	75.88	1.04
Singapore	7.53	0.03	9.24	0.02	74.19	0.67
Slovak Republic	7.32	0.03	8.67	0.03	65.97	0.94
Slovenia	7.56	0.03	9.13	0.02	72.77	0.64
Sweden	7.40	0.04	9.37	0.02	77.44	0.73

	Average effort invested in the PISA test (1-10) (10 indicates the effort invested in something that is highly important to pupils personally)		Average effort pupils would have invested in the PISA test (1-10) if scores on the test were going to be counted in their school marks		Percentage of pupils indicating that they invested less effort in the PISA test than if their scores were going to be counted in their school marks	
	Mean	S.E.	Mean	S.E.	%	S.E.
Switzerland	7.24	0.04	9.05	0.03	78.30	0.64
Turkey	8.91	0.04	9.34	0.02	37.15	0.97
Ukraine	8.08	0.03	9.19	0.03	59.61	0.92
United Kingdom	7.46	0.03	9.29	0.02	76.01	0.72
United States	8.25	0.03	9.44	0.02	64.84	0.97
Wales	7.68	0.04	9.33	0.02	72.67	1.17
OECD Average	7.65	0.01	9.11	0.00	68.42	0.13

Source: PISA 2018 database

Evidence for excellence in education

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This document is available for download at

https://gov.wales/achievement-15-year-olds-program-international-student-assessment-pisa-national-report-2018

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