Department for Education

PISA 2022: National Report for England

Research report

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Jenni Ingram, Jamie Stiff, Stuart Cadwallader, Gabriel Lee & Heather Kayton: University of Oxford

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Executive Summary

Introduction

The Programme for International Student Assessment (PISA) assesses the knowledge and skills in mathematics, reading and science of 15-year-old pupils in countries around the world. PISA is run by the Organisation for Economic Co-operation and Development (OECD), and assessment is typically undertaken every 3 years, allowing us to chart how performance changes over time and across different education systems. PISA 2022, which was undertaken 4 years after the previous cycle due to the global COVID-19 pandemic, involved 81 education systems, including England.

In England, 4,763 15-year-old pupils from 165 schools completed a 2-hour computer-based assessment and pupil questionnaire. Headteachers at participating schools were also asked to complete a school questionnaire. The study was carried out in November and December 2022, with most of those pupils who participated completing their GCSE exams in 2023. This report analyses their performance in the three subject domains of mathematics, reading and science, as well as their responses to the pupil questionnaire, and their headteachers' responses to the school questionnaire.

When reading this report, it is important to keep in mind that England's sample of participating pupils may not be entirely representative of all 15-year-old pupils in England. This is, to some degree, always the case with international studies such as PISA, but in this case the sample for England did not meet 2 of the 82 PISA Technical Standards. Analysis of the characteristics of the pupils who participated revealed that the final sample had somewhat higher academic attainment on average than the general population and a somewhat lower proportion of pupils who had been eligible for free school meals in the past 6 years. In other words, higher performing pupils may be over-represented in the final sample and some of the PISA results may therefore be somewhat higher than they might otherwise be[1]. This issue was also a challenge for some of the other participating education systems including several OECD countries[2]. Given that the sample may not be entirely representative of the population, caution is required when interpreting the analysis that is presented in this report, though this does not necessarily translate directly to a particular score being a certain number of points

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[1] The OECD estimate that this may translate in a small upward bias for some of the reported results of approximately 7 or 8 points after non-response adjustments are taken into account (OECD, PISA 2022 Reader's Guide, forthcoming).

[2] In other education systems which were able to produce a full non-response bias analysis, the OECD estimated that the impact may translate to an upward bias of between 7 and 10 points. The data required to calculate the impact was not available in some of these education systems, and the OECD concluded that bias in these education system's data could not be ruled out.

higher than its 'true' value, and the OECD itself makes no adjustments to the scores in any education system in which some of the PISA's Technical Standards were not met.

The term 'significant' is used throughout this report to refer to statistically significant differences between scores or values. In this report, we use a '95% confidence level' to define statistical significance. A statistically significant result is one that is not likely to occur by chance, due to the sampling process, and is more likely to be attributable to a genuine difference between groups. Similarly, the term average, as in 'average score', is used to refer to the arithmetic mean for the relevant group, unless stated otherwise.

Highlights

- Average performance in mathematics and reading had significantly declined across the OECD since 2018. England's scores for mathematics and reading had also declined significantly since 2018 but remained significantly above the OECD average in each case. England's performance in 2022 was similar to that of previous PISA cycles (between 2006 and 2015).
- For science, England's performance in 2022 was not significantly different to 2018, and this was also the case for average performance across the OECD countries. England's average score in 2022 was significantly lower than in 2015 but remains significantly above the OECD average.
- As with previous PISA cycles, the highest performing education systems tended to be in East Asia, with Singapore significantly outperforming all other education systems in all subjects. Japan, Taiwan, Macao and South Korea were also among the top performing systems for all three subject domains.
- England's average score in PISA was significantly higher than that of Northern Ireland, Scotland and Wales for both mathematics and science. For reading, England's average score was significantly higher than those of Northern Ireland and Wales, but not Scotland.

Achievement in mathematics

Pupils in England achieved a mean PISA mathematics score of 492 in 2022, significantly higher than the OECD average score of 472. Pupils in 8 of the education systems which participated in PISA 2022 mathematics assessment achieved an average score that was significantly above that of England, with a further 9 education systems having scores that were not significantly different, and pupils in the remaining 62 education systems scoring significantly below those in England on average. The highest performing education systems were Singapore, Macao, Taiwan, Hong Kong, Japan, and South Korea, with Estonia and Switzerland also scoring significantly higher than England.

For PISA 2022, performance in mathematics was, on average, lower across the OECD in comparison to average performance for PISA 2018. It seems probable that the COVID-19 pandemic had an impact on the performance of pupils around the world. England's score of 492 was significantly lower than the 504 achieved in 2018, although it was not significantly different to average scores in PISA cycles prior to 2018. In total, 26 of the 37 higher performing education systems (those with a score above 450), including England, saw a significant decrease in their average mathematics score in 2022 relative to 2018, and only one education system, Taiwan, saw a significant increase.

PISA also describes performance in terms of levels of proficiency, with higher proficiency levels representing better knowledge and skills in the subject domain. The percentage of pupils in England who performed at the highest proficiency levels, Levels 5 or 6, was 12%, which was significantly larger than the OECD average of 9%. The percentage of pupils in England performing at the lowest proficiency levels (those below Level 2) was 23%, which was significantly smaller than the OECD average of 31%.

Achievement in reading

For PISA 2022, England's average score in reading was 496, significantly above the OECD average of 476. Pupils in 8 of the education systems who participated in the PISA 2022 reading assessment achieved an average score that was significantly above that of England, with a further 5 education systems having reading scores that were not significantly different to England's. Pupils from 65 of the other participating education systems achieved an average score that was significantly below that in England. The highest performing education systems were Singapore, the Republic of Ireland, Japan, South Korea, Taiwan and Estonia, with Macao and Canada also scoring significantly above England.

England's average score in reading for PISA 2022 was significantly below the average score in 2018 (505). However, this was a pattern that was observed in many education systems, and the OECD trend average was also significantly lower in 2022 (477) than in 2018 (488). England's score in 2022 was not significantly different from scores achieved between 2006 and 2015, while the OECD trend average has declined.

In terms of PISA's reading proficiency levels, the percentage of pupils in England who performed at the highest proficiency levels, Levels 5 or 6, was 10%, which was significantly larger than the OECD average of 7%. The percentage of pupils in England performing at the lowest proficiency levels (those below Level 2) was 20%, which was significantly smaller the OECD average of 26%.

Achievement in science

England's overall average score in science in PISA 2022 was 503. This was significantly higher than the OECD average of 485, and significantly higher than the scores of 62 of the other education systems who participated in the PISA 2022 science assessment. There were 8 education systems which scored similarly to England, and 9 which scored significantly higher. The highest performing education systems for science were Singapore, Japan, Macao, Taiwan, South Korea, and Estonia, with Hong Kong, Canada and Finland also performing significantly above England.

The overall average score for the OECD in 2022 was 2 points lower than that in 2018, which was not a significant decline. England's overall average science score for 2022 (503) was not significantly different to the score of 507 that was achieved in PISA 2018. In contrast, average scores in 9 of the higher-performing education systems (those with scores above 450) improved significantly in comparison to 2018, the scores for 6 education systems were significantly lower in 2022 when compared to 2018, and the difference between scores in 2022 and 2018 was not significantly different for the remaining 22 higher-performing education systems. However, between 2015 and 2022, the performance of pupils in science has declined significantly both for England, and on average across the OECD. England's overall average science score dropped from 512 in 2015 to 503 in 2022.

In terms of PISA's science proficiency levels, the percentage of pupils in England who performed at the highest levels, Levels 5 or 6, was 11%, which was significantly larger than the OECD average of 7%. The percentage of pupils in England working at the lowest proficiency levels (those below Level 2) was 19%, significantly smaller than the OECD average of 24%.

Variations in PISA scores by pupil characteristics

Pupils' PISA scores in mathematics, reading and science were analysed by gender and socioeconomic status, alongside other pupil characteristics.

On average across OECD countries the average mathematics score for boys (477) was significantly higher than that for girls (468). This was also true in England, where the average score for boys (499) was significantly higher than that for girls (485). For reading, girls in England performed significantly better than boys, with an average score of 505 for girls compared to an average score of 488 for boys. Across the OECD, the average score for girls (488) was also significantly higher than that for boys (464). For science, girls in England had an average science score of 499, compared to an average of 507 for boys, but this does not represent a statistically significant difference in performance. On average across the OECD, there was also no significant difference in the performances of girls (485) and boys (485) in science.

In terms of socioeconomic status, there was an 85 score point difference in mathematics performance between the most disadvantaged group and the least disadvantaged group in England. This was not significantly different from the OECD difference of 93 score points. For reading, the difference in performance between the most disadvantaged group and the least disadvantaged group was 82 score points, which was not significantly different to the average gap across the OECD (93 score points). Finally, for science, the performance gap between the most disadvantaged group and the least disadvantaged group was 92 score points, which was not different from the performance gap on average across OECD countries (96 score points).

Pupil wellbeing, aspirations and experiences of teaching and learning

Pupils who participated in PISA 2022 were asked to complete a questionnaire relating to their attitudes and beliefs, experiences in school, hopes for the future and general wellbeing. Pupils are asked to rate their overall life satisfaction on a scale from 0 to 10, with 0 indicating very low life satisfaction, and 10 indicating very high satisfaction. Pupils in England reported a significantly lower average level of satisfaction (6.01) when compared to the average across the OECD education systems (6.75). The extent to which a pupil feels satisfied with their life is related to performance in the PISA mathematics assessment. Those pupils who reported a rating of 7 or 8 had the highest average score in mathematics, with an average score of 514.

Most pupils in England (93%) reported that they felt safe in their classrooms at school, which was the same as the proportion of pupils on average across OECD countries (93%). Pupils who reported feeling safe in their classrooms at school had a significantly higher mathematics score on average than pupils who reported not feeling safe (a difference of 54 score points).

Most pupils in England reported that they feel that they belong at school (63%). On average across OECD countries 75% of pupils reported that they feel that they belong in school. This is of note, given that pupils who agreed that they have a sense of belonging at their school scored, on average, performed better in PISA mathematics, scoring around 32 points more than those who reported that they did not feel like they belonged at their school.

The majority of pupils in England perceived that the quality of their mathematics instruction was good, and that their mathematics teacher supported their learning. Pupils who spent between 30 minutes and 1 hour a day on mathematics or science homework had higher mathematics and science scores respectively than pupils who spent more or less time.

Schools

As part of PISA 2022, headteachers of participating school were asked to complete a questionnaire. Among other things, this questionnaire asked for background information about their school and their views on the school climate and learning environment.

When asked about school admission policies, headteachers in England reported that the residential area of the pupil was a key factor in the school's decision (81% of pupils in England were in schools where this was the case, compared to 60% of pupils across the OECD). Headteachers indicated that another important factor was whether the learner had a family member who was currently or formerly at the school (69% of pupils in England were in schools where this was a factor in admissions decisions, compared to 40% of pupils across the OECD). Academic records were considered less often in England (22% of pupils were in schools where headteachers reported this as a significant factor, compared to 52% of pupils on average across the OECD).

Headteachers reported that a larger proportion of pupils in England were grouped by ability for some or all subjects (97%) than on average across OECD countries (37%). Headteachers also reported using a wide range of school monitoring and evaluation policies and practices, which were largely focused on school and teaching improvement. The most commonly reported approach to monitoring teachers, both in England and across the OECD, was the use of lesson observations by headteachers or senior staff (94% of pupils in England attend schools in which the headteachers reported this, and 77% across the OECD). Teacher peer review (91% of pupils in England, 58% across the OECD) and tests or assessments of pupil achievement (78% in England, 73% across the OECD) were also reported. A lack of teaching staff was reported to be the most common barrier to teaching both in England and across the OECD (54% of pupils in England attended schools where the headteachers reported this hindering instruction "to some extent" or "a lot", compared to 47% across the OECD).

Alongside the questionnaire, it is possible to explore the extent to which mathematics performance varies within each of the participating schools relative to how much performance varies between schools. In England, 22% of the variance in mathematics performance was attributable to differences between schools rather than differences within schools. This was below OECD average, where 32% of the variance in mathematics performance was attributable to differences between schools. This suggests that mathematics performance varied less from school to school in England than on average across OECD countries. Caution is advised when interpreting this finding because the potential factors that contribute towards between and within school variance are widespread and difficult to disentangle.

PISA across the UK

The average mathematics score for England (492) was significantly higher than the average scores for Northern Ireland (475), Scotland (471) and Wales (466). Similarly, the average science score for England (503) was significantly higher than the average scores for Northern Ireland (488), Scotland (483) and Wales (473). For reading, the average score for England (496) was significantly higher than those for Northern Ireland (485) and Wales (466) but not significantly different to the average score for Scotland (493).

Gender differences in PISA 2022 were consistent across the nations of the UK, with boys having a significantly higher average score for mathematics and girls having a significantly higher average score for reading in all UK nations. In science there were no significant gender differences in any nation of the UK.

Pupils from relatively disadvantaged socio-economic backgrounds performed significantly worse than those from relatively less disadvantaged backgrounds across all three subjects and all UK nations. When comparing the difference in performance between the most and least disadvantaged pupils, the performance gaps in England were not significantly different to the gaps in any of the other UK nations for any of the three subjects.

1 Introduction to PISA

1.1 What is PISA?

The Programme for International Student Assessment (PISA) is a study of 15-year-old[3] pupils around the world organised by the Organisation for Economic Co-operation and Development (OECD). PISA assesses knowledge and skills that are considered necessary for participation in social and economic life, specifically in mathematics, reading and science. Although PISA is typically carried out every 3 years, PISA 2022 was undertaken 4 years after the previous assessment in 2018 because of the global COVID-19 pandemic.

Although mathematics, reading and science are always assessed, each round of PISA focuses on one of these three areas in particular – this is called the 'major domain'. The major domain for PISA 2022 was mathematics, as it was in 2012 and 2003, with reading and science as minor subject domains. In England, Northern Ireland and Wales, PISA 2022 was carried out on behalf of the respective governments by Pearson and Oxford University Centre for Educational Assessment (OUCEA), which acted as the National Centre for PISA 2022.

Across different assessment cycles, the OECD presents PISA scores on the same scale to enable countries to identify and monitor trends in pupil performance over time. Each participating country receives a detailed breakdown of their results, allowing them to understand how groups of pupils with differing demographic characteristics have performed (e.g., pupils from different socio-economic backgrounds). The data collected through PISA also enables governments to benchmark education policy and performance, to make evidence-based decisions and to learn from policies and practices in other countries.

In this chapter, we provide an overview of the PISA study. First, we provide information about other countries that participate in PISA and a description of England's past participation. We then provide a guide to interpreting the PISA results, including details of the study design, data collection and analysis, and limitations of the data. Finally, we provide an overview of the structure of the report.

1.2 Who participates in PISA?

The number of participating PISA education systems has increased from 43 in the initial cycle to 81 in the current PISA 2022 cycle (OECD, 2022a), and around 690,000 pupils

[3] Pupils who participate in PISA are generally described as "15-year-olds" but the sample consists of pupils aged from 15 years and 3 months to 16 years and 2 months at the beginning of the PISA assessment period.

participated worldwide. Of the 81 participating education systems, 37 were members of the OECD, including the United Kingdom.

In this report Cyprus was not included when comparisons were made between the performance of pupils in mathematics, reading and science in England and pupils in other participating education systems as the data were not available at the time of writing. This was also the case for Vietnam when comparing the performance of pupils in reading.

1.2.1 Which other countries participate in PISA?

The participating OECD countries are: Australia, Austria, Belgium, Canada, Chile, Colombia, Costa Rica, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Israel, Italy, Japan, Latvia, Lithuania, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, the Republic of Ireland, Slovakia, Slovenia, South Korea, Spain, Sweden, Switzerland, Turkey, United Kingdom, and the United States.

The participating partner countries and economies (education systems) are: Albania, Argentina, Azerbaijan (Baku City only), Brazil, Brunei, Bulgaria, Cambodia, Croatia, Cyprus, Dominican Republic, El Salvador, Georgia, Guatemala, Hong Kong, Indonesia, Jamaica, Jordan, Kazakhstan, Kosovo, Macao, Malaysia, Malta, Moldova, Mongolia, Montenegro, Morocco, North Macedonia, Palestinian Authority, Panama, Paraguay, Peru, Philippines, Qatar, Romania, Saudi Arabia, Serbia, Singapore, Taiwan, Thailand, Ukrainian regions[4], United Arab Emirates, Uruguay, Uzbekistan and Vietnam.

1.2.2 England's participation in PISA

In England, 4,763 15-year-old pupils from 165 schools completed a 2-hour computer-based assessment and pupil questionnaire. In all countries, headteachers at participating schools were also asked to complete a questionnaire, which included questions regarding school resources and other contextual information. The study was carried out in November and December 2022, and most pupils who took part completed their GCSE exams in 2023. England has participated in all studies since the first PISA study in 2000, however, due to low school and student response rates in 2000 and 2003, results are only comparable from 2006 onwards.

Please see Section 1.4.2 for a discussion of how the findings of this report should be interpreted with caution because of the characteristics of the pupils who participated in PISA 2022.

[4] 18 out of 27 regions of Ukraine participated in PISA 2022

1.3 What does PISA measure?

Each cycle of PISA assesses pupils in mathematics, reading and science. The major domain for PISA 2022 was mathematics, which means that mathematics was assessed in more detail, with reading and science assessed less extensively, and a new mathematics assessment framework was developed for this cycle. The reading and science frameworks have remained unchanged from the PISA 2018 cycle.

1.3.1 The PISA 2022 assessment frameworks

In each PISA cycle, a new assessment framework for the major domain is developed (mathematics in PISA 2022). This outlines the specific skills to assess mathematical literacy and the way in which they will be measured. The PISA 2022 mathematics framework is available on the OECD website, along with sample mathematics items.

The OECD's definition of mathematical literacy has a particular focus on pupils who are becoming proficient users of mathematics across school and everyday life. The definition of mathematical literacy used in PISA 2022 is:

> Mathematical literacy is an individual's capacity to reason mathematically and to formulate, employ, and interpret mathematics to solve problems in a variety of real-world contexts. It includes concepts, procedures, facts, and tools to describe, explain, and predict phenomena. It helps individuals know the role that mathematics plays in the world and make the well-founded judgments and decisions needed by constructive, engaged and reflective 21st Century citizens. – *OECD (2023b, p.7)*

The PISA 2022 mathematics assessment framework includes a new component of mathematical reasoning in addition to the three components of Formulate, Employ, and Interpret and Evaluate used in the PISA cycles since 2000. PISA 2022 also looks at four content knowledge areas: Quantity, Uncertainty and Data, Change and Relationships, and Space and Shape.

Reading literacy is defined as a pupil's 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, 2023b, p.14).

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, 2023b, p.14).

1.3.2 The PISA questionnaires

Alongside the PISA assessments in mathematics, reading and science, participating schools and pupils are asked to complete questionnaires. The pupil questionnaire requests information about participating pupils' background, their attitudes and feelings, their educational experiences and their future aspirations. As mathematics was the major domain for PISA 2022, pupils were also asked to report on their experiences and attitudes to mathematics in greater detail. The school questionnaire requested information from the headteacher or a member of the Senior Leadership Team about the school climate, resources, and perceived barriers to learning, as well as perceptions of the impact of the COVID-19 pandemic.

1.3.3 The PISA assessment

Following a detailed, iterative review of the test items (questions) by different local and international experts, the PISA 2022 items were translated into different languages and, where appropriate, verified by the PISA consortium (OECD, 2018). Through a field trial process, items were evaluated using samples of 15-year-old pupils across all participating countries. This ensured that the items met PISA's technical specifications and were comparable across education systems.

PISA takes a sophisticated and therefore technically complex approach to the design and administration of assessment. This differs from more conventional assessments, such as GCSE examinations, where every pupil takes the same test with the same items, and the cohort's average performance is an aggregation of these individual pupil performances. As mentioned above, the assessment itself is computer-based and, unlike other international assessments, employs multi-stage adaptive testing (for mathematics and reading). An adaptive test is one which automatically selects items to suit the ability of the person taking it. This meant that pupils were presented with 'blocks' of items that were selected based on their performance on preceding question blocks (OECD, 2020).

For more detailed and technical information, please refer to the PISA 2022 Technical report (OECD, forthcoming)[5].

1.3.4 PISA study design and sampling

It is impractical for the PISA assessment to be administered to every single pupil in each participating country. Participating countries therefore assess a sample of their eligible pupils. The OECD employs a two-stage sampling method to ensure that the pupils chosen to take part in the study are nationally representative of the pupil population as a whole. The first stage is to sample schools, the second to sample pupils within the

[5] This report will be available on the PISA publications page of the OECD website

selected schools. Countries that participate in PISA are required to adhere to strict international sampling procedures which facilitates sample comparability.

In line with this procedure, a sample of secondary schools were selected to take part in PISA 2022. Schools were selected to represent the different geographical regions within England, the different types of school that pupils may attend (for example, academy or independent), and a range of academic attainment at the school level (based on the GCSE performance of previous pupil cohorts). Within each participating school, a random sample of 40 eligible pupils were selected to take the assessment. Most of these pupils were in year 11.

With any sample, some sub-populations may be under or over-represented once the final data is obtained. It is important to note that the PISA design counteracts this, as far as is possible, through statistical methods. Please refer to the PISA 2022 Technical Standards (OECD, 2022) for further detail. England's response rates in relation to these Technical Standards are discussed in section 1.4.

1.4 Interpreting results from PISA 2022: a reader's guide

This section provides important information and context for interpreting England's results in PISA 2022. As discussed, the PISA 2022 data for England are based upon a sample of pupils rather than a census of all pupils. This means that there is a degree of uncertainty in the findings because, however carefully selected the sample, there is always at least some chance that it does not fully represent the overall population of pupils. This uncertainty is described as 'sampling error', though it does not mean a mistake has been made - it is present in all research which relies on the analysis of data taken from a sample.

Another source of uncertainty is 'measurement error', which relates to the extent to which an individual pupil's performance on the PISA test reflects their true ability. Measurement error occurs because a pupil's score may be influenced by factors that are unrelated to their ability, such as their interpretation of the items that they respond to or their level of motivation on the day of the test.

To contextualise and account for this uncertainty, statistical analyses of the differences between education systems or groups of pupils have been undertaken in this report to determine whether they are 'statistically significant'. Statistically significant differences are unlikely to be the result of either sampling or measurement error and are likely to reflect a true difference between the education systems or groups being compared. In this report, we use a '95% confidence level' to define statistical significance. For clarity of writing, the term 'significant' is used throughout this report to refer to statistically significant differences between scores or values. Similarly, the term average, as in ‘average score’, is used to refer to the arithmetic mean for the relevant group, unless stated otherwise.

Particular caution should be taken when considering the ‘rank order’ of countries who participated in PISA. The two forms of uncertainty discussed above mean that, were the test to be retaken, there would likely be differences in the average scores of each country that would cause the rank order of performances to change. This report therefore focuses on statistically significant differences between countries and groups, providing greater confidence that findings are robust. As discussed above, findings should also be considered with regard to how representative the pupils who took the test (the sample) are of the population of pupils as a whole. Section 1.4.2 discusses this with regard to England in 2022.

It is also important to note that test items may not be equally difficult for pupils from different socio-cultural or language backgrounds, or across countries and translations. Previous research suggests that some test items may not have necessarily performed in a comparable manner across different countries and languages, thus somewhat undermining the comparability of results (Kreiner & Christensen, 2014; Rutkowski et al., 2016). During the aforementioned PISA development cycle, the OECD make every effort to ensure that comparisons between countries and translations can be validly made but the cross-country comparisons presented in this report should still be cautiously interpreted, especially when comparing distinct educational systems and different languages.

1.4.1 PISA and the COVID-19 pandemic

Data collection for PISA (the administration of the assessment and the questionnaires) had originally been planned for 2021 but was delayed by 12 months because of the COVID-19 pandemic. Although data collection was undertaken in November and December of 2022 in England, the pandemic still had an impact on recruitment, retention and pupil engagement.

The pandemic caused widespread disruption to schools, teaching and learning, which included significant periods of time when school buildings were closed. Remote instruction or distance learning resources were made available in line with Government guidance at the time. Schools were also offering a range of programmes and types of support to pupils whose learning and wellbeing were affected. However, the impact of this disruption varied between regions, schools and individual pupils within those schools, as well as between different countries and education systems.

Given this complexity, it is not possible to ascertain precisely how the COVID-19 pandemic affected performance in the PISA 2022 assessments for those who were able to participate, or how it may have affected their responses to the questionnaires. A small number of items were included in the pupil and school questionnaires that specifically focused on the impact of the COVID-19 pandemic, but as fewer than 70% of participating pupils or headteachers responded to the majority of these items, they have not been included in this report, although they are reported on in the OECD's international report.

In terms of delivering the assessment process, some schools were still experiencing issues around the availability of staff in 2022 and were seeking to prioritise support for the learning and wellbeing of their pupils. This, understandably, had an effect on school recruitment, with some schools deciding that they were unable to take part in the study and others needing to withdraw late in the process, sometimes during the data collection period itself. In such cases, it was not always possible to recruit replacement schools (schools with similar characteristics such as region in which they were located, school type, and GCSE results, to replace schools which could not participate from the original sample) in the time available. We further discuss response rates, and what they mean for interpreting the findings of PISA 2022, below.

The disruption caused by the COVID-19 pandemic also caused some changes in how parts of the data collection process were undertaken. For example, the field trial that is undertaken ahead of each series of PISA, the purpose of which is to establish the suitability of new test items, was disrupted, though it still produced sufficiently detailed data ahead of the main assessment window. In addition, it was necessary to undertake certain processes, such as the training of coders (markers) and the coding itself, remotely. These processes worked efficiently but were different to those operated in previous cycles of PISA. Despite these challenges, it is important to note that, of the 82 PISA technical standards, 80 were successfully met for England. The two standards which were not met relate to response rates and are discussed below.

1.4.2 PISA 2022 response rates for England

PISA Technical Standard 1.11 states that the final weighted school response rate should be at least 85% of sampled schools. Where a response rate is below 85%, an acceptable response rate can still be achieved through the recruitment of replacement schools, however, the target then moves upwards – for example, with a main sample response of 75%, the after-replacement target is 90% rather than 85%. For England, the initial weighted response rate was 66%. Replacement schools were recruited such that the final weighted school response rate was 82%, against an after-replacement target of 94.3%.

Similarly, PISA Technical Standard 1.12 states that the final weighted pupil response rate should be at least 80% of all sampled pupils across responding schools. For England, the final weighted pupil response rate was 75%, again below the OECD target.

Given that these response rates did not meet the relevant Technical Standards, a Non-Response Bias Analysis (NRBA) was undertaken to understand, among other things, differences between responding and non-responding schools and between originally sampled schools and replacement schools. The purpose of this analysis was to establish the extent to which the final sample of pupils is likely to represent the population of pupils in England. The key findings of the NRBA, and what they mean for interpreting England's PISA 2022 results, are described briefly below, and a full report of the analysis can be found in Appendix A.

The task of ensuring a high participation rate was particularly challenging in the context of the COVID-19 pandemic and England was not the only nation unable to meet the PISA sampling technical standards, with Australia, Canada, Hong Kong, the Republic of Ireland, the Netherlands, Northern Ireland, New Zealand, Scotland, the United States and Wales among those where the final weighted samples did not meet the threshold. PISA sampling technical standards were also unmet in a number of other OECD countries that are included in the 'OECD average' scores which also serve as a comparison throughout the report.

For England, the NRBA identified some differences between the characteristics of the final sample of participating pupils and the estimated study population. Most substantively, the final pupil sample had somewhat higher academic attainment at key stage 2 on average than the population and a somewhat lower proportion of pupils who had been eligible for free school meals in the past 6 years. In other words, higher performing pupils may be over-represented and some of the PISA results may subsequently be somewhat higher than they might otherwise be. The OECD estimate that this may translate in a small upwards bias for some of the reported results of approximately 7 or 8 points after non-response adjustments are taken into account (OECD, 2023c). In total 13 education systems did not meet some of the sampling standards, and the OECD estimates that this may translate to an upwards bias of between 7 and 10 points in 5 of these education systems but the data required to calculate the size of the bias were not available in the remaining 8 education systems, and the OECD concluded that bias in these systems' data could not be ruled out. Given that a number of affected countries are members of the OECD, including Australia, Canada and the Republic of Ireland, which are used as comparator countries in this report, there may be some effect on the OECD average scores, but this has not been quantified by the OECD. Caution is therefore required when considering this bias in relation to some of the results included in this report though this does not necessarily translate directly to a particular score being 7 or 8 points higher than its 'true' value, and the OECD itself makes no adjustments to the scores in any education system that did not meet some of the PISA Technical Standards.

This is very important to keep in mind while interpreting the results and there are regular reminders of this caveat throughout the report. Cautious interpretation is particularly necessary when considering trends in performance over time and when making international comparisons. More confident conclusions can be drawn when making comparisons between groups of pupils within England, where the analysis does not seek to generalise beyond the sample (such analyses are reported in Chapter 6, where a fuller explanation is provided). Overall, while cautious consideration of the results is encouraged, the analysis remains a valuable insight into the knowledge and skills of 15-year-old pupils in England in mathematics, reading and science, and how they compare to other 15-year-old pupils from around the world.

1.4.3 Selection of comparator education systems

Given the large number of education systems that participated in PISA 2022, it is necessary to be selective when making international comparisons. For this report, four main education systems have been selected for comparison to England. These education systems are the Republic of Ireland, Singapore, Australia and Canada, and they have been selected on the basis that they provide valid, meaningful and valuable comparisons, serving to contextualise the performance of pupils from England.

In all four comparator education systems, the majority of people in the country speak English, or use English as the language of instruction for the majority of pupils in schools. Furthermore, the Republic of Ireland is selected on the basis of its cultural similarities to England and its relative performance in previous PISA cycles, where it has received similar scores for mathematics (in 2012) and has demonstrated high performance in reading. Australia has also performed similarly to England in the past. Canada and Singapore perform well across all PISA domains and provide useful comparisons to high-performing education systems with different contexts.

1.4.4 Comparisons to OECD averages and OECD trend averages

The report frequently compares information about England's performance to the OECD average performance. The OECD average has been selected for such comparisons, rather than the average for all education systems which participated in PISA 2022, because OECD countries are more economically comparable to England and have participated in PISA more consistently over time. For 2022, the OECD average included 37 education systems – all 38 OECD countries apart from Luxembourg, which did not participate in PISA 2022. However, the countries which are part of the OECD have changed over time as the OECD has expanded; for example, Costa Rica has joined the OECD since PISA 2018. This means that the OECD average for each cycle of PISA includes a different number of countries. In order to ensure comparisons are consistent and any changes over time in the OECD average are not unduly distorted by the countries which are included or excluded in a given comparison, the OECD has calculated several different averages. These include different sets of education systems, allowing for accurate comparisons of change over time to be made in different contexts.

This report will be comparing England's performance to two different OECD averages, depending on the most appropriate comparison. When comparisons are made to 2022, the report uses the average of all 37 OECD countries which participated in PISA 2022. When comparing trend data, the report uses the average across the 35 OECD member countries which took part in both 2018 and 2022 and have results included in the international reports for both cycles. This allows more robust comparisons to be made. These differing averages will be called the 'OECD average' and the 'OECD trend average' respectively.

1.5 Organisation of this report

The rest of this report is divided into 8 main chapters. Chapters 2 to 5 focus on England's performance in PISA mathematics, reading and science, including an overview of how England's performance has changed over time in relation to other participating education systems, and differences between the highest- and lowest-performing pupils. As mathematics was the focus of PISA 2022, a detailed comparison of performance across content and process subdomains will be presented for mathematics in Chapter 0. Chapter 6 looks at performance in mathematics, reading and science by pupils' gender, socioeconomic status, immigration background, language spoken at home and special educational needs.

Chapter 7 provides details of pupils' responses on the PISA background questionnaire, with an emphasis upon how they view mathematics. It also investigates pupils' wellbeing and their aspirations, taking into consideration how these have changed over time, and how they compare to other parts of the world. The chapter also provides details on how pupil wellbeing and aspirations relate to performance in mathematics, reading and science.

Chapter 8 is about the school environment. The chapter focuses on the views of the headteachers of the participating pupils as reported in the PISA school questionnaire. This includes measures of school management, policies, resources, staff inclusiveness and access to digital devices. The chapter further investigates mathematics instruction within schools by exploring the school policies on the use of assessment in mathematics, how pupils are grouped and the availability of additional lessons in mathematics. This chapter ends by exploring school-level variation in mathematics performance across England.

Chapter 9 focuses on the similarities and differences in outcomes between the 4 nations of the United Kingdom. This includes how test scores vary across the UK, and whether gender and socioeconomic gaps are bigger in certain nations of the UK than others.

2 Performance in mathematics

2.1 Chapter overview

This chapter reports the performance of pupils in England in mathematics. It draws on findings outlined in the international report (OECD, 2023) and places outcomes for England in the context of those findings. This performance is considered alongside that of previous cycles, PISA 2018, 2015 and 2012. Caution needs to be taken in interpreting these findings as some of the sampling standards for PISA 2022 were not met in England as described in Chapter 1.

2.2 Key findings

- Pupils in England achieved a mean score of 492 in 2022 which was significantly higher than the OECD average of 472.
- Average performance in mathematics was lower on average across the OECD trend countries in PISA 2022 (475) compared to PISA 2018 (490), and England's score of 492 was similarly lower than the 504 achieved in 2018, although not significantly different to average scores prior to 2018.
- In total, 41 of the 72 education systems that participated in both 2018 and 2022 saw a significant decrease in their average mathematics score in 2022 compared to 2018, with only 7 education systems saw a significant increase. The remaining 24 education systems saw no significant change in their scores.
- Pupils in 8 out of the other 79 participating education systems achieved an average score that was significantly above England, with a further 9 education systems having mathematics scores that were not significantly different from England's and 62 education systems achieving an average score that was significantly below England. The highest performing countries were East Asian, with Singapore, Macao, Taiwan, Hong Kong, Japan, and South Korea outperforming all other education systems, with Estonia and Switzerland also scoring significantly higher than England.
- The gap between England's highest- and lowest-achieving pupils of 252 score points was significantly above the OECD average of 235 score points and has increased since 2018, largely due to the significant decrease in the scores of the lowest-achieving pupils.
- The percentage of pupils in England who performed at the highest proficiency levels (12%) was significantly above the OECD average of 9%, and the percentage of pupils in England working at the lowest proficiency levels (below level 2) was 23%, which was significantly smaller than the OECD average of 31%.

2.3 Introduction to PISA mathematics

This chapter focuses on England's performance in the mathematics domain of PISA. It outlines how England's performance in 2022 compares to that of other participating education systems, as well as how performance has changed over time. In PISA 2022, mathematics was the major domain and was assessed using the OECD 2022 mathematics framework. It was previously the major domain in 2012 and was one of the minor domains in 2018 and 2015.

As England's school-level and pupil-level response rates did not meet some of the PISA sampling standards, caution is required when interpreting the analysis reported here. Cautious interpretation is particularly necessary when considering trends in performance over time and when making international comparisons. Australia, Canada, and the Republic of Ireland, which have been included as comparator countries, also did not meet some of the PISA sampling standards as well as some of the other OECD countries included in the OECD averages. For more information see Section 1.4.2.

2.4 England's performance in mathematics

Pupils in England achieved an average score of 492 in mathematics in PISA 2022. This was significantly above the OECD average score of 472.

In 2022, of a total of 81 participating education systems including England, 23 had an average score significantly above the OECD average, 10 education systems were not significantly different to the OECD average and 48 education systems were significantly below the OECD average. As in previous cycles, most of the top-performing education systems were from East Asia (Singapore (575), Macao (552), Taiwan (547), Hong Kong (540), Japan (536) and South Korea (527)). In addition to England, the European countries that had an average score significantly above the OECD average were Estonia (510), Switzerland (508), Netherlands (493), the Republic of Ireland (492), Belgium (489), Denmark (489), Poland (489), Austria (487), Czech Republic (487) Slovenia (485), Finland (484) and Sweden (482). The two remaining comparator countries, Canada (497) and Australia (487), also had an average score in mathematics significantly above the OECD average.

Pupils in 8 out of the other 79 participating education systems[6] achieved an average score that was significantly above England, with a further 9 education systems having mathematics scores that were not significantly different from England's and 62 education systems achieving an average score that was significantly below England. Among the other 37 OECD countries that participated in 2022, only 4 (Japan, South Korea, Estonia

[6] International comparisons involving England in this report do not include Cyprus as these data were not available at the time of writing.

and Switzerland) had a significantly higher average mathematics score than England. The results of the higher-performing education systems with an average score of 450 points or higher are presented in Table 2.1, including England. The education systems with an average score less than 450 are not included in Table 2.1.

Table 2.1: Mathematics performance of higher-performing education systems in PISA 2022 relative to England

Performance relative to England	Education system and score
Education systems that scored significantly higher than England in mathematics in PISA 2022	Singapore (575), Macao (552), Taiwan (547), Hong Kong (540), Japan (536), South Korea (527), Estonia (510), Switzerland (508)
England and education systems that did not score significantly higher or lower than England in mathematics in PISA 2022	Canada (497), Netherlands (493), **England (492),** Republic of Ireland (492), Belgium (489), Denmark (489), Poland (489), Austria (487), Australia (487), Czech Republic (487)
Education systems that scored significantly lower than England in mathematics in PISA 2022	Slovenia (485), Finland (484), Latvia (483), Sweden (482), New Zealand (479), Lithuania (475), Germany (475), France (474), Spain (473), Hungary (473), **OECD average (472),** Portugal (472), Italy (471), Vietnam (469), Norway (468), Malta (466), United States (465), Slovakia (464), Croatia (463), Iceland (459), Israel (458), Turkey (453)

Base: All education systems with average scores over 450 in mathematics in PISA 2022
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included education systems.

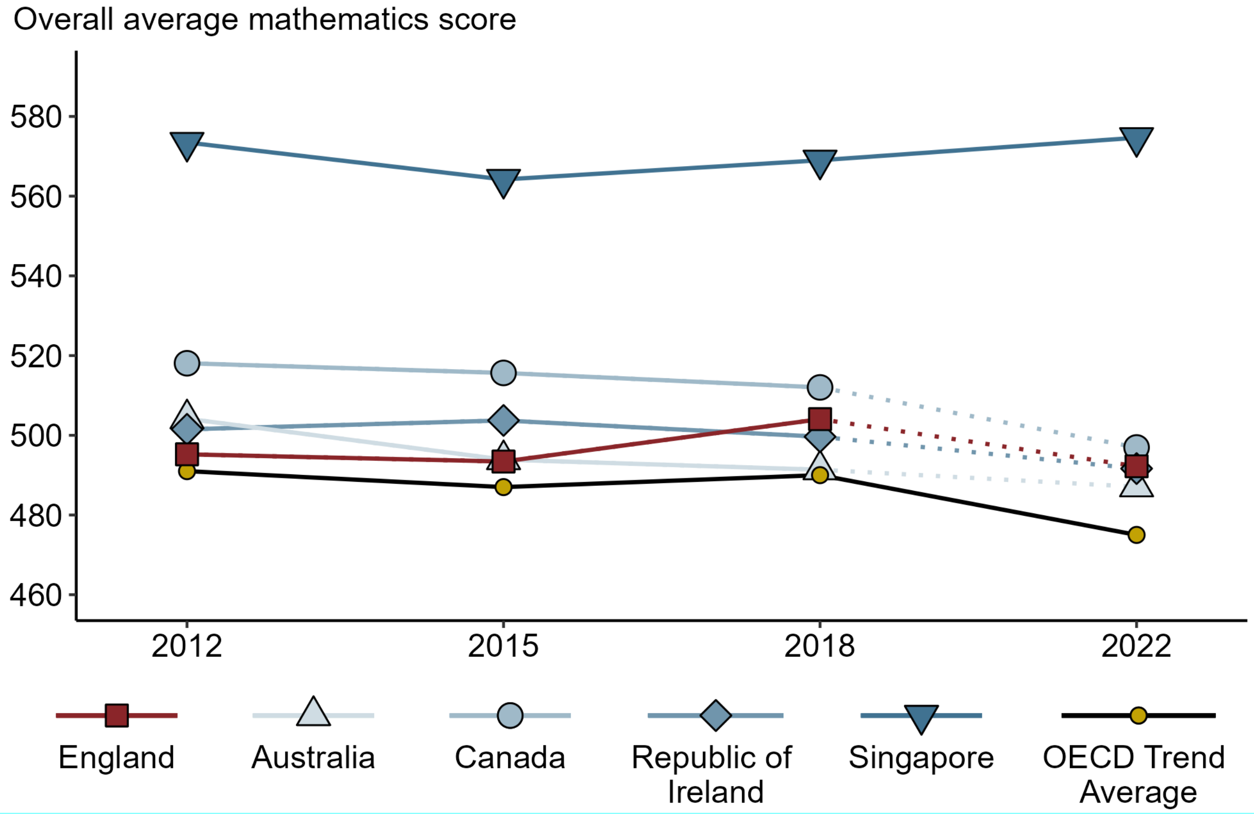
Source: OECD, PISA 2022 Database

2.5 Mathematics performance over time

Pupils in England achieved a significantly lower average score of 492 in mathematics in PISA 2022 compared to the score of 504 in PISA 2018. The average scores of 493 in PISA 2015, 495 in PISA 2012, 493 in PISA 2009 and 495 in PISA 2006 are not significantly different from England's average score in 2022.

England was also significantly above the OECD trend average in 2018 and 2015 but not significantly different from the OECD trend average in 2012. The trends over time in mathematics scores in England, Australia, Canada, the Republic of Ireland, Singapore and on average across current OECD countries in 2022 are shown in Figure 2.1.

Figure 2.1: Trends in mathematics performance in England, comparator countries and on average across the OECD trend countries



Country	2012	2015	2018	2022
England	495	493	*504	492
Australia	*504	494	491	487
Canada	*518	*516	*512	497
Republic of Ireland	*501	*504	*500	492
Singapore	573	*564	569	575
OECD Trend Average	* 491	* 487	* 490	475

Asterisks (*) indicate that the score shown was significantly different to that country's score for PISA 2022.
Trend results between 2018 and 2022 in England, Australia, Canada, and the Republic of Ireland where PISA sampling standards were not all met are indicated with dotted lines in the figure.
OECD trend averages calculated using OECD countries in PISA 2022 excluding Costa Rica, Luxembourg and Spain.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included education systems.

Source: OECD, PISA 2022 Database

In total, 41 of the 72 education systems that participated in both 2018 and 2022 saw a significant decrease in their average mathematics score in 2022 compared to 2018, with only 7 education systems seeing a significant increase. The remaining 24 education systems saw no significant change in their scores. Table 2.2 shows the changes in average mathematics scores between PISA 2022 and PISA 2018 for each education system that participated in both cycles of PISA and scored above 450 in mathematics in PISA 2022. Only 1 of these education systems, Taiwan, scored significantly higher in mathematics in PISA 2022 than in PISA 2018 with an increase of 16 score points. In contrast, 26 of these education systems, including England saw a significant decrease in their average mathematics score in 2022 compared to 2018. There were no significant differences between their scores in PISA 2018 and PISA 2022 for 10 of these education systems.

Table 2.2: Changes in mathematics average score between 2018 and 2022 for higher-performing education systems

Trend in mathematics performance	Education system and change in score
Scored significantly higher in mathematics in PISA 2022 than in PISA 2018	Taiwan (+16)
No significant differences in mathematics average scores between PISA 2022 and PISA 2018	Japan (+9), Singapore (+6), South Korea (+1), Turkey (0), Croatia (-1), Australia (-4), Israel (-5), Malta (-6), Lithuania (-6), Switzerland (-7)
Scored significantly lower in mathematics in PISA 2022 than in PISA 2018	Iceland (-36), Norway (-33), Poland (-27), Netherlands (-27), Germany (-25), Slovenia (-24), Finland (-23), Slovakia (-22), France (-21), Sweden (-21), Portugal (-21), Denmark (-20), Belgium (-19), New Zealand (-15), Italy (-15), Canada (-15), **OECD trend average (-15),** Estonia (-13), United States (-13), Latvia (-13), Czech Republic (-12), **England (-12),** Austria (-12), Hong Kong (-11), Hungary (-8), Republic of Ireland (-8), Macao (-6)

Base: All education systems with average scores over 450 in mathematics in PISA 2022 that also participated in PISA 2018.
Change in mathematics score between 2018 and 2022 shown in parenthesis after the education system. Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included education systems.

Source: OECD, PISA 2022 Database

In 2022 mathematics was the major domain for PISA. The last time that mathematics was the major domain was in 2012. Macao was the only higher-performing education system[7] that participated in PISA 2012 and PISA 2022 and had an average mathematics score that was significantly higher in 2022 than in 2012. There were 10 higher-performing education systems where there was no significant difference between the average mathematics score in PISA 2022 and PISA 2012: England, Singapore, Japan, Latvia, Sweden, Lithuania, Hungary, Croatia, Israel and Turkey. Australia (-17), Canada (-21) and the Republic of Ireland (-10) all had significantly lower average mathematics scores in PISA 2022 than in 2012.

2.6 Differences between the highest- and lowest-performing pupils in mathematics

It is important to examine the difference in performance between the highest- and lowest-performing pupils in mathematics. This is because even where two education systems have similar average scores in mathematics there may be significant differences in how their pupils are performing across the attainment range. For example, a country with a wide spread of attainment may have a relatively high percentage of pupils who are performing at the lowest levels and a high percentage of pupils performing at the highest levels – they will have greater disparity across their population of pupils. On the other hand, a country with a lower spread of attainment may have fewer very high-performing pupils but may also have fewer lower-performing pupils – they will have less disparity across their pupils. Despite these differences, it would be possible for these two education systems to obtain the same average score, masking important differences between the two. There needs to be particular caution in interpreting the scores of the highest- and lowest-performing pupils in England as the non-response bias analysis suggests that lower-performing pupils may be under-represented in the England sample for PISA 2022.

The first way in which the spread of performance in each country can be examined is by looking at the distribution of scores. The 90th percentile is the score above which the highest-performing 10% of pupils obtain, while the 10th percentile is the score below which the lowest-performing 10% of pupils obtain. The difference between the highest- and lowest- performers at the 90th and 10th percentiles is a better measure of the spread of scores for comparing education systems than using the very highest- and lowest-performing pupils, as the latter comparison may be affected by a small number of pupils with unusually high or low scores.

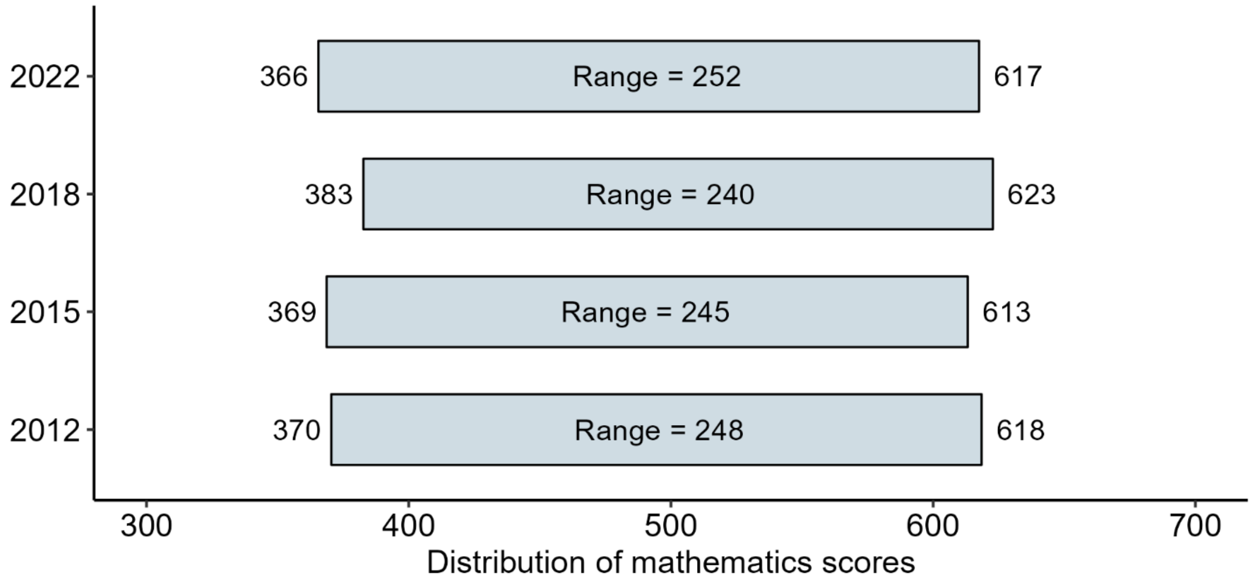
The gap between England's highest- and lowest-performing pupils was 252 score points. This was significantly larger than the OECD average of 235 score points. The gap in performance between England's highest- and lowest-performing pupils in 2018 was 240 score points which was not significantly different from the OECD trend average of 237

[7] Education systems with an average mathematics score above 450

score points. The increase in the gap between the highest- and lowest-performing pupils in England was largely due to the significant decrease in the score at the 10th percentile since 2018 as shown in Figure 2.5.

Figure 2.2 shows the trend in the distribution of PISA mathematics scores in England since PISA 2012. The gap between England's highest- and lowest-performing pupils in mathematics in PISA 2022 was not significantly different from the gap in PISA 2015 or PISA 2012.

Figure 2.2: Trends in the gap in mathematics performance between the highest- and lowest-performing pupils in England



PISA Cycle	10th percentile	90th percentile	Range
2022	366	617	252
2018	383	623	240
2015	369	613	245
2012	370	618	248

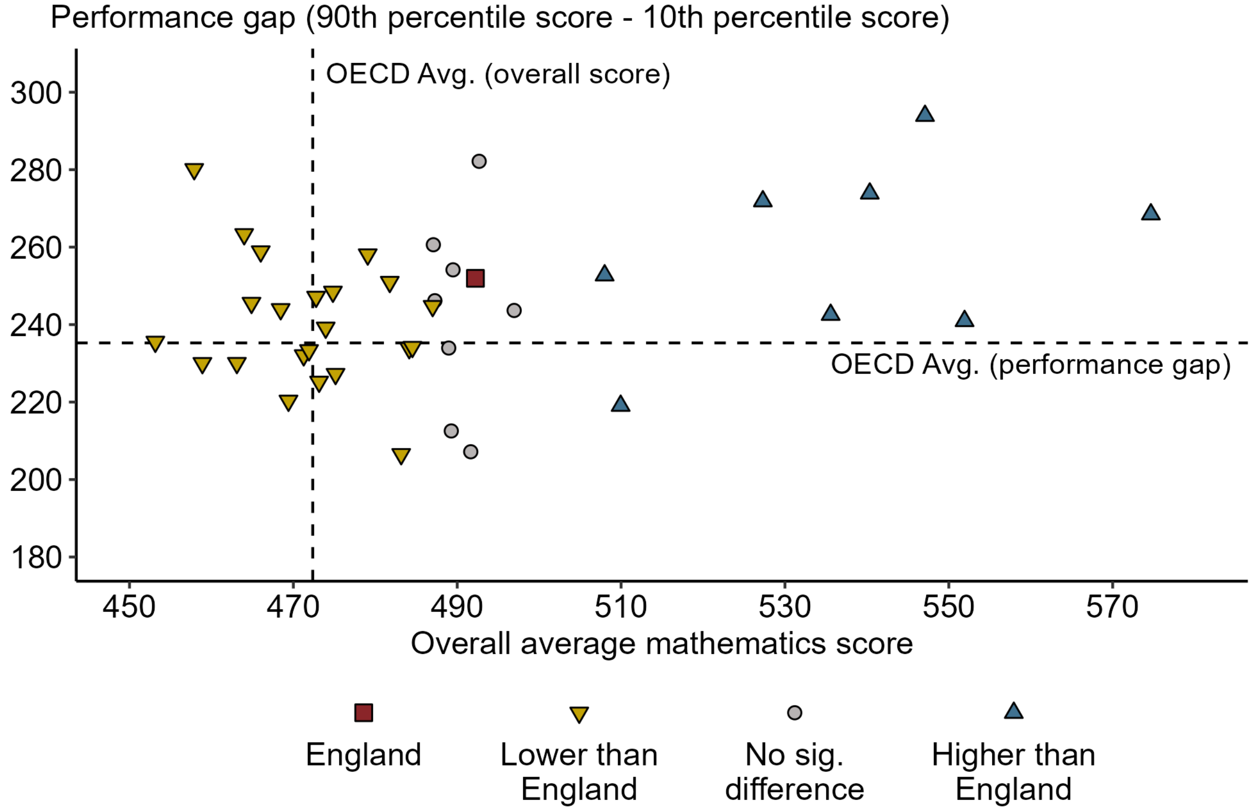
Base: All participating pupils England
Ranges calculated as 90th percentile – 10th percentile.
Ranges may appear inconsistent with percentile scores due to rounding.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022 Database

The score at the 90th percentile in mathematics in England was 617 and the score at the 10th percentile was 366 score points. On average across OECD countries the score at the 90th percentile in mathematics was 590 and the score at the 10th percentile was 355. These scores were both significantly lower than the respective scores in England.

To further consider the differences between the highest- and the lowest-performing pupils in mathematics in England, scores at the 90th and 10th percentiles can be compared with those of other education systems. Singapore has a gap in performance of 268 which was significantly larger than the gap in performance in England. The gap in performance in the Republic of Ireland (207) was significantly smaller than in England. There were no significant differences between the gap in performance in England and the gap in performance in Australia (261) or the gap in performance in Canada (244). Figure 2.3 shows the differences between pupils performing at the 90th and the 10th percentiles in all education systems with a mathematics score of 450 score points or above.

Figure 2.3: Gaps in mathematics performance for higher-performing education systems and on average across OECD countries

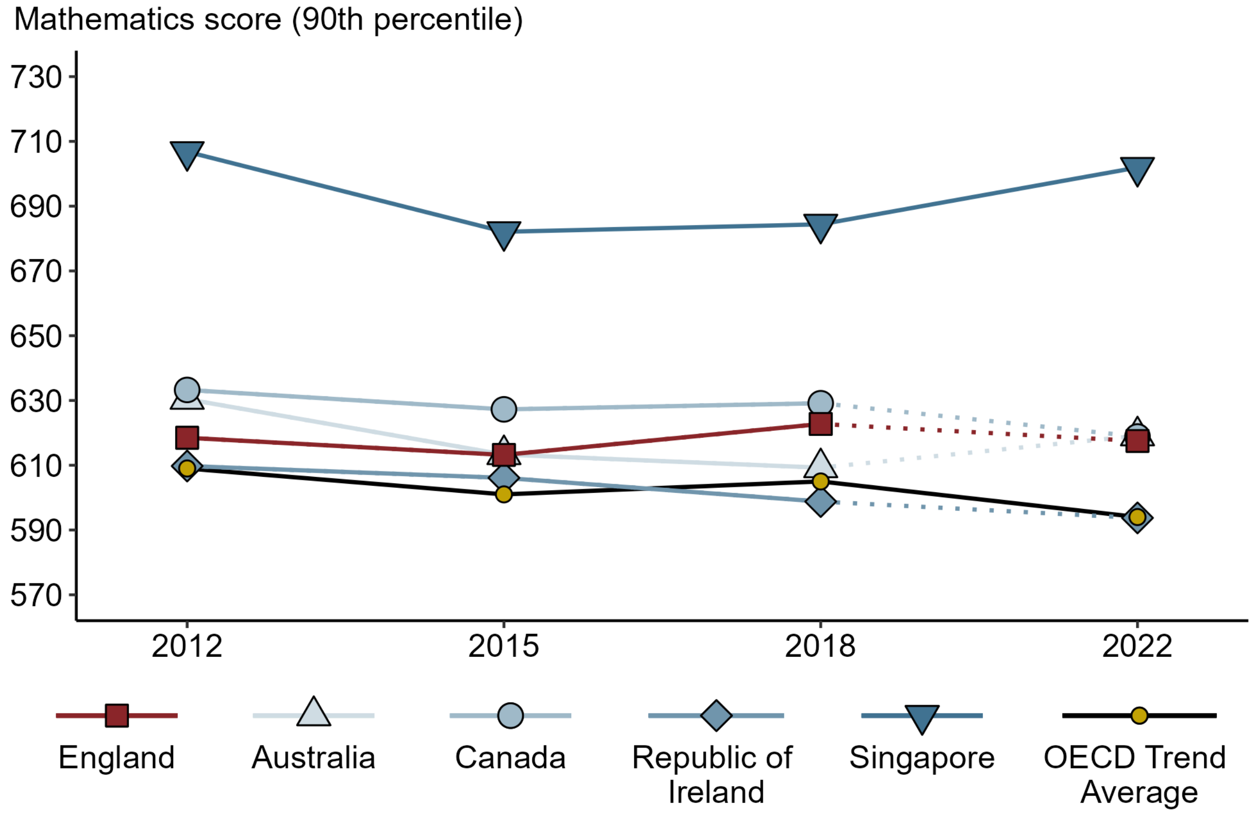


Base: Countries with an overall mathematics score of 450 score points or above
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included education systems.

Source: OECD, PISA 2022 Database

While there have been no significant differences in the score at the 90th percentile in England since PISA 2012, both Singapore and Australia saw a significant increase in their mathematics scores at the 90th percentile between PISA 2018 and PISA 2022. In contrast, Canada's score was significantly lower in PISA 2022 compared to PISA 2018. There was no significant difference between the Republic of Ireland's scores in PISA 2018 and PISA 2022. Trends in the performance at the 90th percentile across the 4 most recent cycles of PISA for England, Singapore, Australia, the Republic of Ireland, Canada and on average across OECD trend countries are shown in Figure 2.4.

Figure 2.4: Trends in mathematics performance at the 90th percentile for England, comparator countries and on average across OECD trend countries



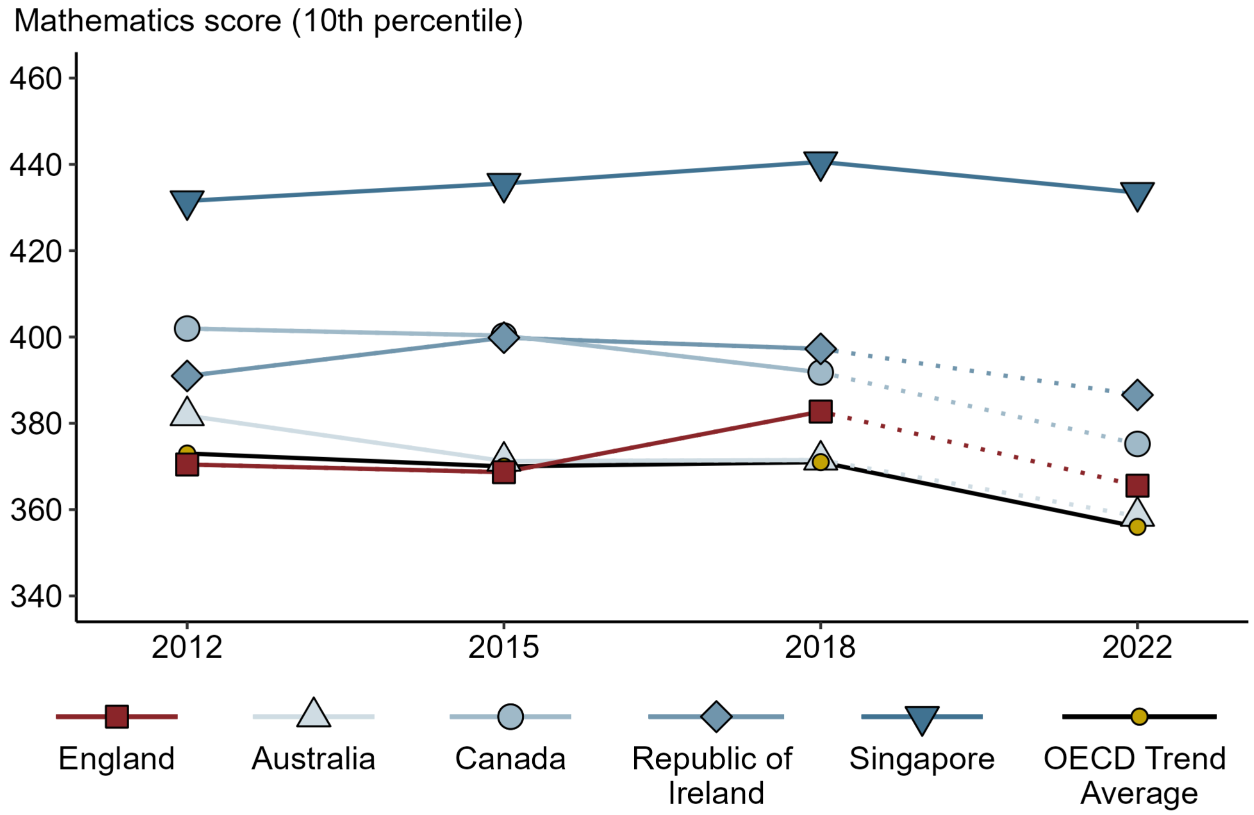
Country	2012	2015	2018	2022
England	618	613	623	617
Australia	*630	613	*609	619
Canada	*633	627	*629	619
Republic of Ireland	*610	*606	599	594
Singapore	707	*682	*684	702
OECD Trend Average	*609	*601	*605	*594

Base: all participating pupils
Asterisks (*) indicate that the score shown was significantly different to that country's score for PISA 2022.
Trend results between 2018 and 2022 in England, Australia, Canada, and the Republic of Ireland where PISA sampling standards were not all met are indicated with dotted lines in the figure.
OECD averages calculated using OECD countries in PISA 2022 excluding Costa Rica, Luxembourg and Spain.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included education systems.

Source: OECD, PISA 2022 Database

In England there was a significant decrease in the score at the 10th percentile in mathematics between PISA 2018 and PISA 2022. Australia, Canada and the Republic of Ireland also had a significant decrease in their scores at the 10th percentile between PISA 2018 and PISA 2022. There was no significant difference between the performance at the 10th percentile in Singapore between 2018 and 2022. Trends in the performance at the 10th percentile across the 4 most recent cycles of PISA for England, Singapore, Australia, the Republic of Ireland, Canada and on average across OECD countries are shown in Figure 2.5.

Figure 2.5: Trends in mathematics performance at the 10th percentile for England, comparator countries and on average across OECD trend countries



Country	2012	2015	2018	2022
England	370	369	*383	366
Australia	*382	*371	*371	358
Canada	*402	*400	*392	375
Republic of Ireland	391	*400	*397	387
Singapore	432	436	441	433
OECD Trend Average	*373	*370	*371	356

Asterisks (*) indicate that the score shown was significantly different to that country's score for PISA 2022. Trend results between 2018 and 2022 in England, Australia, Canada, and the Republic of Ireland where PISA sampling standards were not all met are indicated with dotted lines in the figure.

OECD averages calculated using OECD countries in PISA 2022 excluding Costa Rica, Luxembourg and Spain.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included education systems.

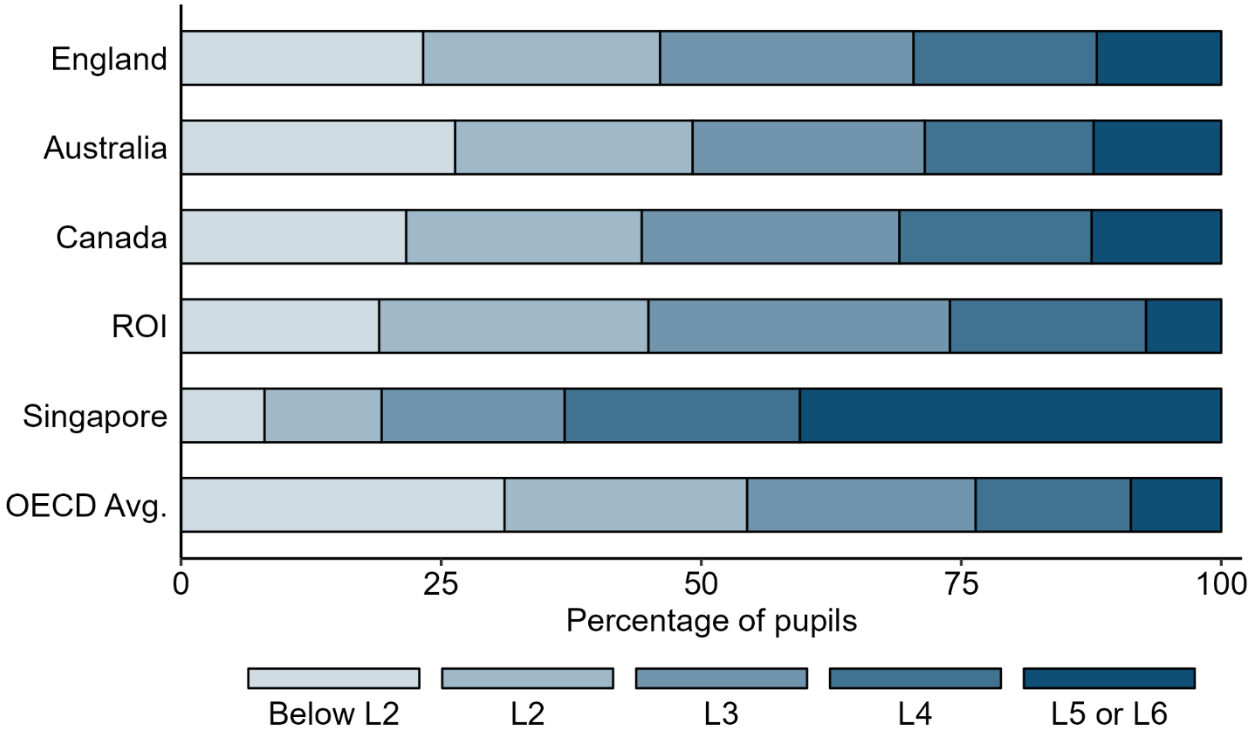
Source: OECD, PISA 2022 Database

2.7 Performance across mathematics proficiency levels

Another way of examining the spread of performance is by looking at England's performance at each of the PISA proficiency levels. The PISA proficiency levels describe the tasks that pupils performing at each level can do. They are devised internationally and are illustrated in the International Report (OECD, 2023). Mathematics performance in PISA is described in terms of 8 proficiency levels (Levels 1-6, with Level 1 subdivided into 1a, 1b and 1c). These performance levels are outlined in the PISA 2022 Assessment and Analytical Framework (OECD, 2023, p.49). Pupils who score below Level 2 are considered low performers and those who perform at Level 5 or above are considered top performers. Level 2 is considered the baseline level of proficiency in mathematics where pupils can begin to use mathematics in simple real-life situations, which is needed to participate fully in society.

In total 12% of pupils in England performed at the highest proficiency levels (5 or 6) which was significantly larger than the OECD average of 9%. England had 23% of pupils working at the lower proficiency levels (below level 2) which was significantly smaller than the OECD average of 31%. The distribution of pupils in England, Australia, Canada, the Republic of Ireland, Singapore and on average across OECD countries achieving each of the proficiency levels for mathematics in PISA 2022 is shown in Figure 2.6.

Figure 2.6: Percentage of pupils performing at each mathematics proficiency level in England, comparator countries and on average across OECD countries



Country	Below L2	L2	L3	L4	L5 or L6
England	23%	23%	24%	18%	12%
Australia	26%	23%	22%	16%	12%
Canada	22%	23%	25%	18%	12%
Republic of Ireland (ROI)	19%	26%	29%	19%	7%
Singapore	8%	11%	18%	23%	41%
OECD Average	31%	23%	22%	15%	9%

Base: All participating pupils.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022 Database

The percentage of top-performing pupils in England (12%) was not significantly different from those in 2018, 2015, and 2012 of 14%, 11% and 12% respectively. Although the percentage of pupils performing below the baseline of proficiency level 2 was significantly higher in 2022 than in 2018, rising from 19% to 23% of pupils in England, it was not significantly different from the percentages in 2015 or 2012 (both 22%).

On average across OECD trend countries, the percentage of top performing pupils in mathematics in PISA 2022 (8%) was statistically significantly smaller than the percentage in 2015 (9%) and the percentage in 2012 (11%), and not significantly different to the percentage in 2018. The percentage of pupils performing below Level 2 on average across OECD trend countries was statistically significantly larger in 2022 (30%) than in 2018 (24%), 2015 (25%) and 2012 (24%).

3 Performance on the mathematics subscales

3.1 Chapter overview

This chapter reports the performance of pupils in England on the mathematics content subdomain scales. It draws on findings outlined in the international report (OECD, 2023) and places outcomes for England in the context of those findings. Caution needs to be taken in interpreting these findings as some of the sampling standards for PISA 2022 were not met in Northern Ireland as described in Chapter 1.

3.2 Key findings

- Pupils in England had a higher average score on the uncertainty and data subscale (502) than on the other content subdomains assessed in PISA 2022. Pupils in England also had a lower space and shape average score (480) than in the other content subdomains.
- There were no significant differences between scores on the 4 process subscales in England, with a score of 493 on mathematical reasoning, 488 on formulating, 492 on employing and 495 on interpreting.
- The average score for pupils in England for all 4 content and 4 process subscales was significantly higher than the average across OECD countries.
- A larger percentage of pupils in England (17%) performed at Level 5 or above on the uncertainty and data subscale than on any of the other content subscales.
- A smaller percentage of pupils in England (11%) performed at Level 5 or above on the space and shape subscale than on any of the other content subscales.
- Around one quarter of pupils in England did not meet the baseline proficiency level (Level 2) in each of the content subdomains. On average across OECD countries around one third of pupils did not meet this baseline proficiency level.
- There were no significant differences between the percentage of pupils who performed at the highest proficiency levels in each of the process subdomains.
- The percentage of pupils in England performing below the baseline proficiency level was significantly larger for the formulating process (28%) than for the interpreting (23%) or the mathematical reasoning process subscales (23%).
- The gap between the highest- and lowest-performing pupils was largest on the uncertainty and data subscale and smallest on the space and shape subscale.

3.3 Introduction to the subdomains

Mathematical literacy in PISA 2022 is assessed in relation to 4 content subdomains (change and relationships, quantity, space and shape, and uncertainty and data) and 4 process subdomains (mathematical reasoning, formulating, employing, and interpreting). The process subdomain of mathematical reasoning was introduced in PISA 2022. The remaining process subdomains and all the content subdomains were included in the previous mathematics assessment frameworks. The subdomains are described in further detail in this chapter and in the PISA 2022 mathematics framework (OECD, 2023c).

In addition to their overall performance, pupils' performance in mathematics was analysed separately for each of the subdomains. In some education systems, pupils showed notably stronger or weaker performance in some of these areas. Differences between average scores on these subscales could have implications for teaching and learning or might reflect differences in the balance of these content areas across different curricula.

Stronger conclusions can be drawn when comparing across subscales within England because the report not trying to generalise beyond the sample of pupils in England. The fact that the sample deviates from the sampling standards has less of an influence because the comparison is taking place within it, rather than between it and samples from previous years or from other education systems. In other words, the subscales within England that are being compared are equally affected by the sampling deviations.

3.4 Mathematics content subdomain scale scores

The 4 mathematics content subdomain scales include change and relationships, quantity, space and shape, and uncertainty and data. These are described below.

3.4.1 Change and relationships

The change and relationships subdomain involves pupils demonstrating their understanding of types of change and recognising when they occur. This can involve the use of suitable mathematical models to both describe the changes and relationships but also to predict change. It also requires the use of appropriate functions and equations to model the change and the relationships, as well as moving between and interpreting different representations of these changes and relationships (https://pisa2022-maths.oecd.org/).

In 2022, England's average score for the change and relationships subdomain was 491 which was significantly higher than the average of 470 across OECD countries. Pupils in Australia and in the Republic of Ireland achieved an average score for the change and relationships subdomain that was not different from England, 486 and 492 respectively. The average scores of 502 in Canada and 574 in Singapore were both significantly higher than the average scores of pupils in England for the change and relationships subdomain in PISA 2022.

3.4.2 Quantity

Quantity incorporates the quantification of attributes of objects, relationships, situations and entities in the world, understanding various representations of those quantifications and judging interpretations and arguments based on quantity. The essence of mathematical literacy relative to quantity include number sense, multiple representations of numbers, elegance in computation, mental calculation, estimation and the assessment of the reasonableness of results. This subdomain includes applying knowledge of number and number operations in a wide variety of settings (https://pisa2022-maths.oecd.org/).

England's average score for the quantity subdomain was 491 which was significantly higher than the average of 472 across OECD countries. The average scores for the quantity subdomain in Canada and the Republic of Ireland were not significantly different from England's, with pupils in both countries achieving an average score of 494. The average score in Singapore (579) was significantly higher than the average score in England, while the average score in Australia (483) was significantly lower for the quantity subdomain.

3.4.3 Space and shape

Shape and space involves a wide range of phenomena that are encountered in our visual and physical world. This includes patterns, properties of objects, positions and orientations, representations of these objects, decoding and encoding of visual information, navigation and dynamic interaction with real shapes as well as with representations, movement, displacement, and the ability to anticipate actions in space. Being literate in the shape and space subdomain involves understanding perspective and interpreting views of three-dimensional shapes from different perspectives, as well as constructing and transforming representations of shapes. It also includes creating and reading maps (https://pisa2022-maths.oecd.org/).

England's average score for the space and shape subdomain was 480 which was significantly higher than the average across OECD countries of 471. Pupils in Singapore and Canada performed significantly higher than pupils in England for the space and shape subdomain, with an average score of 571 and 491 respectively. There was no significant difference between pupils' average score in the Republic of Ireland (474) and England, or between pupils' average score in Australia (486) and England.

3.4.4 Uncertainty and data

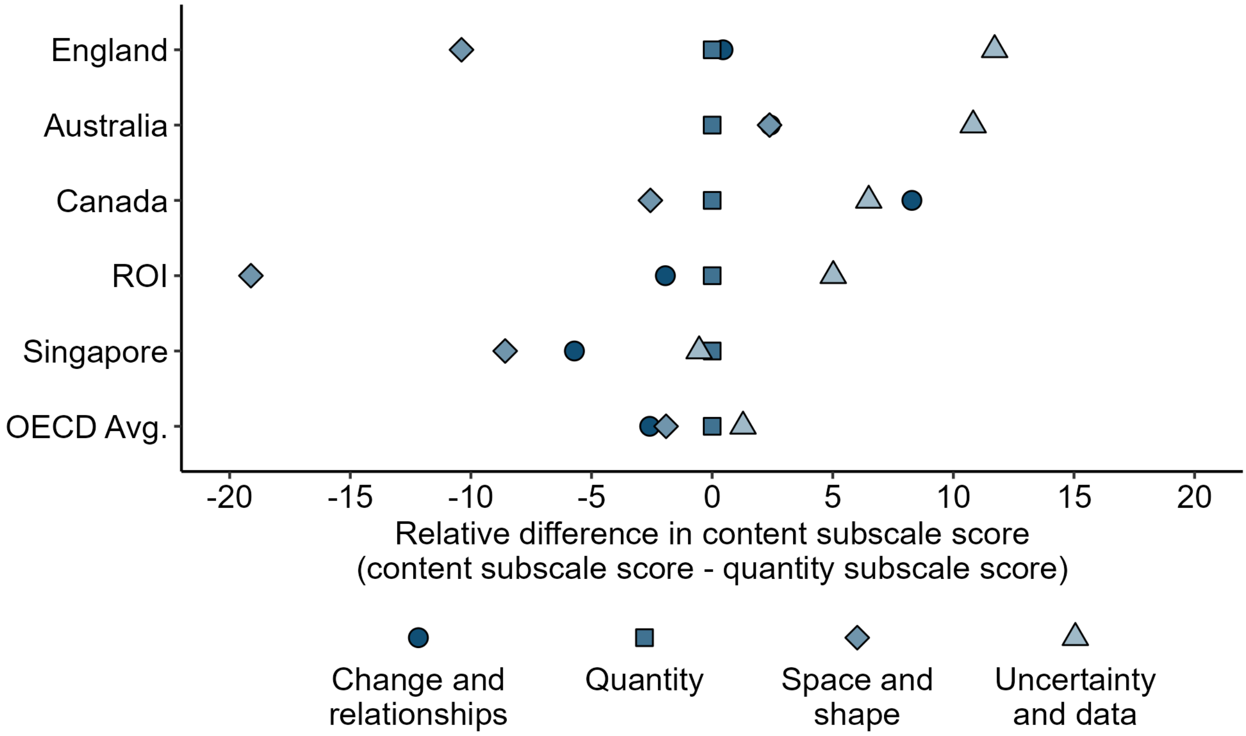
Uncertainty is a phenomenon at the heart of the mathematical analysis of many problem situations. The uncertainty and data content subdomain includes recognising the place of variation in processes, having a sense of the quantification of that variation, acknowledging uncertainty and error in measurement, and knowing about chance (https://pisa2022-maths.oecd.org/).

Pupils in England's average score for the uncertainty and data subdomain was 502 which was significantly higher than the average across OECD countries of 474. Only the top 6 East Asian education systems with the highest average mathematics scores also had a significantly higher average score for uncertainty and data than England (Singapore (579), Macao (551), Taiwan (546), Hong Kong (542), Japan (540) and South Korea (524). The average scores for the uncertainty and data subdomain in the Republic of Ireland (499) and Canada (500) were not significantly different from the average score in England in PISA 2022. The average score in Australia (494) was significantly lower than England for the uncertainty and data subdomain.

3.4.5 Differences between content subdomain scores

In England, the highest average content subdomain score was for uncertainty and data subdomain. This was also the case in Australia, the Republic of Ireland, and on average across OECD countries, although not all of these were significantly higher than the other subdomain scores. The lowest average subdomain score in England was for space and shape, which was also the lowest average subdomain score in Canada, the Republic of Ireland and Singapore, though not all of these were significantly lower than the other subdomain scores. On average across OECD countries the difference between the highest average content subdomain score (uncertainty and data) and the lowest average content subdomain score (change and relationships) was 4 score points. In England, this difference was 25 score points between uncertainty and data and space and shape. This is the same as the difference in the Republic of Ireland (25 score points). The distribution of the content subdomain scores in England, across the comparator countries and on average across the OECD countries is shown in Figure 3.1.

Figure 3.1: Distribution of the average scores for each content subdomain for England, comparator countries and on average across on average across OECD countries



Country	Change and relationships	Quantity	Space and shape	Uncertainty and data
England	491	491	480	502
Australia	486	483	486	494
Canada	502	494	491	500
Republic of Ireland	492	494	474	499
Singapore	574	579	571	579
OECD average	470	472	471	474

Base: All participating pupils
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included countries.

Source: OECD, PISA 2022 Database

3.4.6 Differences between the highest- and lowest-performing pupils on the content subscales

In England, there were no significant differences in the gap in performances for each of the content subscales between the lowest performers (those in the lowest 10% of pupils) and the highest performers (those above the 90% percentile), except between the uncertainty and data subscale, where the gap in performance was 282 score points, and the space and shape subscale, where the gap in performance was 264 score points. The score at the 90th percentile on the uncertainty and data subscale (643) was significantly higher than score at the 90th percentile on each of the other 3 content subscales, with a score of 626 on the change and relationships subscale, 628 on the quantity subscale and 613 on the space and shape subscale. This score of 613 on the space and shape subscale was also significantly smaller than the score of 628 on the quantity subscale. For the score at the 10th percentile, there were no significant differences between the different content subscales except that the score for the uncertainty and data subscale (362) was significantly higher than the score for the space and shape subscale (349).

In respect to the PISA proficiency levels, a significantly larger percentage of pupils in England (17%) performed at Level 5 or above on the uncertainty and data subscale than on any of the other content subscales. A smaller percentage of pupils in England performed at Level 5 or above on the space and shape subscale (11%) and this was significantly smaller than on any of the other content subscales. On average across OECD countries, 10% of pupils performed at proficiency level 5 or above on the change and relationships, quantity and space and shape subscales and 11% of pupils performed at proficiency level 5 or above on the uncertainty and data subscale. The percentage of top performers (level 5 or 6) in England, in the comparator countries and on average across OECD countries are shown in Table 3.1.

The percentage of top-performing pupils in Singapore was significantly larger than the percentage of top-performing pupils in England across each of the 4 content subdomains. The percentage of top-performing pupils in the Republic of Ireland was significantly smaller than the percentage of top-performing pupils in England on each of the 4 content subscales. For the change and relationships and the space and shape subdomains, the percentage of top-performing pupils in Canada was also significantly larger than the percentage of pupils in England, but there were no significant differences between the percentage of top-performing pupils in England and Canada for the other 2 subdomains. There were no significant differences between the percentage of top-performing pupils in England and Australia for each of the 4 content subdomains.

Table 3.1: Percentage of top performing pupils on the content subscales in England, comparator countries and on average across OECD countries

Country	Change and relationships	Quantity	Space and shape	Uncertainty and data
England	14%	14%	11%	17%
Australia	13%	13%	13%	16%
Canada	16%	14%	14%	17%
Republic of Ireland	8%	10%	5%	12%
Singapore	40%	43%	39%	43%
OECD average	10%	10%	10%	11%

Base: All participating pupils
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included countries.

Source: OECD, PISA 2022 Database

On each of the content subscales around one quarter of pupils in England did not meet the baseline level (Level 2) in PISA 2022. A significantly larger percentage of pupils in England did not meet the baseline level on the space and shape subscale (28%) than on the uncertainty and data subscale (23%) or the change and relationships subscale (25%). Around one-third of pupils on average across OECD countries performed below the baseline proficiency level (Level 2), with 33% of pupils for the change and relationships subscale, and 32% of pupils for the quantity, space and shape, and uncertainty and data subscales. The percentage of pupils performing below the baseline level in England, in the comparator countries and on average across OECD countries are shown in Table 3.2.

Singapore also had a significantly smaller percentage of pupils than in England not performing at proficiency level 2 or above on each of the 4 content subscales. Similarly, the percentage of pupils in the Republic of Ireland not performing at proficiency level 2 or above was significantly smaller than the percentage of pupils in England below the baseline level except on the space and shape subscale where there was no significant difference. The percentage of pupils in Australia not performing at proficiency level 2 or above was significantly larger than the percentage of pupils in England below the baseline level except on the space and shape subscale where there was no significant difference. There were no significant differences between the percentage of the lowest-performing pupils in England and Canada for each of the content subscales except on the change and relationships subscale where a larger percentage of pupils in England performed below the baseline proficiency level than in Canada.

Table 3.2: Percentage of pupils performing below the baseline level on the content subscales in England, comparator countries and on average across OECD countries

Country	Change and relationships	Quantity	Space and shape	Uncertainty and data
England	25%	26%	28%	23%
Australia	28%	29%	28%	26%
Canada	22%	25%	26%	24%
Republic of Ireland	20%	21%	25%	19%
Singapore	9%	9%	9%	9%
OECD average	33%	32%	32%	32%

Base: All participating pupils
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included countries.

Source: OECD, PISA 2022 Database

3.5 Mathematics process subdomain scale scores

3.5.1 Mathematical reasoning

The mathematical reasoning subdomain was new for PISA 2022. It focuses on pupils' ability to reason logically and present arguments. This subdomain involves 6 key understandings that include:

- understanding quantity, number systems and their algebraic properties;
- appreciating the power of abstraction and symbolic representation;
- seeing mathematical structures and their regularities;
- recognising functional relationships between quantities;
- using mathematical modelling as a lens onto the real world (e.g. those arising in the physical, biological, social, economic and behavioural sciences); and
- understanding variation as the heart of statistics

The average score of pupils in England for the mathematical reasoning subscale was 493 which was significantly higher than the average score across OECD countries of 473. Only educational systems that had a significantly higher average score for mathematics also had a significantly higher average score for mathematical reasoning, including Singapore with an average score of 572. Pupils in Canada and in the Republic of Ireland had average scores for the mathematical reasoning subscale that were not significantly different from pupils in England with average scores of 499 and 490 respectively. On average, pupils in Australia had a significantly lower average score (486) for mathematical reasoning than pupils in England.

3.5.2 Formulating

The formulating subdomain focuses on the ability of pupils to recognise and identify opportunities to use mathematics and then provide mathematical structure to a problem presented in some contextualised form. In the process of formulating situations mathematically, pupils need to determine where they can extract the essential mathematics to analyse, set up and solve the problem. They also need to be able to translate from a real-world setting to the domain of mathematics and provide the real-world problem with mathematical structure, representations and specificity. They also need to reason about and make sense of constraints and assumptions in the problem.

In England, the average score for the formulating subscale was 488 which was significantly higher than the OECD average score of 469. Only education systems that had a significantly higher average score for mathematics also had a significantly higher average score for formulating, including Singapore where on average pupils achieved a score of 576. The average score of 488 in England was not significantly different from the average scores in Australia (484), the Republic of Ireland (487) and Canada (494).

3.5.3 Employing

The employing subdomain focuses on pupils' ability to apply mathematical concepts, facts, procedures and reasoning to solve mathematically formulating problems to obtain mathematical conclusions. In the process of employing mathematical concepts, facts, procedures and reasoning to solve problems, pupils need to perform the mathematical procedures needed to derive results and find a mathematical solution. They work on a model of the problem situation, establish regularities, identify connections between mathematical entities and create mathematical arguments.

Pupils in England achieved an average score of 492 on the employing subscale which was significantly higher than the average across OECD countries of 472. Only education systems that had a significantly higher average score for mathematics also had a significantly higher average score for employing, including pupils in Singapore who achieved an average score of 580 for employing. There were no significant differences between the pupils' average scores in Australia (486), the Republic of Ireland (494) and Canada (495) and pupils' average score in England.

3.5.4 Interpreting

The interpreting subdomain focuses on the ability of pupils to reflect upon mathematical solutions, results or conclusions and interpret and evaluate them in the context of the real-life problem that initiated the process. This involves translating mathematical solutions or reasoning back into the context of the problem and determining whether the results are reasonable and make sense in the context of the problem.

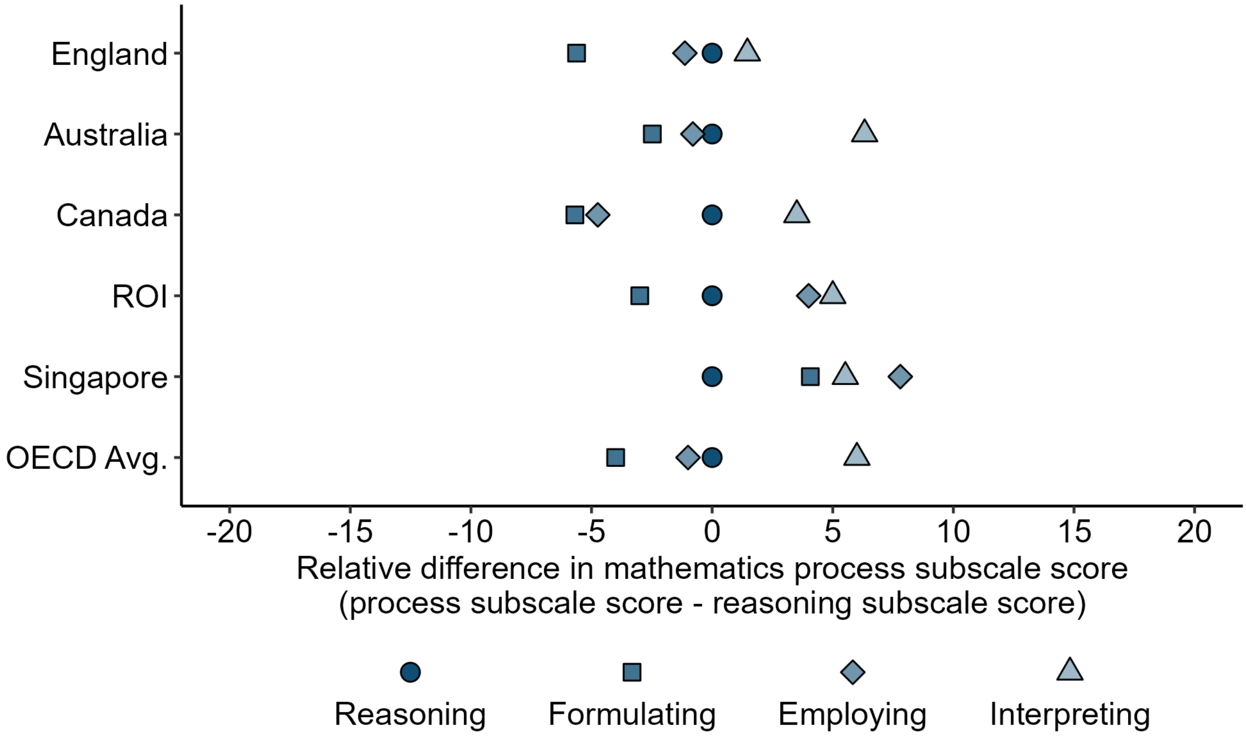
In the interpreting subscale, pupils in England achieved an average score of 495 which was significantly higher than the OECD average of 474. Canada has a significant higher score for the interpreting subscale (503) than England but has a score in mathematics that was not significantly different from the average score in England. All the other education systems that had a significantly higher score for the interpreting subscale than England also had a significantly higher score for mathematics overall. Pupils in Australia and in the Republic of Ireland achieved average scores on the interpreting subscale that were not significantly different from the average scores of pupils in England (493 and 495 respectively).

3.5.5 Differences between process subdomain scores

In England, the highest average process subscale score was for the interpreting subscale. The interpreting subscale was also the highest subscale score in Australia, the Republic of Ireland, Canada and on average across OECD countries, though it was not always significantly higher than the other process subscale scores. In all of the comparator countries except Singapore, in England, and on average across the OECD, the lowest average process subscale score was on the formulating subscale. In Singapore, mathematical reasoning was the lowest average process subscale score.

The difference between the highest process subscale score and the lowest subscale scores in England was 7 score points. On average across the OECD this difference was 5 score points. The distribution of the content subscale scores in England, across the comparator countries and on average across the OECD countries is shown in Figure 3.2.

Figure 3.2: Distribution of the average scores for each process subscale for England, comparator countries and on average across OECD countries



Country	Mathematical reasoning	Formulating	Employing	Interpreting
England	493	488	492	495
Australia	486	484	486	493
Canada	499	494	495	503
Republic of Ireland	490	487	494	495
Singapore	572	576	580	577
OECD average	473	469	472	474

Base: All participating pupils in England
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included countries.

Source: OECD, PISA 2022 Database

3.5.6 Differences in the highest- and lowest-performing pupils on the process subscales

There were no significant differences between the percentage of pupils in England who performed at Level 5 or above across each of the 4 process subscales, with 15% of pupils on the formulating subscale, 15% on the employing subscale, 14% on the interpreting subscale and 13% on the mathematical reasoning subscale. On average across OECD countries, 10% of pupils performed at Level 5 or above on the formulating, employing and interpreting subscales and 9% on the mathematical reasoning subscale. The percentage of pupils in England, comparator countries and on average across the OECD performing at the highest proficiency levels are shown in Table 3.3.

Table 3.3: Percentage of top performers on the process subscales in England, comparator countries and on average across OECD countries

Country	Mathematical reasoning	Formulating	Employing	Interpreting
England	13%	15%	15%	14%
Australia	13%	14%	14%	14%
Canada	14%	15%	15%	17%
Republic of Ireland	7%	9%	10%	9%
Singapore	40%	41%	43%	42%
OECD average	9%	10%	10%	10%

Base: All participating pupils
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included countries.

Source: OECD, PISA 2022 Database

The percentage of top-performing pupils (Level 5 or above) in Singapore was significantly larger than the percentage in England, across all the process subscales. The percentage of top-performing pupils in Canada on the interpreting process subscale (17%) was also significantly larger than the percentage of pupils in England (14%). There were no other significant differences between the percentage of pupils in England and in Canada performing at the highest levels, across the other process subscales. There were also no significant differences between the percentage of top-performing pupils in Australia and top-performing pupils in England on each of the 4 process subscales. The percentage of pupils in the Republic of Ireland performing at the highest proficiency levels was significantly smaller than the percentages in England for each of the 4 process subscales with just 9% of pupils for the formulating or interpreting process subscales, 10% for the employing process subscale and 7% for the mathematical reasoning process subscale.

The percentage of pupils in England performing below Level 2 was significantly larger for the formulating process (28%) than for the interpreting (23%) or the mathematical reasoning process subscales (23%). There were no other significant differences between the percentage of pupils in England performing below Level 2 on each of the process subscales. On average across OECD countries 34% of pupils for the formulating subscale, 32% of pupils for the employing subscale and 31% of pupils for the interpreting and the mathematical reasoning subscales performed below the baseline Level 2 in PISA 2022. The percentage of pupils performing below the baseline level on the process subscales in England, comparator countries and on average across OECD countries is shown in Table 3.4.

The percentage of pupils performing below the baseline level in PISA 2022 in Singapore was significantly smaller in Singapore than in England with just 9% of pupils in Singapore on each of the 4 process subscales. There were no significant differences in the percentage of pupils performing below the baseline level in Canada or in the Republic of Ireland and the percentage of lower-performing pupils in England. There were also no significant differences between the percentage of pupils on the formulating or interpreting process subscales achieving below the baseline level in Australia and in England, but on the mathematical reasoning or employing process subscales the percentage of lower-performing pupils in Australia was significantly larger (27% and 29% respectively) than the percentage of lower-performing pupils in England (23% and 26% respectively).

Table 3.4: Percentage of pupils performing below the baseline level on the process subscales in England, comparator countries and on average across OECD countries

Country	Mathematical reasoning	Formulating	Employing	Interpreting
England	23%	28%	26%	23%
Australia	27%	30%	29%	25%
Canada	22%	26%	25%	23%
Republic of Ireland	20%	23%	21%	19%
Singapore	9%	9%	9%	9%
OECD average	31%	34%	32%	31%

Base: All participating pupils
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included countries.

Source: OECD, PISA 2022 Database

4 Reading

4.1 Chapter overview

This chapter focuses on England's performance in the reading domain of PISA 2022, and how this compares to the performance of other education systems and to England's participation in previous cycles. This chapter also looks at the distribution of reading performance in England, the percentage of pupils in England who performed at the different PISA proficiency levels in reading. Caution needs to be taken in interpreting these findings as some of the sampling standards for PISA 2022 were not met in England as described in Chapter 1.

4.2 Key findings

- In 2022, England's average score in reading (496) was significantly above the OECD average (476).
- Pupils in 8 out of the other 78 participating education systems achieved an average score that was significantly above England, with a further 5 education systems having reading scores that were not significantly different from England's and 65 education systems achieving an average score that was significantly below England.
- The highest performing education systems in reading was Singapore (543), with the Republic of Ireland (516), Japan (516), South Korea (515), Taiwan (515), Estonia (511), Macao (510), and Canada (507) also performing significantly above England.
- England's average score in reading in 2022 was significantly below the average score in 2018 (505), and the OECD trend average was also significantly lower in 2022 (477) than in 2018 (488). England's score in 2022 was not significantly different from scores achieved between 2006 and 2015, while the OECD average declined between 2012 and 2022.
- In total, 37 of the 71 education systems that participated in both 2018 and 2022 saw a significant decrease in their average reading score in 2022 compared to 2018, with only 6 education systems saw a significant increase. The remaining 28 education systems saw no significant change in their scores.
- The distribution of reading scores in England in 2022 is wider than in the previous cycles of PISA. This is due to a decrease in the score of lowest performing pupils in the country, whereas performance of the highest performing pupils has remained stable since 2018.

- Approximately 10% of pupils in England achieved the highest reading proficiency levels (Levels 5 and 6). This was significantly larger than the 7% of pupils on average across OECD countries. A significantly smaller percentage of pupils in England scored below the baseline reading proficiency level (Level 2) (20%) than on average 26% across OECD countries (26%).

4.3 Introduction to reading in PISA

This chapter focuses on England's performance in the reading domain of PISA, looking at how England's performance in 2022 compares to that of other participating education systems, as well as the range between the highest- and lowest-performing pupils. The chapter also looks at historical trends in performance.

The framework for assessing pupils' reading literacy was revised in PISA 2018, when reading was the major domain of assessment. The reading component of the PISA 2022 assessment aims to consider both the pupils' capacity to understand, use and reflect on written texts as well as the potential purpose of reading such as developing knowledge and participating in society (OECD, 2023).

As England's school-level and pupil-level response rates did not meet some of the PISA sampling standards, caution is required when interpreting the analysis reported here. Cautious interpretation is particularly necessary when considering trends in performance over time and when making international comparisons. Australia, Canada, and the Republic of Ireland, which have been included as comparator countries, also did not meet some of the PISA sampling standards as well as some of the other OECD countries included in the OECD averages. For more information see Section 1.4.2.

4.4 England's performance in reading

England's average score in reading in PISA 2022 was 496. This was significantly above the OECD average of 476. Table 4.1 shows England's performance relative to every other education system with average reading scores greater than 450. A total of 8 education systems had average scores significantly above England, while 5 systems had average scores that were not significantly different to England's. Every other education system had an average score in reading that was significantly below England's[8].

The highest performing system in PISA 2022 was Singapore (543), which outperformed all other participating education systems. The Republic of Ireland (516), Japan (516), South Korea (515), Taiwan (515), Estonia (511), Macao (510) and Canada (507) were

[8] International comparisons in the performance in reading involving England in this report do not include Cyprus or Vietnam as these data were not available at the time of writing..

the next highest performing systems, and all achieved average scores which were significantly higher than England.

Table 4.1: Reading performance of education systems in PISA 2022 relative to England

Performance relative to England	Education system and average score
Education systems that scored significantly higher than England in reading in PISA 2022	Singapore (543), Republic of Ireland (516), Japan (516), South Korea (515), Taiwan (515), Estonia (511), Macao (510), Canada (507)
England and education systems that did not score significantly higher or lower than England in reading in PISA 2022	United States (504), New Zealand (501), Hong Kong (500), Australia (498), **England (496)**, Finland (490)
Education systems that scored significantly lower than England in reading in PISA 2022	Denmark (489), Poland (489), Czech Republic (489), Sweden (487), Switzerland (483), Italy (482), Austria (480), Germany (480), Belgium (479), Portugal (477), Norway (477), **OECD average (476),** Croatia (475), Latvia (475), Spain (474), France (474), Israel (474), Hungary (473), Lithuania (472), Slovenia (469), Netherlands (459), Turkey (456)

Base: All education systems with average scores over 450 in reading in PISA 2022.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included education systems.

Source: OECD, PISA 2022

4.5 Reading performance over time

England's reading average score of 496 in PISA 2022 represents a drop of 9 score points from PISA 2018 (505). This decline was significant. This trend was not unique to England, with the OECD trend average being also significantly lower in PISA 2022 (477) than in PISA 2018 (488). Out of 71 education systems that participated in both PISA 2018 and PISA 2022 including England, 6 education systems scored significantly higher in reading in PISA 2022 than in PISA 2018. By contrast, 37 education systems saw their reading average score significantly lower in PISA 2022 than in PISA 2018. Table 4.2 shows the changes in reading average score between PISA 2018 and PISA 2022 for every education system that participated in both PISA 2018 and PISA 2022 and scored above 450 in reading in PISA 2022.

Table 4.2: Changes in reading average score between 2018 and 2022 for higher-performing education systems

Trend in reading performance	Education system and change in score
Scored significantly higher in reading in PISA 2022 than in PISA 2018	Taiwan (+13), Japan (+12)
Scored statistically lower in reading in PISA 2022 than in PISA 2018	Singapore (-7), **England (-9),** Turkey (-10), **OECD trend average (-10),** Estonia (-12), Denmark (-12), Canada (-13), Belgium (-14), Macao (-15), Portugal (-15), Germany (-18), France (-19), Sweden (-19), Norway (-23), Poland (-23), Hong Kong (-25), Netherlands (-26), Slovenia (-27), Finland (-30)
No significant differences in reading average score between PISA 2022 and PISA 2018	Italy (+5), Israel (+3), South Korea (+1), Switzerland (-1), United States (-1), Czech Republic (-2), Republic of Ireland (-2), Hungary (-3), Croatia (-3), Austria (-4), Lithuania (-4), Latvia (-4), Australia (-5), New Zealand (-5)

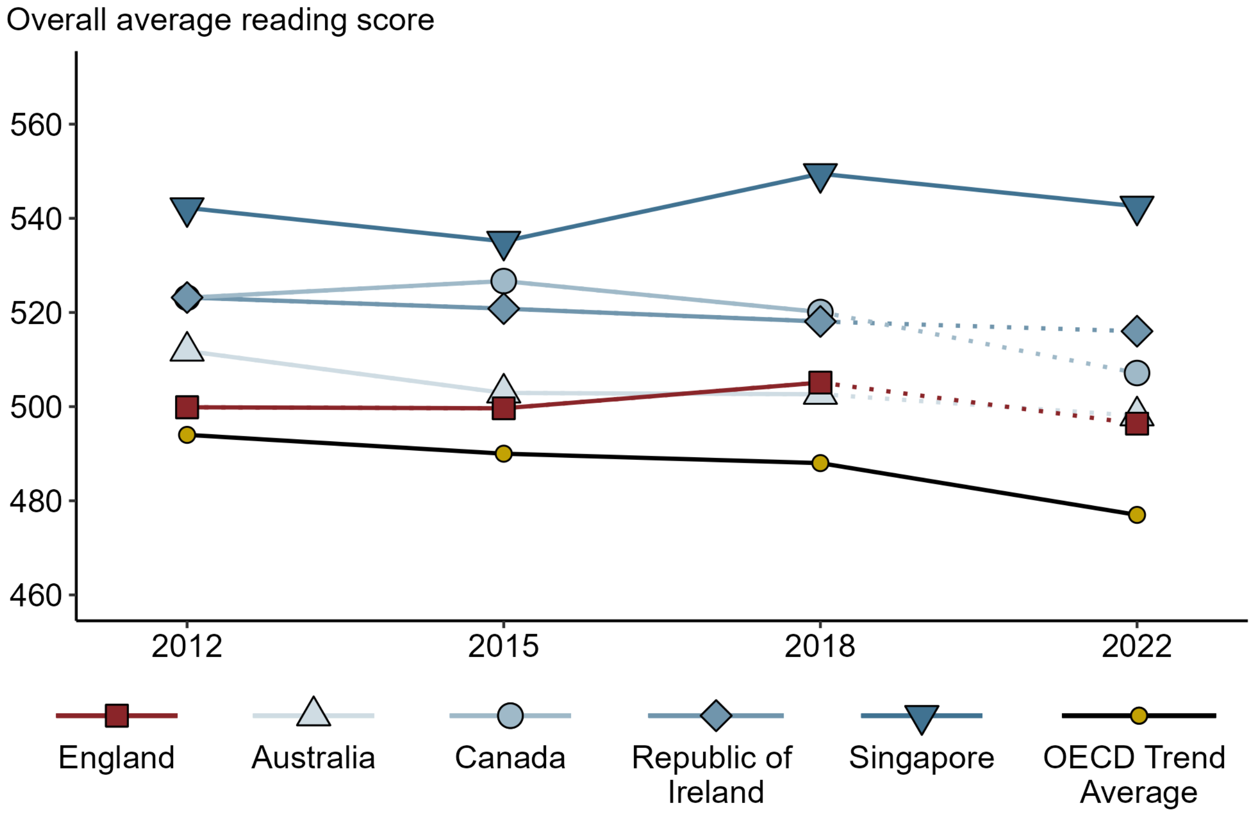
Base: All education systems with average scores over 450 in reading in PISA 2022 that also participated in PISA 2018.
Change in reading score between 2018 and 2022 shown in parenthesis after the education system.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included education systems.

Source: OECD, PISA 2022

Figure 4.1 presents England's overall reading performance over the last four cycles of PISA relative to the comparator countries and to the OECD average. England's reading average score in PISA 2022 (496) was statistically significantly lower than the score in 2018 (505), but not significantly different to the scores in 2015 (500), 2012 (500), 2009 (495) or 2006 (496). Looking at the comparator countries, the trajectory of Singapore's overall reading performance showed a similar trend to England. Singapore scored significantly lower in PISA 2022 (543) than in 2018 (549), but not significantly different to the scores in 2015 (535) and 2012 (542). Australia scored significantly lower in PISA 2022 (498) than in 2012 (512), but not significantly different to the scores in 2018 (503) and 2015 (503) despite a 5 score point drop. Canada scored significantly lower in PISA 2022 (507) than in all the three previous PISA cycles, whereas the Republic of Ireland's reading average score in PISA 2022 (516) was not significantly different to the scores in 2018 (518), 2015 (521) and 2012 (523).

Across the OECD trend countries, the overall reading performance showed a downward trend since 2012. The OECD trend average in PISA 2022 (477) was statistically significantly lower than the scores in 2018 (488), 2015 (490) and 2012 (494).

Figure 4.1: Trends in reading performance in England, comparator countries and on average across OECD trend countries



Country	2012	2015	2018	2022
England	500	500	*505	496
Australia	*512	503	503	498
Canada	*523	*527	*520	507
Republic of Ireland	523	521	518	516
Singapore	542	535	*549	543
OECD Trend Average	*494	*490	*488	477

Asterisks (*) indicate that the score shown was statistically significantly different to that system's score for PISA 2022.
Trend results between 2018 and 2022 in England, Australia, Canada, and the Republic of Ireland where PISA sampling standards were not all met indicated with dotted lines in the figure.
OECD averages calculated using OECD countries in PISA 2022 excluding Costa Rica, Luxembourg and Spain.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included education systems.

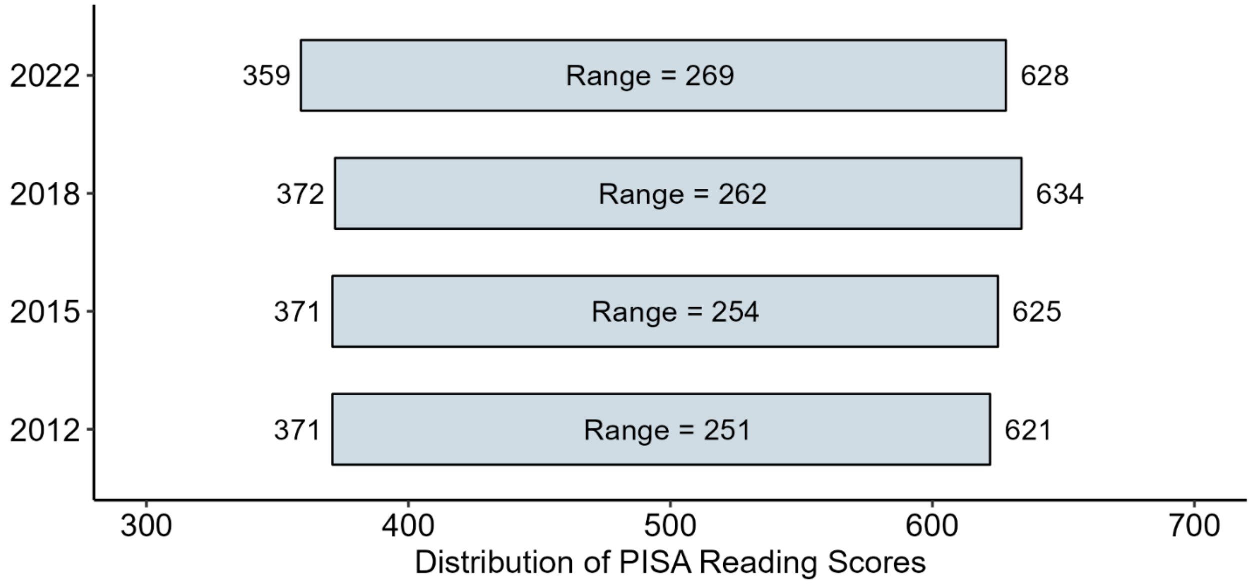
Source: OECD, PISA 2022

4.6 Differences between the highest- and lowest-performing pupils in reading

In this section, we look at the range of pupils' performance in reading by discussing England's performance at the 90th and 10th percentiles. The 90th percentile was the score above which the highest performing 10% of pupils obtain, while the 10th percentile was the score below which the lowest performing 10% of pupils obtain. The difference between the highest and lowest performers at the 90th and 10th percentiles is a better measure of the spread of scores for comparing countries than using the very highest and lowest performing pupils as the latter comparison may be affected by a small number of pupils with unusually high or low scores. There needs to be particular caution in interpreting the scores of the highest- and lowest-performing pupils as the non-response bias analysis suggests lower performing pupils may have been under-represented in among pupils who participated in PISA 2022.

Figure 4.2 shows the distribution of reading scores for England in each PISA cycle since 2012. Since 2012, there has been a widening in the distribution of reading scores in England. The range in reading scores in PISA 2022 (269) was statistically significantly wider than the range in 2015 (253), a decrease of 15 score points, but not significantly different to the ranges in 2018 (262) and 2012 (251) despite a 19 score point increase (after taking into account the rounding of figures) from 2012. This increasing range can be explained by a 13 score point drop in the reading score at the 10th percentile and a 3 score point increase in the score at the 90th percentile in 2022 from 2015, although neither change was statistically significant.

Figure 4.2: Trends in the gap in reading performance between the highest- and lowest-performing pupils in England



PISA Cycle	10th percentile	90th percentile	Range
2022	359	628	269
2018	372	634	262
2015	371	625	254
2012	371	621	251

Ranges calculated as 90th percentile – 10th percentile.
Ranges may appear inconsistent with percentile scores due to rounding.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in England.

Source: OECD, PISA 2022

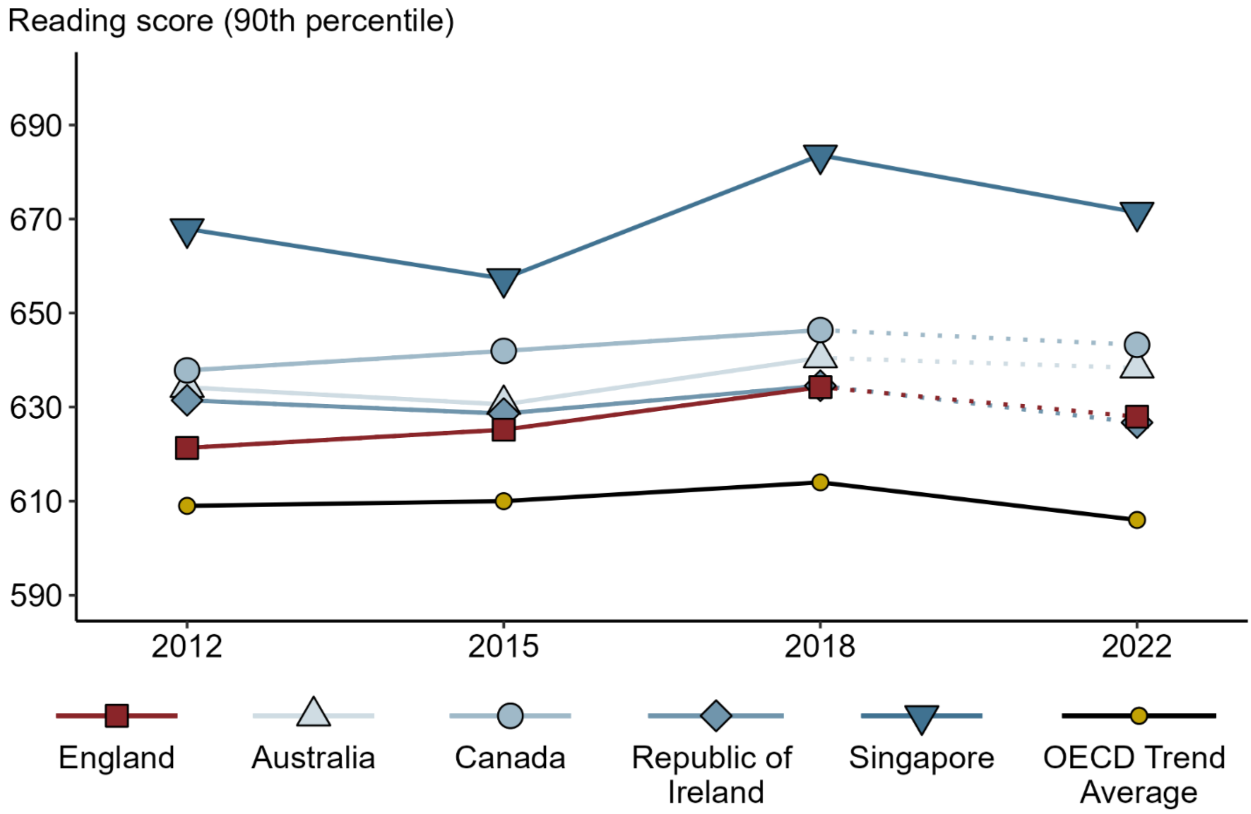
Figure 4.3 and Figure 4.4 highlight this finding by focusing on reading performance at the 90th and 10th percentiles respectively, and with reference to international trends at these percentiles.

Figure 4.3 shows England's reading performance at the 90th percentile across the last 4 PISA cycles. England's reading score of 628 at the 90th percentile in PISA 2022 was not statistically significantly different to the scores in 2018 (634), 2015 (625) and 2012 (621).

The reading score of 606 at the 90th percentile on average across OECD trend countries in PISA 2022 was statistically significantly lower than the scores in 2018 (614), but not statistically significantly different to the scores in 2015 (610) or 2012 (609). Comparing pupils' reading performance at the 90th percentile in England and across the OECD countries, England's reading score at the 90th percentile has been statistically significantly above the OECD's score since 2012.

Looking at the comparator countries, Australia, Canada and the Republic of Ireland, like England, showed relative consistency in reading performance at the 90th percentile since 2012. In each of the three countries, the reading score at the 90th percentile in PISA 2022 was not statistically significantly different to the scores in the three previous PISA cycles. On the other hand, Singapore has showed a fluctuation in reading performance at the 90th percentile since 2012. The reading score at the 90th percentile in PISA 2022 (671) was statistically significantly lower than the score in 2018 (684) and statistically significantly higher than the score in 2015 (657), but not statistically significantly different to the score in 2012 (668).

Figure 4.3: Trends in reading performance at the 90th percentile in England, comparator countries and on average across OECD trend countries.



Country	2012	2015	2018	2022
England	621	625	634	628
Australia	634	631	640	638
Canada	638	642	646	643
Republic of Ireland	631	629	635	627
Singapore	668	*657	*684	671
OECD Trend Average	609	610	*614	606

Asterisks (*) indicate that the score shown was statistically significantly different to that system's score for PISA 2022.
Trend results between 2018 and 2022 in England, Australia, Canada, and the Republic of Ireland where PISA sampling standards were not all met indicated with dotted lines in the figure.
OECD averages calculated using OECD countries in PISA 2022 excluding Costa Rica, Luxembourg and Spain.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included education systems.

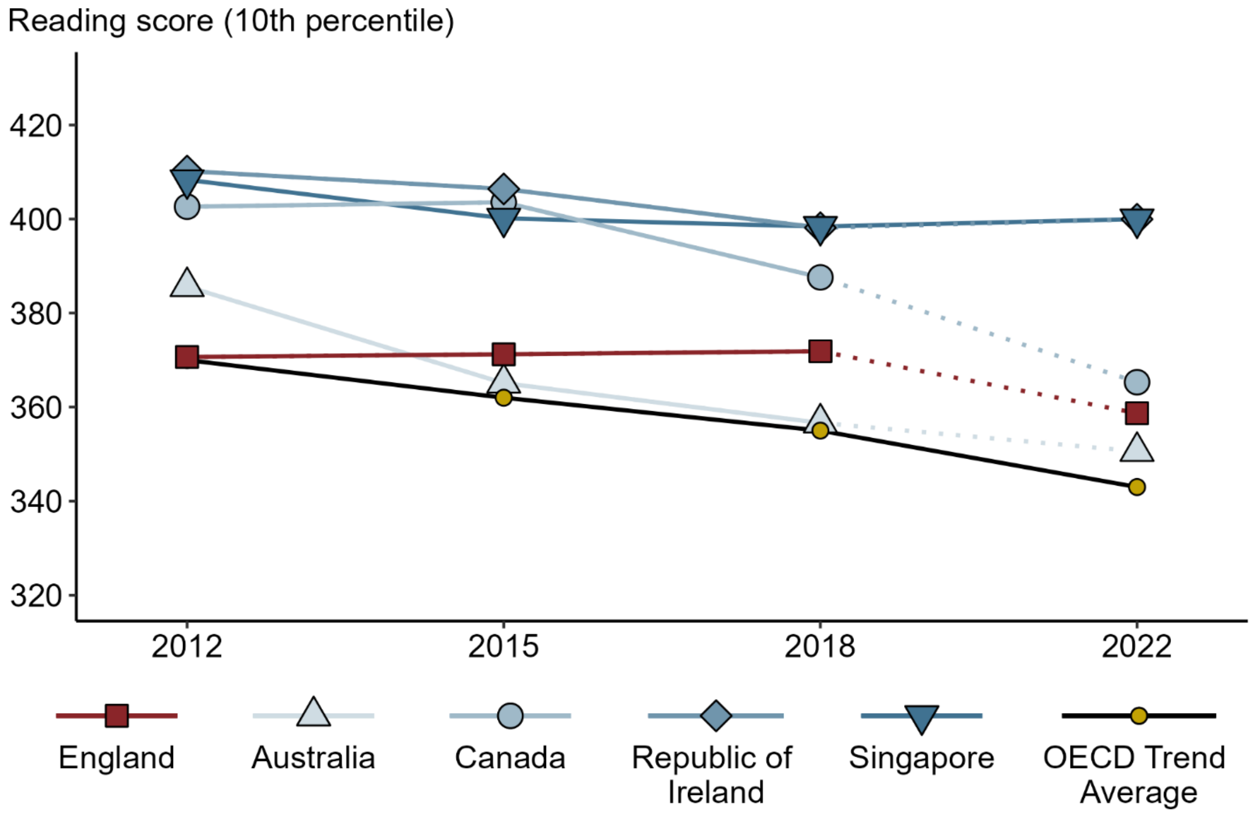
Source: OECD, PISA 2022

Figure 4.4 shows England's reading performance at the 10th percentile across the last 4 PISA cycles. England's score of 359 at the 10th percentile in PISA 2022 was lower than the scores in 2018 (372), 2015 (371) and 2012 (371), but these differences are not statistically significant.

However, on average across the OECD trend countries, there has been a downward trend in reading performance at the 10th percentile since 2012. The reading score at the 10th percentile was statistically significantly lower in PISA 2022 (343) than in 2018 (355), 2015 (362) and 2012 (370). Comparing pupils' reading performance at the 10th percentile in England and on average across OECD trend countries, England's reading score at the 10th percentile has been statistically significantly above the average across OECD trend countries since 2018. In 2015 and 2012, England's reading score at the 10th percentile was not statistically significantly different to the average across OECD countries.

Looking at the comparator countries, Australia's reading performance at the 10th percentile showed a downward trend from 2012. Australia's reading score at the 10th percentile was statistically significantly lower in PISA 2022 (351) than in 2015 (365) and 2012 (386) but not statistically significantly different to the score in 2018 (357). Canada also showed a downward trend from 2015, with Canada's reading score at the 10th percentile statistically significantly lower in PISA 2022 (365) than in the three previous PISA cycles. On the other hand, Republic of Ireland and Singapore showed little change in reading performance at the 10th percentile from 2012. In both countries, the reading score in PISA 2022 was not statistically significantly different to the scores in the three previous PISA cycles.

Figure 4.4: Trends in reading performance at the 10th percentile in England, comparator countries and on average across OECD trend countries



Country	2012	2015	2018	2022
England	371	371	372	359
Australia	*386	*365	357	351
Canada	*403	*404	*388	365
Republic of Ireland	410	406	398	400
Singapore	408	400	398	400
OECD Trend Average	*370	*362	*355	343

Asterisks (*) indicate that the score shown was statistically significantly different to that system's score for PISA 2022.
Trend results between 2018 and 2022 in England, Australia, Canada, and the Republic of Ireland where PISA sampling standards were not all met indicated with dotted lines in the figure.
OECD averages calculated using OECD countries in PISA 2022 excluding Costa Rica, Luxembourg and Spain.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included education systems.

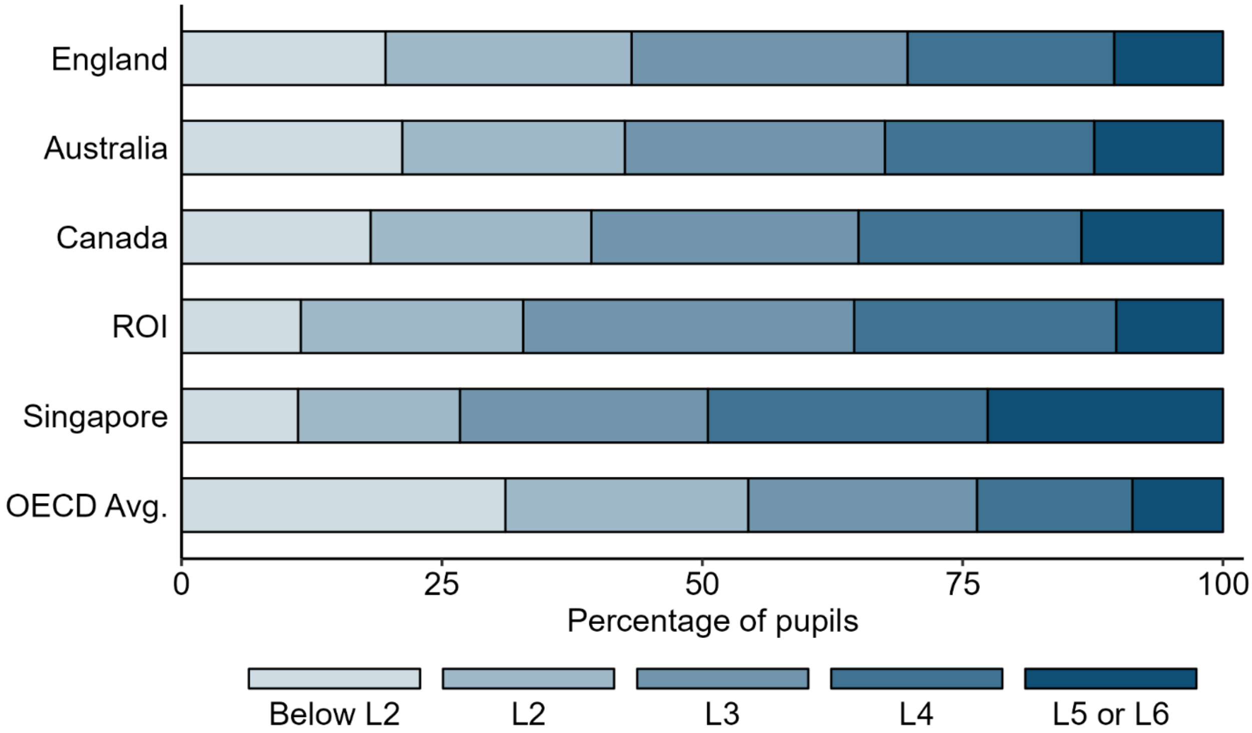
Source: OECD, PISA 2022

4.7 Performance across reading proficiency levels

Another way of assessing the spread of reading performance across the country was to look at percentage of pupils performing at each of the PISA proficiency levels. These provide descriptors of how PISA scores in reading correspond with pupils' ability to understand, interpret, and critically evaluate texts (OECD, 2023). Pupils who score below Level 2 are considered low performers and those who perform at Level 5 or above are considered top performers. Level 2 is considered the baseline level of proficiency in reading needed for pupils to participate fully in society.

Figure 4.5 provides an overview of the percentage of pupils in England who performed at each of the proficiency levels in reading in PISA 2022, compared to the percentage of pupils reaching each proficiency level across the OECD countries and the comparator countries.

Figure 4.5: Percentage of pupils performing at each reading proficiency level in England, comparator countries and on average across OECD countries



Country	Below L2	L2	L3	L4	L5 or L6
England	20%	24%	26%	20%	10%
Australia	21%	21%	25%	20%	12%
Canada	18%	21%	26%	21%	14%
Republic of Ireland (ROI)	11%	21%	32%	25%	10%
Singapore	11%	16%	24%	27%	23%
OECD Average	26%	24%	25%	17%	7%

Base: All participating pupils
Percentages may appear inconsistent due to rounding.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included education systems.

Source: OECD PISA 2022

In PISA 2022, the percentage of pupils in England performing at the highest proficiency levels (10%) was significantly larger than the 7% of pupils on average across OECD countries. England also had a significantly smaller percentage of pupils performing below the baseline proficiency level with 20% of the pupils in England scoring at these levels compared to 26% across the OECD countries.

Looking at the comparator countries, England had a smaller percentage of pupils achieving the highest proficiency levels than Australia (12%), Canada (14%) and

Singapore (23%), but a similar percentage to the Republic of Ireland (10%). England had a larger percentage of pupils scoring at the lowest proficiency levels than the Republic of Ireland (11%) and Singapore (11%), but a similar percentage to Canada (18%) and Australia (21%).

5 Science

5.1 Chapter overview

This chapter focuses on England's performance in the science domain of PISA 2022, and how this compares to the performance of other education systems and to England's previous participation. This chapter also looks at the distribution of science performance in England, and the percentage of pupils in England who perform at the different PISA proficiency levels in science. Caution needs to be taken in interpreting these findings as some of the sampling standards for PISA 2022 were not met in England as described in Chapter 1.

5.2 Key findings

- England's overall average score in science in PISA 2022 was 503. This was significantly higher than the OECD average of 485, and significantly higher than the scores of 62 other education systems. There were 8 education systems which scored similarly to England, and 9 which scored significantly higher.
- England's overall average science score of 503 was not significantly different to the score of 507 achieved in PISA 2018. On average across the OECD, there was no significant change in the average science score since 2018. Nine of the higher-performing education systems (scores above 450) saw significant improvements in their science scores over this period, whereas 6 saw significant decreases, while the remaining 22 saw no significant change.
- Over the 10-year period from 2012 to 2022 however, the performance of pupils in science has been in decline on average across the OECD. England's overall average science score has dropped significantly from 512 in 2015 to 503 in 2022, though is not significantly different from the average score of 507 in 2018.
- While England's scores at the 90th percentile have remained relatively stable over time, England's scores at the 10th percentile are significantly lower than they were in 2012 and 2015. Theis means that the overall change in England's score has been driven by greater decreases in the scores of lower achieving pupils in England than of higher achieving pupils.
- England has a higher percentage of pupils classified as 'top performers' (performing at Level 5 proficiency or above) in science than on average across OECD countries, as well as a lower percentage of pupils classified as 'low performers' (performing below Level 2 proficiency).

5.3 Introduction to science in PISA

This chapter focuses on England's performance in the science domain of PISA, looking at how England's performance in 2022 compares to that of other participating education systems, as well as the range between the highest and lowest scoring pupils and the percentages of pupils performing at each of the PISA proficiency levels.

The framework for assessing pupils' scientific literacy was revised in PISA 2015, when science was last the major domain in PISA. In the PISA science framework, three main competencies of scientific literacy are assessed:

- Explaining phenomena scientifically
- Evaluating and designing scientific enquiry
- Interpreting data and evidence scientifically

These competencies are assessed over three main content areas:

- Living systems (e.g., cells, organisms and human biology)
- Physical systems (e.g., matter, motion, and forces)
- Earth and space science systems (e.g., the history of the Earth, space, and the universe)

More information on the current PISA science framework and example science test items from previous PISA cycles can be found in the OECD PISA 2015 Science Framework. Unlike in the major domain of PISA 2022, mathematics, there are no subdomain scores for these different competency and content areas of the scientific literacy framework in PISA 2022. Instead, this chapter focuses on England's estimate of overall science performance, including trends over time and in relation to other education systems.

As England's school-level and pupil-level response rates did not meet some of the PISA sampling standards, caution is required when interpreting the analysis reported here. Cautious interpretation is particularly necessary when considering trends in performance over time and when making international comparisons. Australia, Canada, and the Republic of Ireland, which have been included as comparator countries, also did not meet some of the PISA sampling standards as well as some of the other OECD countries included in the OECD averages. For more information see Section 1.4.2.

5.4 England's performance in science

England's score in science in PISA 2022 was 503. This was significantly lower than the overall average science scores of 9 education systems that participated in PISA 2022, not significantly different to the performance of 8 other education systems, and significantly higher than the science scores of 62 education systems[9]. England's overall average science score was also significantly higher than the OECD average science score of 485. These education systems and their scores in science relative to England's are presented in Table 5.1.

Table 5.1: Science performance of education systems in PISA 2022 relative to England

Performance relative to England	Education system and score
Education systems that scored significantly higher than England in science in PISA 2022	Singapore (561), Japan (547), Macao (543), Taiwan (537), South Korea (528), Estonia (526), Hong Kong (520), Canada (515), Finland (511)
England and education systems that did not score significantly higher or lower than England in science in PISA 2022	Australia (507), New Zealand (504), Republic of Ireland (504), **England (503)**, Switzerland (503), Slovenia (500), United States (499), Poland (499), Czech Republic (498)
Education systems that scored significantly lower than England in science in PISA 2022	Latvia (494), Denmark (494), Sweden (494), Germany (492), Austria (491), Belgium (491), Netherlands (488), France (487), Hungary (486), **OECD average (485),** Spain (485), Lithuania (484), Portugal (484), Croatia (483), Norway (478), Italy (477), Turkey (476), Vietnam (472), Malta (466), Israel (465), Slovakia (462), Ukrainian regions (450)

Base: All education systems with average scores over 450 in science in PISA 2022.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included education systems.

Source: OECD, PISA 2022

Singapore was the highest performing education system in science in PISA 2022; their score of 561 was significantly higher than the score of every other participating education system. Japan, Macao and Taiwan were the next highest-performing systems, and all significantly outperformed the highest-performing education system outside of East-Asia, Estonia.

[9] International comparisons involving England in this report do not include Cyprus as these data were not available at the time of writing.

5.5 Science performance over time

England’s science score of 503 in PISA 2022 compares to a score of 507 in PISA 2018, but this difference of 4 points from PISA 2018 does not represent a statistically significant drop in performance. On average across the OECD trend countries there was also no significant change in performance between 2018 (489) and 2022 (487).

Table 2.2 shows the changes in science scores between PISA 2018 and PISA 2022 for the 37 education systems (including England) that participated in both PISA 2018 and PISA 2022 and scored above 450 in science in PISA 2022. Nine of these education systems scored significantly higher in science in PISA 2022 than in PISA 2018, with Taiwan and Japan experiencing the greatest gains. By contrast, 6 education systems saw their overall science score significantly drop from 2018, with the Netherlands experiencing the largest drop. The remaining 22 of these education systems including England experienced no statistically significant changes in their science score over this period.

Table 5.2: Changes in science average scores between 2018 and 2022 for higher-performing education systems

Trend in science performance	Education system and change in score
Scored significantly higher in science in PISA 2022 than in PISA 2018	Taiwan (+22), Japan (+17), Singapore (+10), Croatia (+10), Italy (+9), Malta (+9), Republic of Ireland (+8), Turkey (+8), Latvia (+7)
No statistically significant differences in science scores between PISA 2022 and PISA 2018	South Korea (+9), Switzerland (+7), Hungary (+5), Australia (+4), Hong Kong (+4), Israel (+3), Lithuania (+2), Austria (+1), Spain (+1), Denmark (+1), Czech Republic (+1), Macao (+0), Slovakia (-2), **OECD trend average (-2),** United States (-3), Canada (-3), Estonia (-4), New Zealand (-4), **England (-4),** France (-6), Sweden (-6), Belgium (-6), Portugal (-7)
Scored significantly lower in science in PISA 2022 than in PISA 2018	Slovenia (-7), Germany (-11), Finland (-11), Norway (-12), Poland (-12), Netherlands (-15)

Base: All education systems with average scores over 450 in science in PISA 2022 that also participated in PISA 2018.
Change in science score between 2018 and 2022 shown in parenthesis after the education system.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included education systems.

Source: OECD, PISA 2022

Additionally, Table 5.3 reports the changes in science score since PISA 2015, the last PISA study in which science was the major domain. Of the 37 education systems which participated both in 2015 and 2022 and scored above 450 in science in PISA 2022, 7 have shown statistically significant improvements over this period, while 14 education systems, including England, have experienced significant drops. Most of the education systems that have experienced significant drops in performance over this period are OECD countries in Western Europe. In the remaining 16 education systems there were no significant differences in their average science scores in 2015 and 2022.

Table 5.3: Changes in overall average science score between 2015 and 2022 in higher performing education systems

Trend in science performance	Education system and change in score
Scored significantly higher in science in PISA 2022 than in PISA 2015	Turkey (+50), Macao (+15), South Korea (+12), Hungary (+9), Lithuania (+9), Croatia (+7), Singapore (+6)
No statistically significant differences in science scores between PISA 2022 and PISA 2015	Japan (+8), Taiwan (+5), Czech Republic (+5), Latvia (+4), United States (+3), Slovakia (+1), Republic of Ireland (+1), Malta (+1), Sweden (+0), Israel (-2), Poland (-2), Hong Kong (-3), Switzerland (-3), Australia (-3), Italy (-3), Austria (-4)
Scored significantly lower in science in PISA 2022 than in PISA 2015	**OECD trend average (-4)**, France (-8), Denmark (-8), Estonia (-8), New Zealand (-9), **England (-9)**, Slovenia (-13), Canada (-13), Portugal (-17), Belgium (-17), Germany (-17), Norway (-20), Netherlands (-20), Finland (-20), Vietnam (-52)

Base: All education systems with average scores over 450 in science in PISA 2022 that also participated in PISA 2015.
Change in science score between 2015 and 2022 shown in parenthesis after the education system.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included education systems.

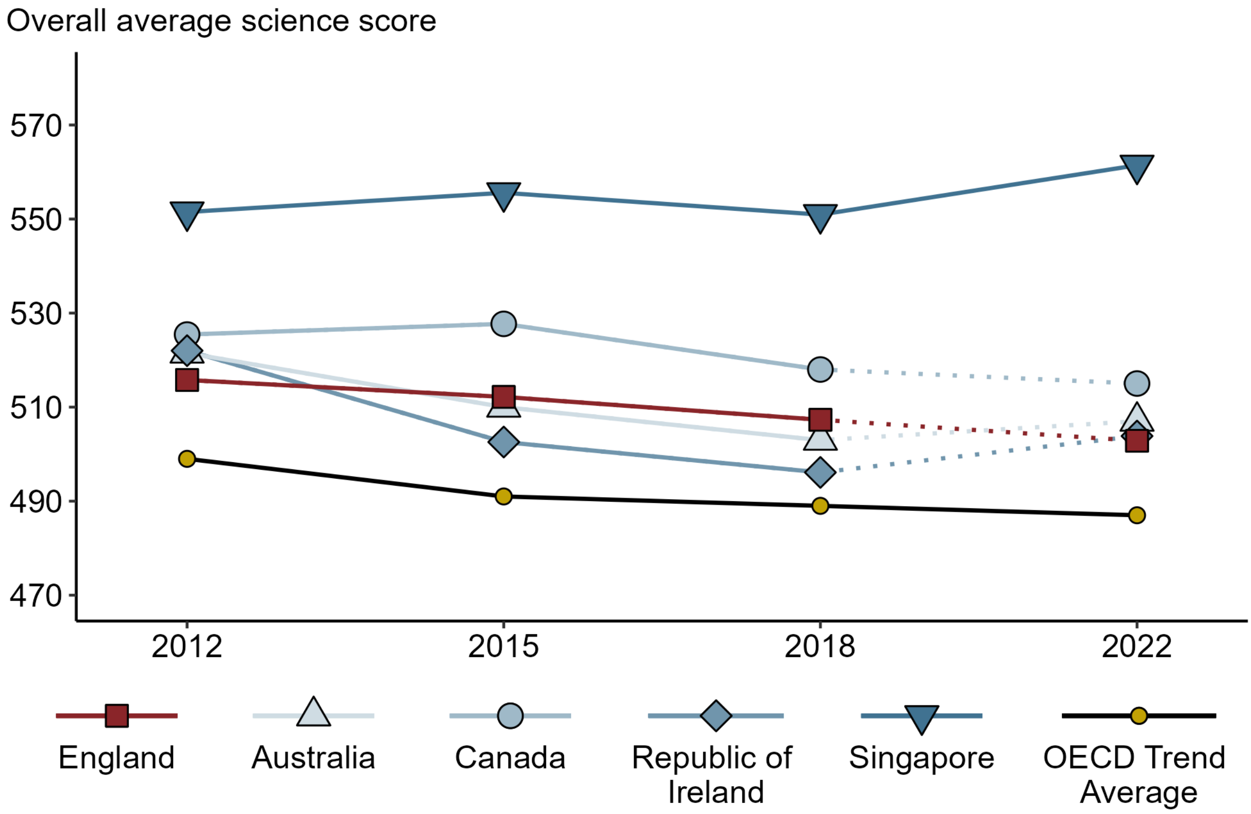
Source: OECD, PISA 2022

Figure 5.1 presents England's overall performance in science over the last 4 cycles of PISA relative to the comparator countries and to the OECD trend average. England's science score of 503 in PISA 2022 is significantly lower than the score in 2015 (512), but not significantly different to the score in 2018 (507). Additionally, England's score of 503 does not significantly differ to the score of 516 achieved in PISA 2012, or the score of 515 achieved in 2009.

The OECD trend average score of 487 in PISA 2022 is significantly lower than the OECD trend average scores in 2015 and 2012. England continues to score significantly above the average science score across the OECD trend countries.

All of the comparator countries have consistently scored above the OECD trend average since 2012. Singapore, the highest scoring country in science in PISA 2022, scored significantly higher than they did in 2015 and 2018, though the change in score from 551 in 2012 to 561 in 2022 is not statistically significant. Canada’s score of 515 in PISA 2022 represents a significant drop from the score of 528 in PISA 2015, though it is not significantly different from PISA 2018, while Australia’s score of 507 is significantly lower than its score in 2012, though again not significantly different to PISA 2015 and PISA 2018. The Republic of Ireland’s science score of 504 represents a statistically significant improvement from the score in PISA 2018, but also remains significantly lower than the score of 522 in PISA 2012.

Figure 5.1: Trends in science performance in England, comparator countries and on average across OECD trend countries



Country	2012	2015	2018	2022
England	516	* 512	507	503
Australia	* 521	510	503	507
Canada	525	* 528	518	515
Republic of Ireland	* 522	503	* 496	504
Singapore	551	* 556	* 551	561
OECD Trend Average	* 499	* 491	489	487

Asterisks (*) indicate that the score shown was significantly different to that country's score for PISA 2022. Trend results between 2018 and 2022 in England, Australia, Canada, and the Republic of Ireland where PISA sampling standards were not all met are indicated with dotted lines in the figure.
OECD trend averages calculated using OECD countries in PISA 2022 excluding Costa Rica, Luxembourg and Spain.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included education systems

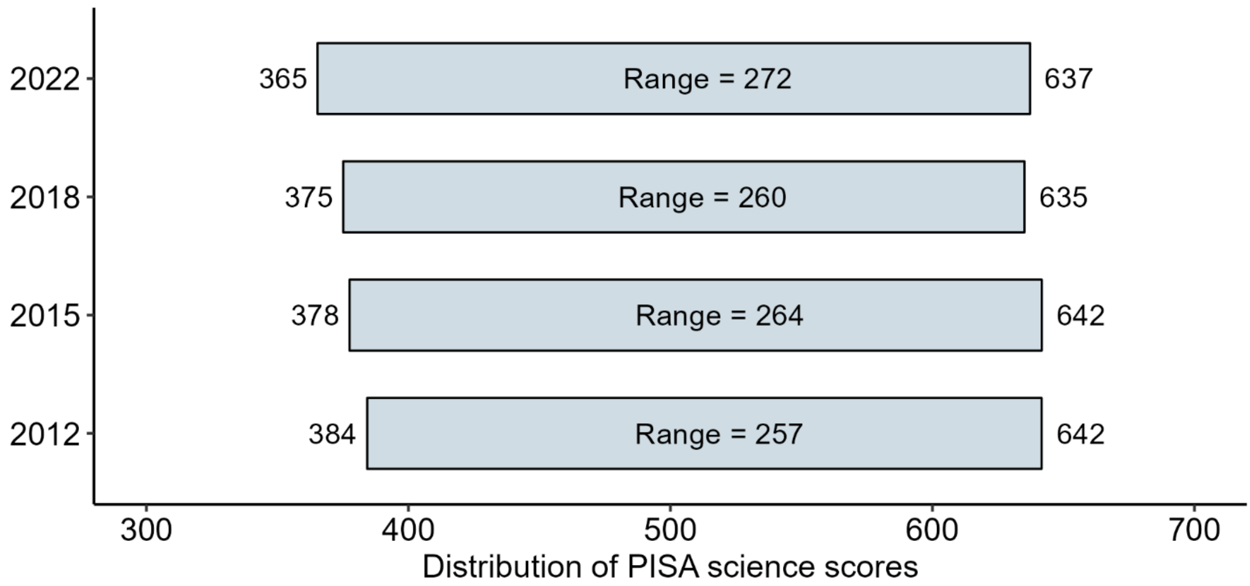
Source: OECD, PISA 2022

5.6 Differences between the highest- and lowest- performing pupils in science

In this section, we look at the range of pupils' achievement in science by discussing England's achievement at the 10th and 90th percentiles. The 90th percentile is the score above which the highest-achieving 10% of pupils obtain, while the 10th percentile is the score below which the lowest-achieving 10% of pupils obtain. The difference between the highest- and lowest-achieving pupils at the 90th and 10th percentiles is a better measure of the spread of scores for comparing countries than using the very highest- and lowest-achieving pupils, as the latter comparison may be affected by a small number of pupils with unusually high or low scores. There needs to be particular caution in interpreting the scores of the highest- and lowest-achieving pupils as the non-response bias analysis suggests that lower-performing pupils may be under-represented in England's sample for PISA 2022.

Figure 5.2 summarises England's scores in science at the 10th and 90th percentiles across the past 4 cycles of PISA, and reports the range between these percentiles (calculated as the 90th percentile score minus the 10th percentile score). In 2022, there was a 272 point range between the 10th and 90th percentile scores in science, which was not significantly different to the ranges in science achievement in England in any of the 3 previous PISA cycles.

Figure 5.2: Distribution of England's PISA science scores across cycles



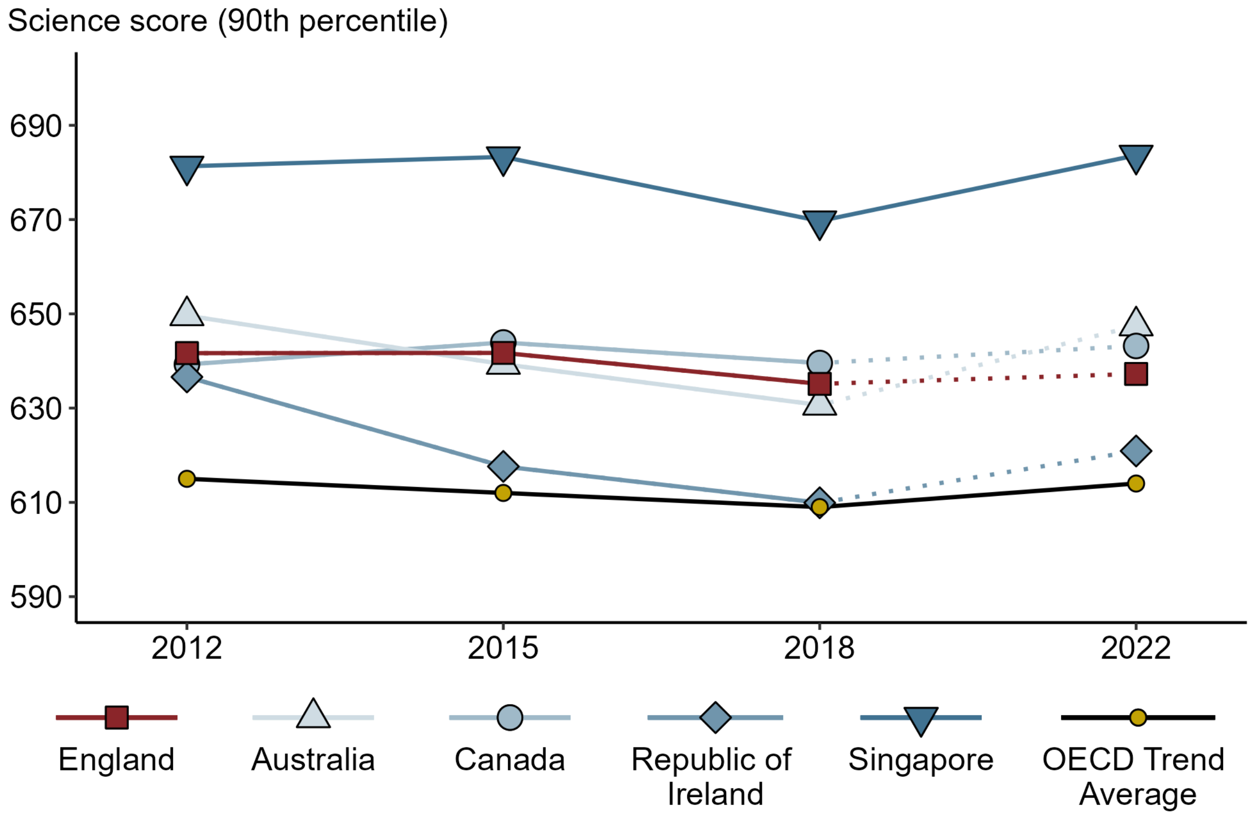
PISA cycle	10th percentile	90th percentile	Range
2022	365	637	272
2018	375	635	260
2015	378	642	264
2012	384	642	257

Ranges calculated as 90th percentile – 10th percentile. Ranges may appear inconsistent with percentile scores due to rounding.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022

Figure 5.3 and Figure 5.4 show the science scores at the 90th and 10th percentiles respectively, in England, in the comparator countries and on average across OECD trend countries.

Figure 5.3: Trends in science scores at the 90th percentile in England, comparator countries and on average across OECD trend countries

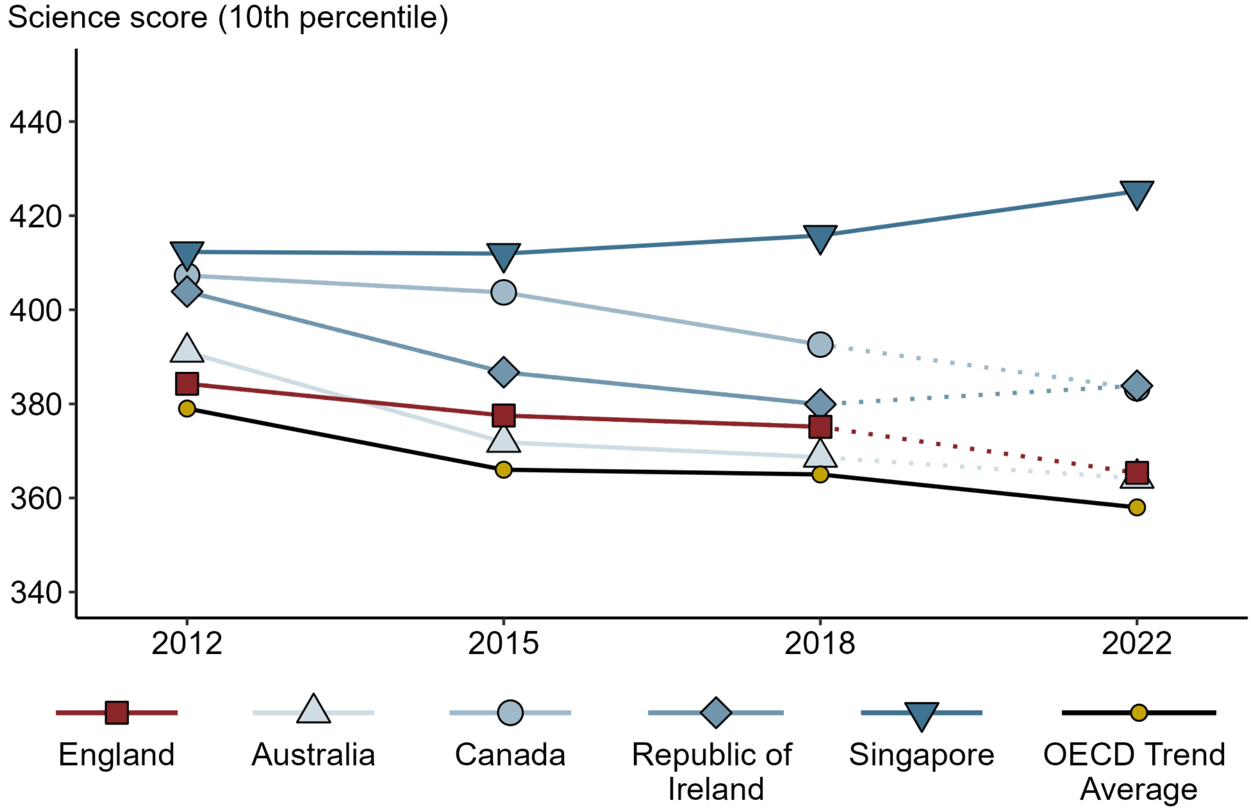


Country	2012	2015	2018	2022
England	642	642	635	637
Australia	650	* 639	* 631	647
Canada	639	644	640	643
Republic of Ireland	* 637	618	* 610	621
Singapore	681	683	* 670	684
OECD Trend Average	615	612	609	614

Asterisks (*) indicate that the score shown was significantly different to that country's score for PISA 2022.
Trend results between 2018 and 2022 in England, Australia, Canada, and the Republic of Ireland where PISA sampling standards were not all met are indicated with dotted lines in the figure.
OECD trend averages calculated using OECD countries in PISA 2022 excluding Costa Rica, Luxembourg and Spain.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included education systems

Source: OECD, PISA 2022

Figure 5.4: Trends in science scores at the 10th percentile for England, comparator countries and on average across OECD trend countries



Country	2012	2015	2018	2022
England	* 384	* 378	375	365
Australia	* 391	* 372	369	364
Canada	* 407	* 404	* 393	383
Republic of Ireland	* 404	387	380	384
Singapore	412	* 412	* 416	425
OECD Trend Average	* 379	* 366	* 365	356

Asterisks (*) indicate that the score shown was significantly different to that country's score for PISA 2022.
Trend results between 2018 and 2022 in England, Australia, Canada, and the Republic of Ireland where PISA sampling standards were not all met are indicated with dotted lines in the figure.
OECD trend averages calculated using OECD countries in PISA 2022 excluding Costa Rica, Luxembourg and Spain.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included education systems

Source: OECD, PISA 2022

While England's score at the 90th percentile in PISA 2022 has not significantly changed since any of the past 3 cycles of PISA, England's score of 365 at the 10th percentile in 2022 is significantly lower than the scores of 384 and 378 in 2012 and 2015 respectively, though not significantly different to the score of 375 in 2018. Additionally, while England's score of 637 at the 90th percentile is significantly above the OECD trend average of 611, England's score at the 10th percentile was not significantly different to the OECD trend average of 356. This marks a change from previous cycles, where England had consistently scored above the OECD trend average at both the 10th and 90th percentiles.

Across the comparators, Australia has witnessed a significant widening in the range between their scores at the 10th and 90th percentiles since 2018, mainly driven by a significant increase in scores at the 90th percentile. This widening range of achievement has also occurred in Canada, though instead has been driven primarily by a significant decrease in the score at the 10th percentile.

The Republic of Ireland has maintained a stable range of science achievement between the 10th and 90th percentiles between 2012 and 2022, with no significant difference in the sizes of these ranges. However, the Republic of Ireland's individual scores at both the 10th and 90th percentiles are significantly lower than their scores at these percentiles in 2012, while significantly higher than in 2018 at the 90th percentile.

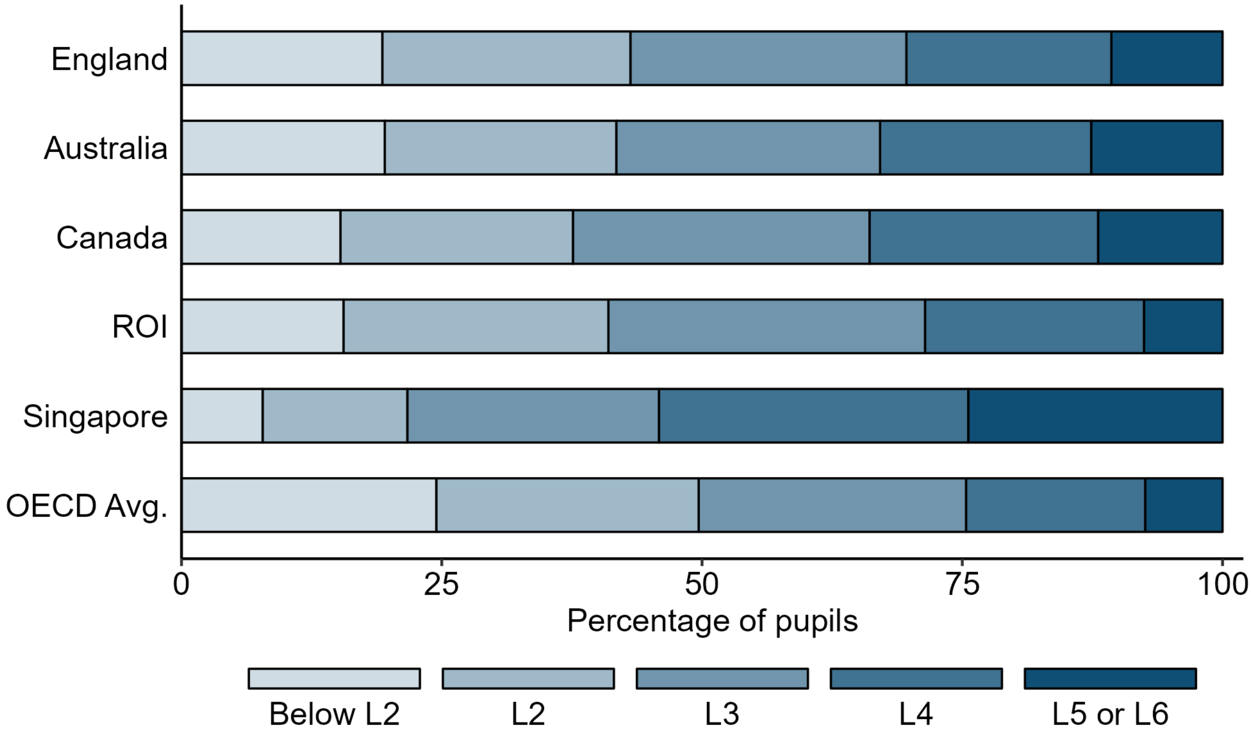
Singapore's strong performance in science in PISA 2022 and significant improvement in their overall average science score from 2018 has been due to significant increases in scores at both the 10th and 90th percentiles, though there has been no significant changes in these scores when comparing performance in 2012 to that of 2022.

5.7 Performance across science proficiency levels

Another way of assessing the spread of performance across an education system is to look at the percentage of pupils performing at each of the PISA proficiency levels. These provide descriptors of how PISA scores in science correspond with pupils' skills, knowledge and proficiencies. The OECD defines low performers in science as those who score below the Level 2 threshold, and top performers as those scoring at or above Level 5. As in the case of mathematics and reading, Level 2 in science is defined as the benchmark at which pupils begin to demonstrate the science skills necessary for full participation in society, and are able to engage in reasoned discourse about science and technology (OECD, 2023a). Pupils performing at Level 5 meanwhile are able to apply their wide skill and knowledge about science to answering a broad range of questions across many different contexts, and evaluate the limitations of different sources of scientific information (OECD, 2023a).

Figure 4.5 provides an overview of the percentage of pupils in England who performed at each of the proficiency levels in science in PISA 2022, compared to the percentage of pupils reaching each proficiency level in comparator countries and on average across OECD countries.

Figure 5.5: Percentage of pupils performing at each science proficiency leven in England, comparator countries and on average across OECD countries



Country	Below L2	L2	L3	L4	L5 or L6
England	19%	24%	27%	20%	11%
Australia	20%	22%	25%	20%	13%
Canada	15%	22%	28%	22%	12%
Republic of Ireland (ROI)	16%	25%	30%	21%	8%
Singapore	8%	14%	24%	30%	24%
OECD Average	24%	25%	26%	17%	7%

Base: All participating pupils.
Percentages may appear inconsistent due to rounding.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included education systems.

Source: OECD, PISA 2022

Approximately 11% of pupils in England scored at or above Level 5 in science. This was significantly larger than the OECD average of 7%. Additionally, England had a significantly smaller percentage of low performers (pupils performing below Level 2) in science than on average across the OECD (19% compared to 24%).

All of the comparator countries had smaller percentages of low performing pupils in science than on average across the OECD. However, the Republic of Ireland did not significantly differ from the OECD average in terms of the percentage of top performing pupils (8% compared to an OECD average of 7%). Singapore had a larger percentage of top-performing pupils in science than ever other participating education system, though a similar percentage of low performing pupils to Macao and Japan.

6 Performance by pupil characteristics

6.1 Chapter overview

In this chapter we explore differences in pupils' PISA scores in mathematics according to specific characteristics: gender, socioeconomic status, immigrant status and ethnic group. Caution needs to be taken in interpreting these findings as some of the sampling standards for PISA 2022 were not met in England as described in Chapter 1.

6.2 Key findings

- In England in mathematics, boys performed significantly higher than girls by 15 score points. This is not significantly different from the difference in performance in mathematics in 2018, 2015 and 2012.On average across OECD countries boys performed significantly higher than girls, by 9 score points. In the majority of higher-performing education systems, boys performed significantly higher than girls in mathematics.
- In reading, girls performed significantly higher than boys, by 16 score points. This pattern was also seen in the OECD average, and in all higher-performing education systems. The gender difference in reading score for England was not significantly different to that of the OECD average, which was 24 score points. England's gender difference in reading in PISA 2022 was not significantly different from the gender difference in 2018, 2015 and 2012.
- In science, the average performance of girls and boys were not significantly different. This was not significantly different from the differences in performance between girls and boys in science in 2018 and 2015, but in 2012 boys performed significantly higher than girls in science.
- England's average score on the OECD's index of economic, social and cultural status (ESCS) was +0.15 indicating that on average, pupils in England had a higher socioeconomic status than the average across OECD countries (0).
- The difference in mathematics and reading performance associated with a one-unit increase in ESCS were significantly smaller in England (36 and 33 score points respectively) than on average across OECD countries (both 39 score points). However, the equivalent figure for science in England (39 score points) was not significantly different from the OECD average (41 score points).
- There was an 85 score point difference in mathematics between the most disadvantaged group of pupils and the least disadvantaged group of pupils in England. In reading this difference was 82 score points and in science it was 92

score points. These were not significantly different to the OECD averages (93, 93 and 96 score points respectively).

- The percentage of the variance in mathematics and science performance in England that could be explained by socioeconomic status was 10%, while in reading it was 8%. On average across OECD countries 15% of the variance in mathematics performance, 13% of the variance in reading performance and 14% of the variance in science performance could be explained by socioeconomic status. A low percentage of the variance in performance being explained by socioeconomic status means that socioeconomic status has less of an influence on performance in PISA.
- Considering the percentage of pupils who succeed academically despite their socioeconomic background, n England 16% of pupils were academically resilient in mathematics and in science and 17% were academically resilient in reading. On average across OECD countries 10% of pupils were academically resilient in mathematics while 11% were academically resilient in reading and science.
- Pupils who spoke a language other than English at home on average scored significantly lower in the mathematics (486), reading (482) and science (487) assessments than pupils who spoke English at home (498, 504 and 511 respectively).

6.3 Introduction

In this chapter we explore differences in pupils' PISA scores in mathematics according to specific characteristics: gender, socioeconomic status, immigrant status, language spoken at home and special educational needs.

We are able to draw somewhat stronger conclusions when comparing across some groups of pupils within England as described in Chapter 1. The non-response bias analysis showed no relationship between the gender of pupils and their likelihood of participating in PISA, for example. We can therefore draw stronger conclusions when comparing the performance of girls and boys within England. However, other pupil characteristics, such as those relating to socioeconomic background or prior attainment, are related to the likelihood of participating in PISA 2022 and consequently caution is needed when interpreting these findings.

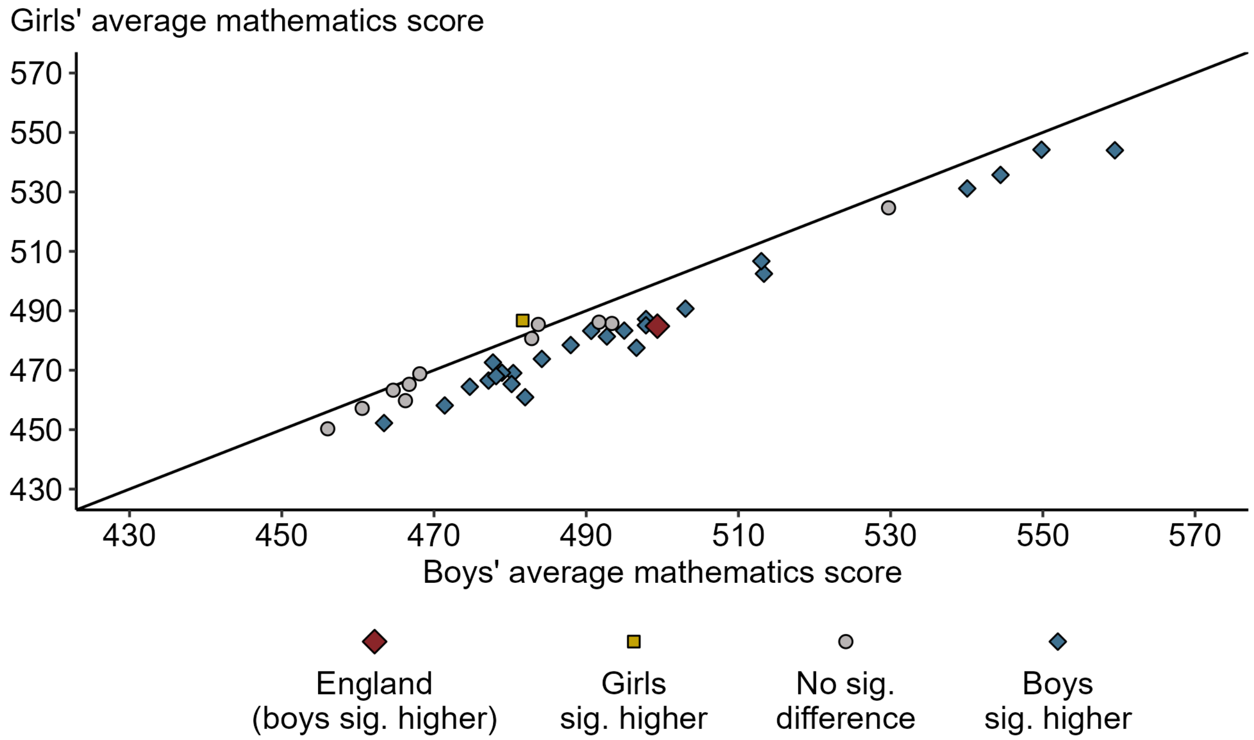
6.4 Gender

6.4.1 Mathematics

Across previous cycles of PISA, on average across OECD countries boys typically outperform girls in mathematics. In England in PISA 2022, boys performed significantly higher than girls by 15 score points (after taking into account the rounding of figures). Boys achieved an average score of 499 while girls achieved an average score of 485. This was not significantly different from 2018, where there was a 20 score point difference, or from the 12 score point gap in 2015 and the 13 score point gap in 2012. Boys in England have consistently achieved higher average mathematics scores than girls since 2006, with a difference of at least 10 score points.

On average across OECD countries, boys performed significantly higher than girls by 9 score points, with an average score of 477 for boys and 468 for girls. In England, both girls and boys perform significantly above the averages across OECD countries for girls and boys. The gap in England between boys' performance in mathematics and girls' performance is statistically significantly larger than on average across OECD countries.

Figure 6.1: Average mathematics scores of girls and boys in higher-performing education systems



Type of gender gap	Education system and gender gap size
Education systems in which girls scored significantly higher than boys in mathematics (represented by yellow squares)	Finland (+5)
Education systems in which boys scored significantly higher than girls in mathematics (represented by blue diamonds)	Italy (-21), Austria (-19), Macao (-15), **England (-15)**, Hungary (-15), United States (-13), Republic of Ireland (-13), Canada (-12), Singapore (-12), Denmark (-11), Germany (-11), Australia (-11), Israel (-11), Switzerland (-11), Netherlands (-11), Vietnam (-10), New Zealand (-10), Spain (-10), France (-10), Latvia (-10), **OECD average (-9),** Japan (-9), Hong Kong (-9), Czech Republic (-7), Estonia (-6), Lithuania (-5)
Education systems without statistically significant gender gaps in mathematics (represented by grey circles)	Belgium (-8), Croatia (-6), Turkey (-6), Taiwan (-6), Poland (-6), South Korea (-5), Iceland (-3), Sweden (-2), Malta (-1), Slovakia (-1), Norway (+1), Slovenia (+2)

Base: All education systems with average scores over 450 in mathematics in PISA 2022.
Gender gaps calculated as girls' mathematics score – boys' mathematics score and reported in parenthesis after the education system.

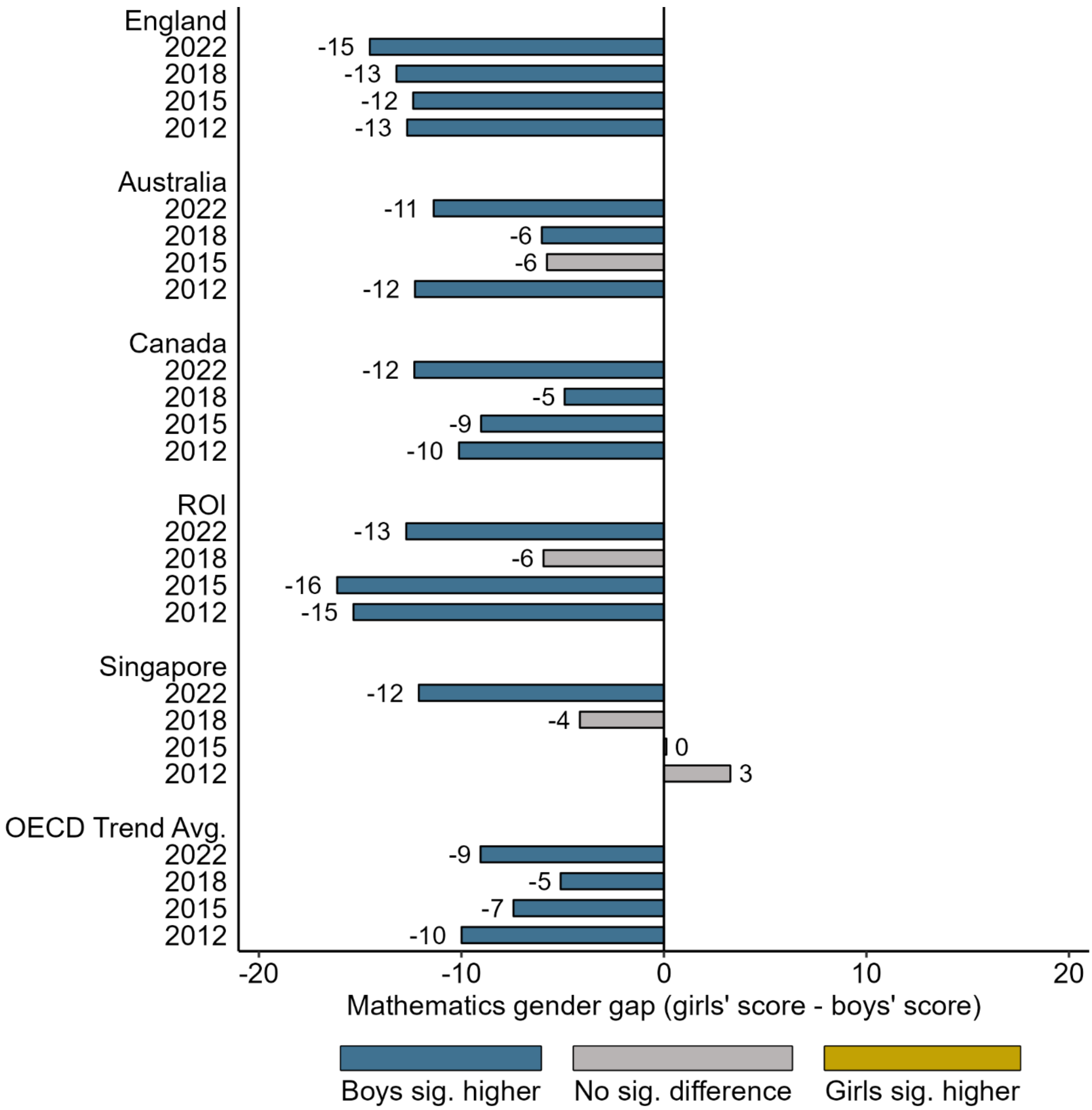
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included education systems.

Source: OECD, PISA 2022

Boys performed significantly higher than girls in the majority (24 out of 37) of higher-performing education systems (those with average mathematics scores over 450 score points) as shown in Figure 6.1. The diagonal line on the figure shows the point where girls and boys scores were not significantly different. Education systems in which girls scored significantly higher than boys in mathematics are shown in yellow above the line, while systems where boys scored significantly higher than girls are shown in blue below the line. Girls scored significantly higher than boys in just 1 of the higher-performing education systems, Finland. In 12 higher-performing education systems there were no significant differences between the average score in mathematics for girls and boys.

As Figure 6.2 shows, the gender gap in England has been relatively stable since 2012 and has also been consistently larger than the OECD average gap. The gender gap in Australia, Canada, and the Republic of Ireland has also been relatively stable, but in Singapore there is a gender gap favouring boys for the first time in PISA 2022.

Figure 6.2: Gender differences in mathematics scores in England, comparator countries and on average across OECD trend countries



Country	2012	2015	2018	2022
England	* -13	* -12	* -13	* -15
Australia	* -12	-6	* -6	* -11
Canada	* -10	* -9	* -5	* -12
Republic of Ireland (ROI)	* -15	* -16	-6	* -13
Singapore	3	0	-4	* -12
OECD Trend Average	* -10	* -7	* -5	* -9

Gender gaps calculated as girls' mathematics score – boys' mathematics score.
OECD trend averages calculated using OECD countries in PISA 2022 excluding Costa Rica, Luxembourg

and Spain.
Asterisks (*) in the table indicate that the gender gap shown represents a statistically significant difference in that year.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included education systems.

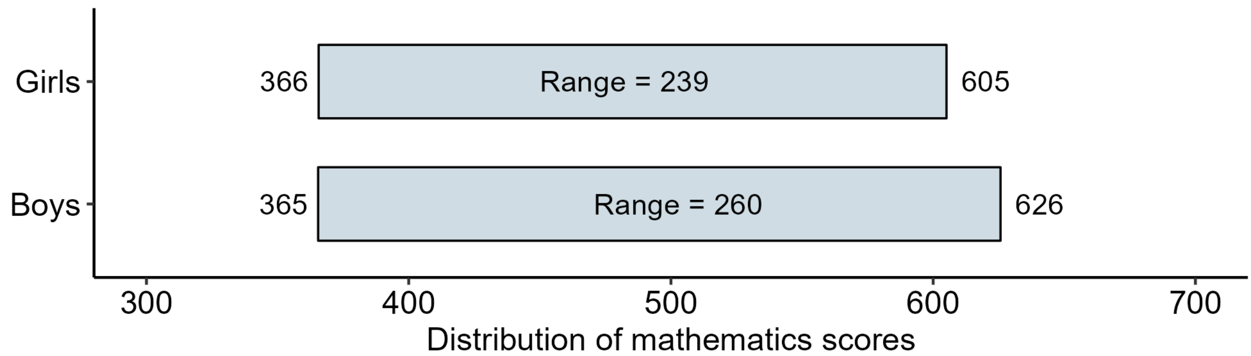
Source: OECD, PISA 2022

6.4.2 Gender differences among the highest- and lowest-performing pupils

There are two ways to look at the differences between the highest- and lowest-performing pupils. One way is to look at the score for the 90th percentile, which is the score above which the highest 10% of pupils within England perform, and the score at the 10th percentile, which is the score below which the lowest 10% of pupils within England perform. Another way is to look at performance at the PISA proficiency levels, specifically the percentage of pupils in England performing at the highest levels, Levels 5 and 6, and the percentage of pupils performing below the baseline threshold of Level 2. In this section, we consider both of these in relation to the differences between girls' and boys' performance.

The gender gap was largest at the 90th percentile with a difference of 21 score points. The score at the 90th percentile for girls was 605 compared to a score of 626 for boys. This is not significantly different from the average across OECD countries where there was a 22 score point difference (after rounding) between boys (600) and girls (579) at the 90th percentile. In England, the score at the 10th percentile for girls (366) was not significantly different from the score at the 10th percentile for boys (365). This is a difference of less than 1 score point. The gender gap in England was also not significantly different from the average gender gap of 4 score points across OECD countries at the 10th percentile where the score for girls was 357 and the score for boys was 353. The distribution of girls' and boys' performance in mathematics in England is shown in Figure 6.3.

Figure 6.3 Performance of girls and boys in England at the 90th and 10th percentiles in mathematics



Gender	10th percentile	90th percentile	Difference
Girls	366	605	239
Boys	365	626	260

Base: All participating pupils.
Some results may appear inconsistent due to rounding.
Difference calculated as score at the 90th percentile – score at the 10th percentile
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022

At the 90th percentile, the gender gap in Singapore was 21 score points, in the Republic of Ireland and Canada it was 25 score points, and in Australia it was 26 score points. At the 10% percentile, the gender gap was 5 score points in Singapore, Canada and Australia, and in the Republic of Ireland it was 2 score points.

At the highest proficiency levels (Levels 5 & 6), there was no significant difference between the percentage of boys (14%) and the percentage of girls (10%) performing at these levels. These percentages are not significantly different to the average across OECD countries of 7% of girls and 11% of boys. There was also no significant difference between the percentage of boys (22%) and the percentage of girls (24%) performing below the baseline proficiency level (Level 2). The percentage of girls performing below the baseline proficiency level in England (24%) was significantly smaller than the percentage on average across OECD countries (32%). Similarly, the percentage of boys performing below the baseline proficiency level in England (22%) was significantly smaller than the percentage on average across OECD countries (31%).

In Singapore, the percentage of girls achieving the highest proficiency levels was 37%, in Australia and Canada it was 10%, and in the Republic of Ireland it was 5%. In all of these comparator countries the percentage of girls was significantly smaller than the percentage of boys achieving the highest proficiency levels. In Singapore, 44% of boys achieved these highest levels, with 15% of boys in Australia and in Canada, and 10% of boys in the Republic of Ireland.

6.4.3 Mathematics Subdomains

Boys had a higher average score than girls across all of the process and content subscales, as shown in Table 6.1. The difference between the average score for boys and the average score for girls was statistically significant, favouring boys, except for on the interpreting subscale where there were no significant differences in the performance of girls and boys in England.

Table 6.1: Average mathematics subscale scores of girls and boys in England

Scale	Average score girls	Average score boys	Score difference
Mathematics overall	485	499	* -15
Change and relationships	484	498	* -13
Quantity	482	499	* -17
Space and shape	471	489	* -18
Uncertainty and data	496	509	* -13
Formulating	479	497	* -18
Employing	482	502	* -20
Interpreting	491	498	-7
Mathematical reasoning	485	502	* -17

Base: All participating pupils
Score difference calculated as the average score for girls – average score for boys
Some results may appear inconsistent due to rounding.
Asterisks (*) in the table indicate that the gender gap shown represents a statistically significant difference

Source: OECD PISA 2022

On average across OECD countries there was a significant difference between the performance of girls and the performance of boys in each of the subdomains. For the content subdomains, the gender gaps were 12 score points in space and shape, 11 score points in quantity, 8 score points in change and relationships and 7 score points in uncertainty and data. For the process subdomains, the gender gaps were 15 score points in formulating, 10 score points in employing, 9 score points in mathematical reasoning and 5 score points in interpreting.

Table 6.2: Average mathematics scores of girls and boys on average across OECD countries

Scale	Average score girls	Average score boys	Score difference
Mathematics overall	468	477	* -9
Change and relationships	466	474	* -8
Quantity	467	478	* -11
Space and shape	464	477	* -12
Uncertainty and data	470	477	* -7
Formulating	461	476	* -15
Employing	467	477	* -10
Interpreting	472	477	* -5
Mathematical reasoning	468	477	* -9

Base: All participating pupils
Score difference calculated as the average score for girls – average score for boys
Some results may appear inconsistent due to rounding.
Asterisks (*) in the table indicate that the gender gap shown represents a statistically significant difference

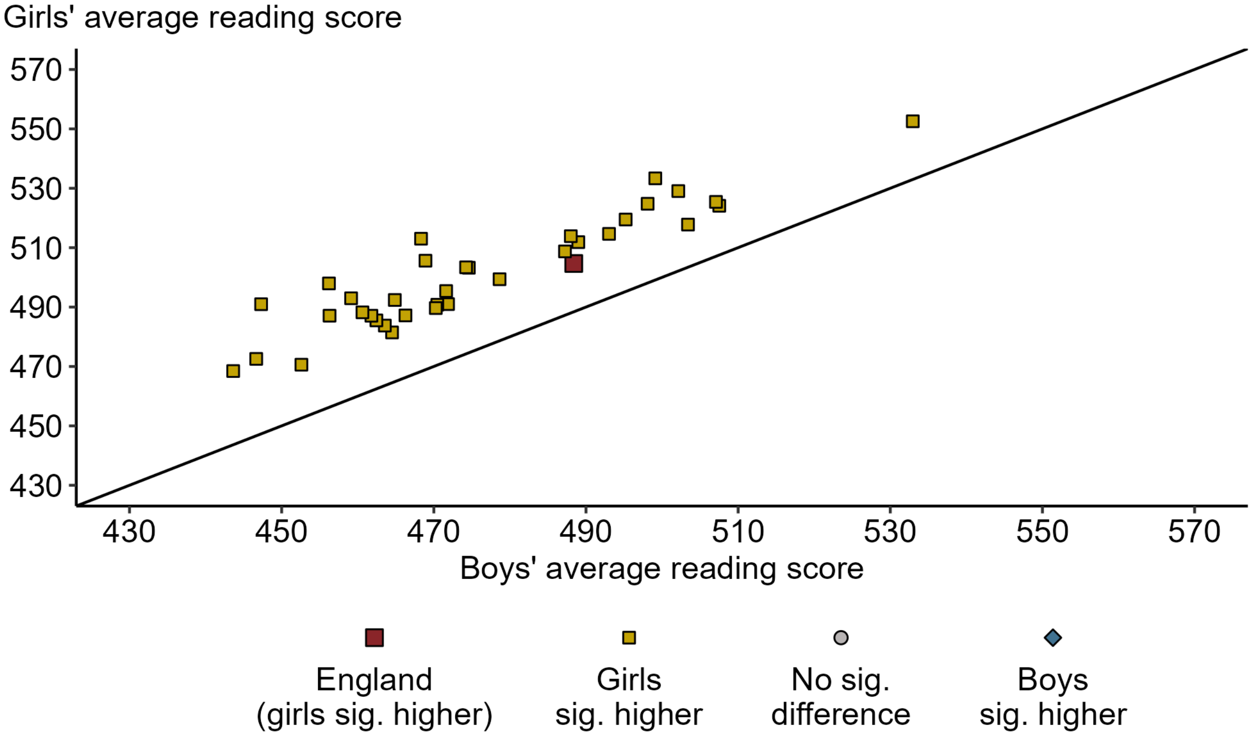
Source: OECD PISA 2022

6.4.4 Reading

In PISA 2022, girls in England had an average score for reading of 505, compared to an average score of 488 for boys. This 16 score point difference (after taking into account the rounding of figures) represents a statistically significant difference in performance. Looking at the OECD average, girls (488) also scored significantly higher than boys (464), with a difference of 24 score points. The gender difference in reading score for England is not significantly different to that of the OECD average.

Figure 6.4 shows the reading performance of girls and boys in every participating education system with an average reading score above 450 in PISA 2022. The diagonal line on the figure shows the point where girls and boys scored equally well. Education systems in which girls scored significantly higher than boys in reading are shown in yellow above the line, and there were no higher-performing education systems where there was no significant difference between the performance of girls and boys, or where boys performed significantly higher than girls. Out of 80 education systems that participated in PISA 2022 for reading including England, in 77 education systems girls scored significantly higher than boys. There were no systems in which boys scored significantly higher than girls.

Figure 6.4: Reading performance of girls and boys in higher-performing education systems



Type of gender gap	Education system and gender gap size
Education systems in which girls scored significantly higher than boys in reading – represented by yellow squares	Finland (+45), Slovenia (+44), Norway (+42), Sweden (+37), South Korea (+34), Croatia (+34), Lithuania (+31), Czech Republic (+29), Poland (+29), Latvia (+28), Belgium (+28), Taiwan (+27), Estonia (+27), Netherlands (+26), New Zealand (+26), Spain (+25), Turkey (+25), Canada (+24), **OECD average (+24),** Switzerland (+24), Israel (+23), Hong Kong (+23), United States (+22), Australia (+22), Portugal (+21), Denmark (+21), Austria (+20), France (+20), Singapore (+20), Germany (+19), Italy (+19), Republic of Ireland (+18), Hungary (+17), Japan (+17), England (+16), Macao (+14)
Education systems without significantly significant gender gaps in reading – represented by grey circles	No higher-performing education systems
Education systems in which boys scored significantly higher than girls in reading	No higher-performing education systems

Base: All education systems with mean scores over 450 in reading in PISA 2022.
Gender gaps calculated as girls' reading score – boys' reading score and reported in parenthesis after the education system.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included education systems.

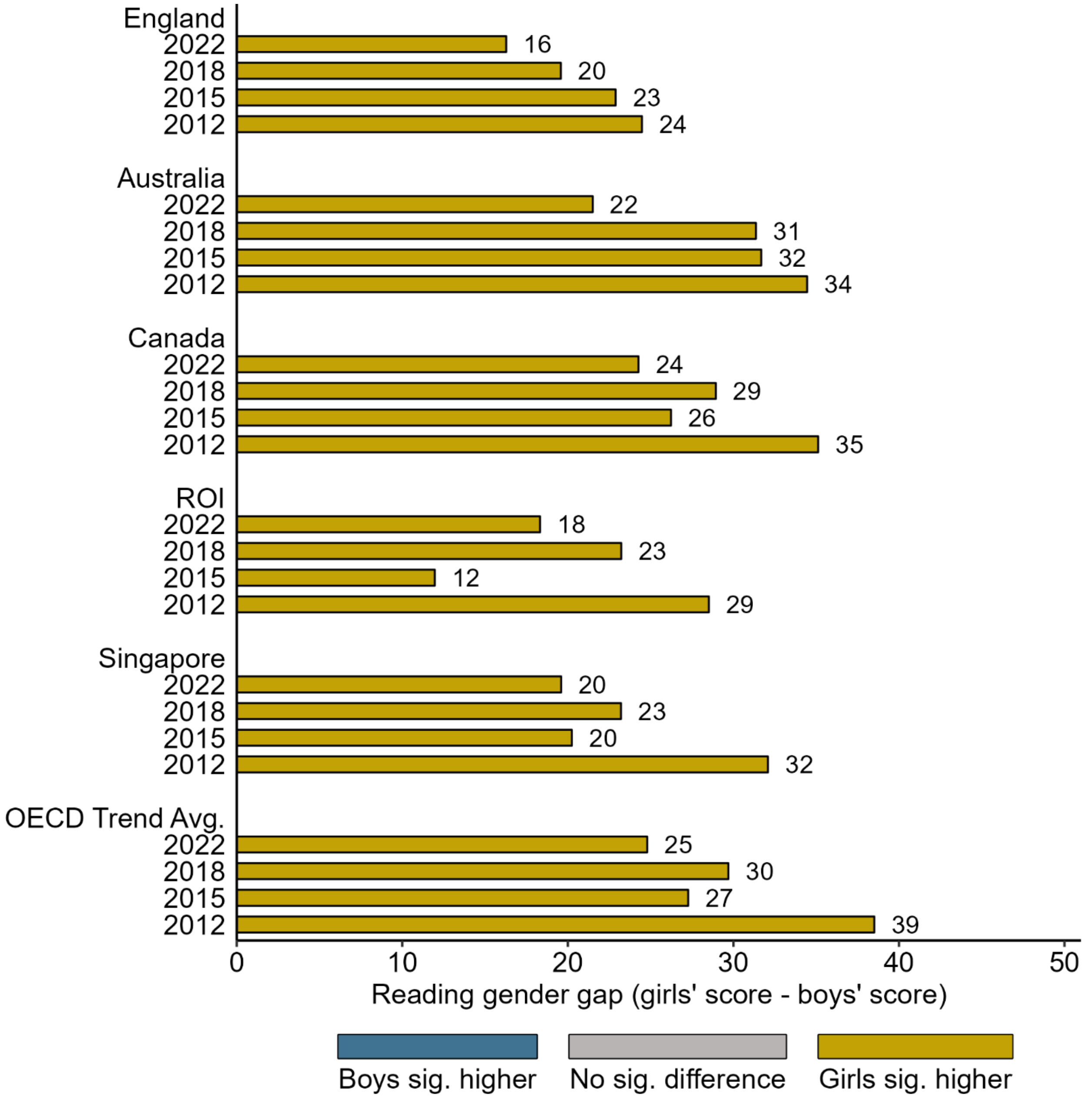
Source: OECD, PISA 2022

Figure 6.5 shows the trends in the gender gaps of England and the comparator countries since the 2012 cycle of PISA. The gender difference in reading score for England in PISA 2022 (+16) was not significantly different to the gender difference in 2018 (+20), 2015 (+23) and 2012 (+24). Likewise, the gender difference in OECD's reading scores in PISA 2022 (+25) was not significantly different to the difference in 2018 (+30), 2015 (+27) and 2012 (+39).

England's gender difference in reading score in PISA 2022 was not significantly different to that of Australia (+22), Canada (+24), the Republic of Ireland (+18) and Singapore

(+20). Among the comparator countries, the gender differences in reading scores were lower in PISA 2022 than in 2018 and 2012, but the decreases were not statistically significant, except that Australia’s gender difference in reading scores was significantly lower in PISA 2022 than in 2018 (+31), 2015 (+32) and 2012 (+34).

Figure 6.5: Trends in gender gaps in reading performance in England, comparator countries and on average across OECD trend countries



Country	2012	2015	2018	2022
England	*24	*23	*20	*16
Australia	*34	*32	*31	*22
Canada	*35	*26	*29	*24
Republic of Ireland (ROI)	*29	*12	*23	*18
Singapore	*32	*20	*23	*20
OECD Trend Average	*39	*27	*30	*25

Gender gaps calculated as girls' reading score – boys' reading score.
Asterisks (*) in the table indicate that the gender gap shown represents a statistically significant difference.

OECD trend averages calculated using OECD countries in PISA 2022 excluding Costa Rica, Luxembourg and Spain
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included education systems.

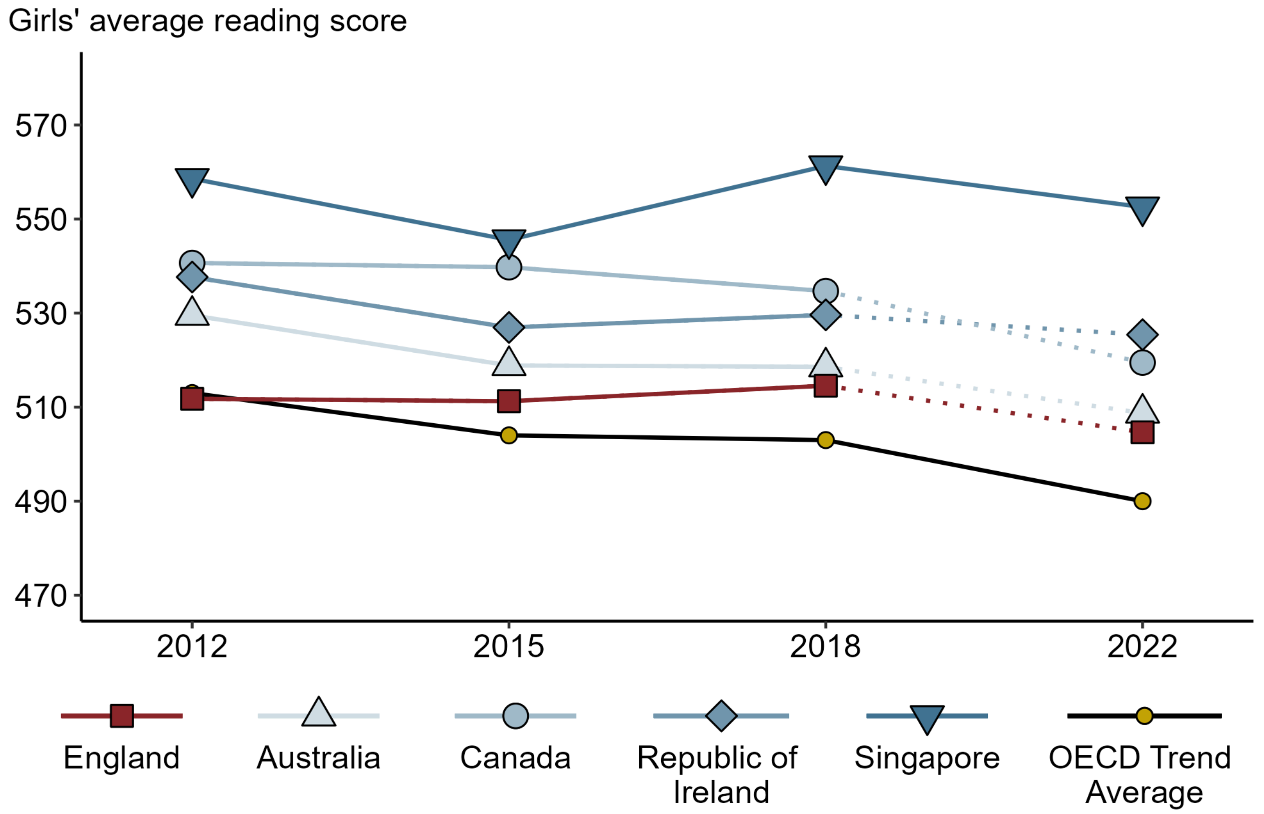
Source: OECD, PISA 2022

The trends in the gender gaps in England and the comparator countries since the 2012 cycle of PISA are further contextualised by Figure 6.6 and Figure 6.7. The two figures focus on the trends in the reading scores of girls and boys respectively. In England, girls and boys showed little difference in reading performance since 2012. There were no significant differences between the boys' average reading score in 2022 (488) and 2018 (495), 2015 (488), or 2012 (487). Similarly, there were no significant differences between the girls' average reading score in 2022 (505) and 2018 (515), 2015 (511) or 2012 (512).

On average across the OECD countries, girls and boys showed a downward trend in reading performance since 2012 and 2015 respectively. The OECD average for girls was significantly lower in PISA 2022 (490) than in 2018 (504), 2015 (504) and 2012 (513), and boys' reading score in PISA 2022 (465) was significantly lower than that in 2018 (473), 2015 (477) and 2012 (474).

The comparator countries showed different trends in reading performance between girls and boys since 2012. In Australia, girls showed a downward trend from 2012 whereas boys showed little difference in reading performance. Girls scored significantly lower in PISA 2022 (509) than in 2018 (519), 2015 (519) and 2012 (530). On the other hand, boys' reading score in PISA 2022 (487) is not significantly different to that in the three previous PISA cycles. In Canada, both girls and boys showed a downward trend in reading performance from 2015. Girls scored significantly lower in PISA 2022 (519) than in the three previous PISA cycles, whereas boys scored significantly lower in PISA 2022 (495) than in 2018 (506) and 2015 (514) but not significantly different to 2012 (506). In Singapore, girls scored significantly lower in PISA 2022 (553) than in 2018 (561), but the score in PISA 2022 is not significantly different to the score in 2015 (546) and 2012 (559). Boys' reading score in Singapore in PISA 2022 (533) is not significantly different to that in the previous three PISA cycles. In the Republic of Ireland, the reading scores of girls and boys in PISA 2022 are not significantly different to those in the three previous PISA cycles, respectively.

Figure 6.6: Trends in girls' reading performance in England, comparator countries and on average across OECD trend countries

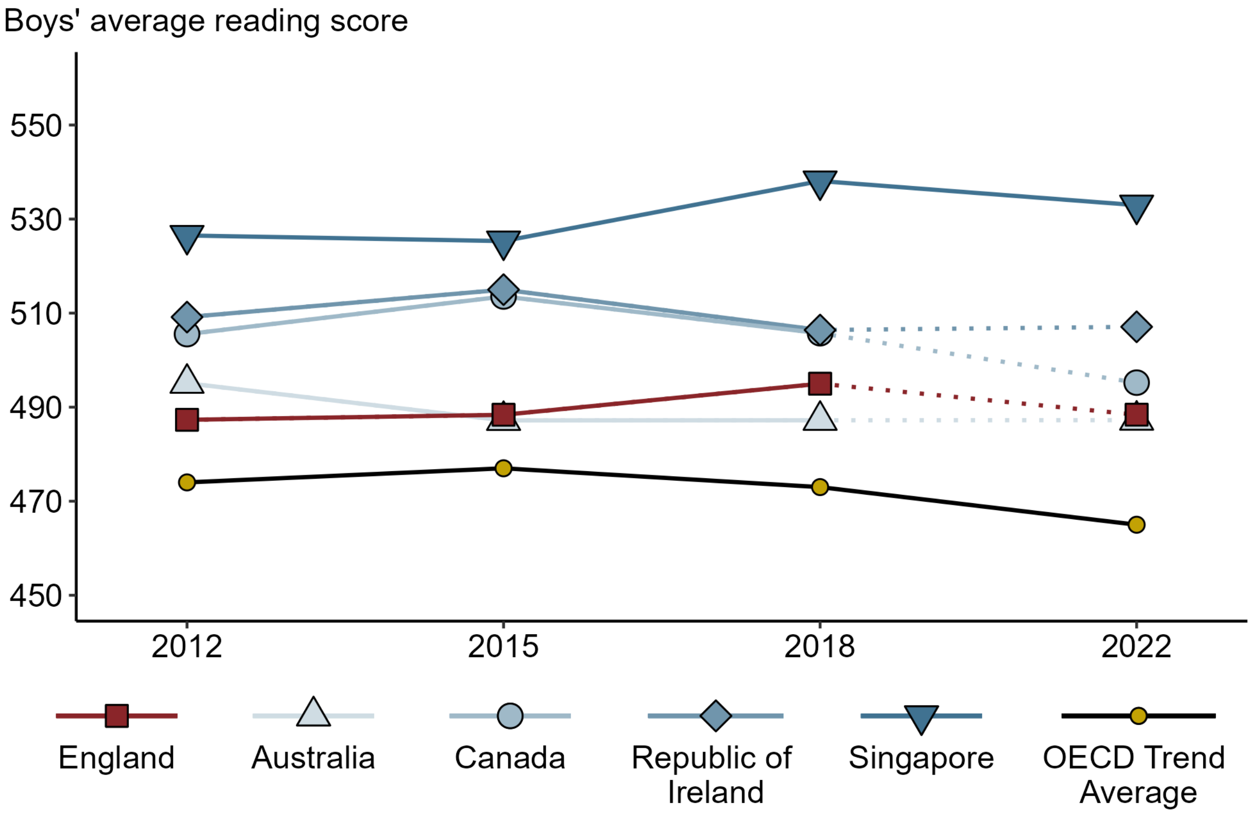


Country	2012	2015	2018	2022
England	512	511	515	505
Australia	*530	*519	*519	509
Canada	*541	*540	*535	519
Republic of Ireland	538	527	530	525
Singapore	559	546	*561	553
OECD Trend Average	*513	*504	*503	490

Base: All participating pupils in the included education systems.
Asterisks (*) indicate that the score shown is significantly different to that system's score for PISA 2022.
Trend results between 2018 and 2022 in England, Australia, Canada, and the Republic of Ireland where PISA sampling standards were not all met indicated with dotted lines in the figure.
OECD trend averages calculated using OECD countries in PISA 2022 excluding Costa Rica, Luxembourg and Spain.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included education systems.

Source: OECD, PISA 2022

Figure 6.7: Trends in boys' reading performance in England, comparator countries and on average across OECD trend countries



Country	2012	2015	2018	2022
England	487	488	495	488
Australia	495	487	487	487
Canada	506	*514	*506	495
Republic of Ireland	509	515	506	507
Singapore	527	525	538	533
OECD Trend Average	*474	*477	*473	465

Base: All participating pupils in the included education systems
Asterisks (*) indicate that the score shown is significantly different to that system's score for PISA 2022.
Trend results between 2018 and 2022 in England, Australia, Canada, and the Republic of Ireland where PISA sampling standards were not all met indicated with dotted lines in the figure.
OECD trend averages calculated using OECD countries in PISA 2022 excluding Costa Rica, Luxembourg and Spain.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included education systems.

Source: OECD, PISA 2022

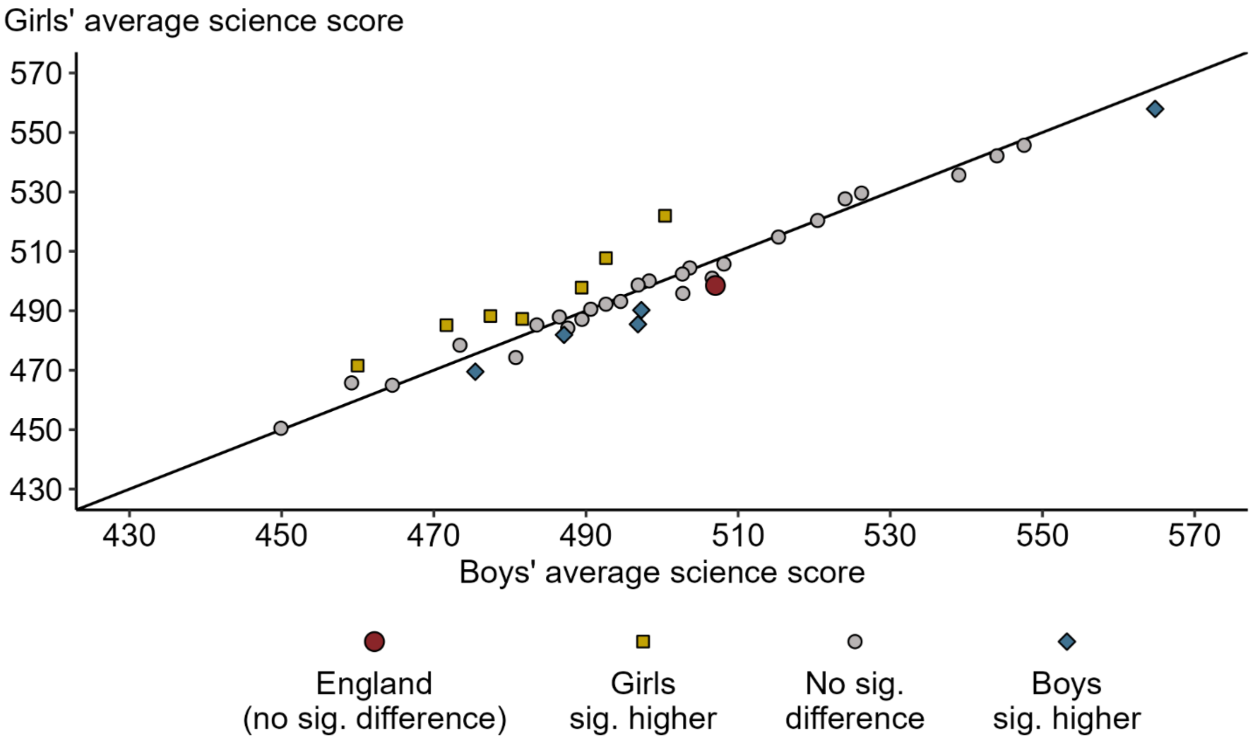
6.4.5 Science

Across previous cycles of PISA, the overarching findings across OECD countries are that girls typically outperform boys in PISA reading, while boys outperform girls in PISA mathematics. The findings relating to science have not been as consistent; in PISA 2018, there was a small, but statistically significant advantage of around 2 points favouring girls in PISA science. This contrasted with the results of the 2015 cycle, where boys in OECD trend countries scored around 3 points higher on average than girls did. In England, boys significantly outperformed girls in science in PISA 2012, but since then, the differences in performance in science have been relatively small and do not represent statistically significant differences in girls’ and boys’ performance.

In PISA 2022, girls in England had an average science score of 499, compared to an average of 507 for boys. This 7 score point difference (after rounding) does not represent a statistically significant difference in performance. On average across OECD countries, there was also no significant difference in the performances of girls (485) and boys (485) in science.

Figure 6.8 shows the science performance of girls and boys in every participating education system with overall science scores greater than 450. The diagonal line on the figure shows the point where girls and boys score equally well. Education systems in which girls scored significantly higher than boys in science are shown in yellow above the line, while systems where boys scored significantly higher than girls are shown in blue below the line. In total, there were 7 systems with overall scores above 450 where girls scored significantly higher than boys, and 4 systems where boys scored significantly higher than girls. Finland, Slovenia and Norway were the education systems in which girls most outperformed boys in science, while Austria and the highest-performing country in science in PISA 2022, Singapore, were the systems with the strongest relative performance of boys. Larger gender gaps, in either direction, tended to be more common in lower-performing systems (not shown in the figure).

Figure 6.8: Average science scores of girls and boys across higher-performing education systems



Type of gender gap	Education system and gender gap size
Education systems in which girls scored significantly higher than boys in science – represented by yellow squares	Finland (+22), Slovenia (+15), Norway (+13), Malta (+12), Croatia (+11), Sweden (+8), Lithuania (+6)
Education systems in which boys scored significantly higher than girls in science – represented by blue diamonds	Austria (-11), Denmark (-7), Singapore (-7), Vietnam (-6), Spain (-5)
Education systems without statistically significant gender gaps in science – represented by grey circles	United States (-7), Italy (-7), England (-7), Republic of Ireland (-6), Hungary (-3), Taiwan (-3), Australia (-2), Netherlands (-2), Japan (-2), Macao (-2), Latvia (-1), Canada (-1), Germany (0), Switzerland (0), Belgium (0), Hong Kong (0), OECD average (0), Israel (0), Ukrainian regions (+1), New Zealand (+1), France (+1), Portugal (+2), Poland (+2), Czech Republic (+2), South Korea (+3), Estonia (+4), Turkey (+5), Slovakia (+7)

Base: All education systems with average scores over 450 in science in PISA 2022.
Gender gaps calculated as girls' science score – boys' science score and reported in parenthesis after the education system.

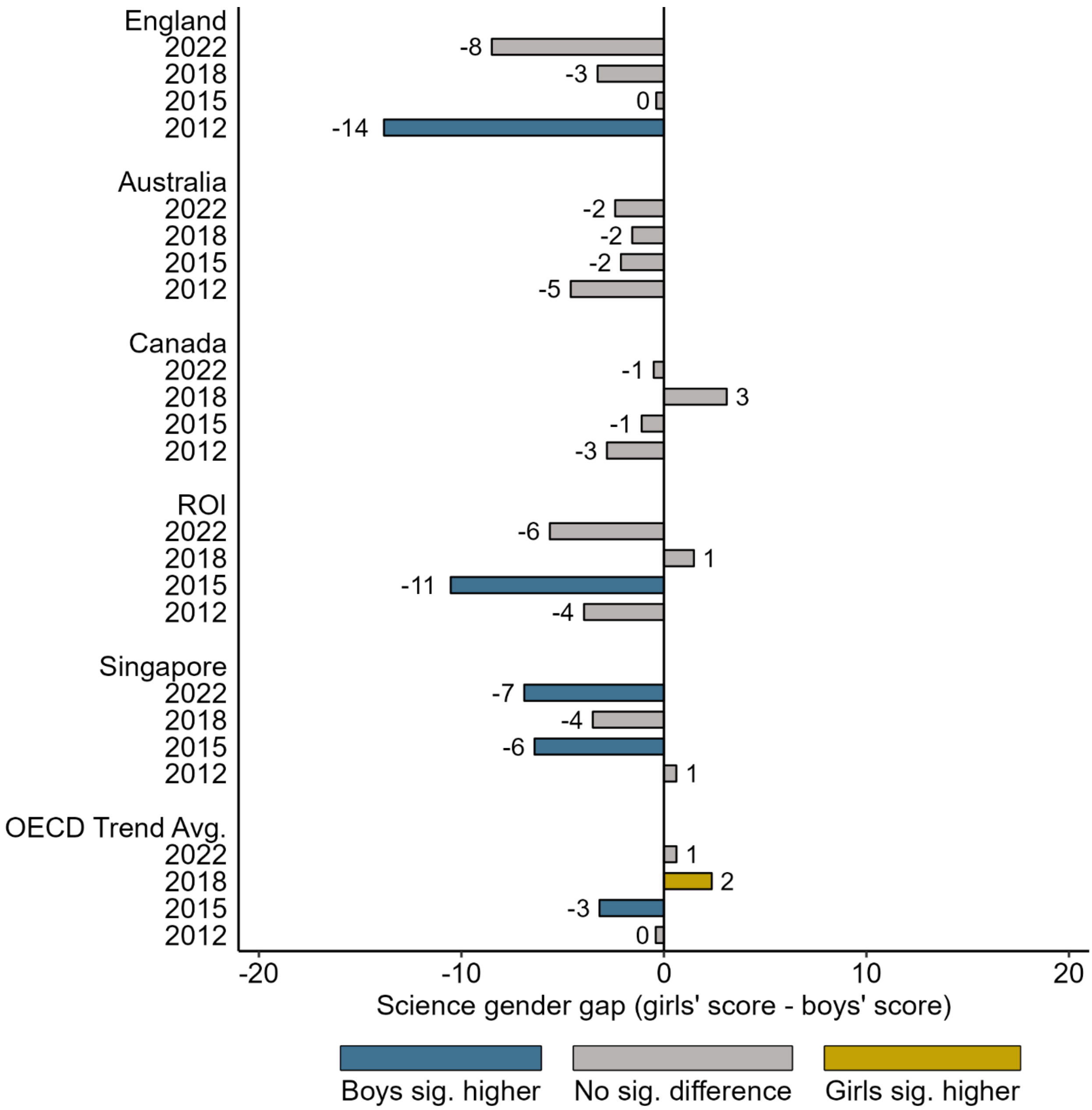
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included education systems.

Source: OECD, PISA 2022

Figure 6.9 shows the trends in the gender gaps of England and the comparator countries since the 2012 cycle of PISA. These are further contextualised by Figure 6.10 and Figure 6.11, which focus on the trends in the average science scores of girls and boys respectively.

The gender gaps in Australia and Canada have not been statistically significant across all PISA cycles since 2012. The gender gap in the Republic of Ireland has also not been statistically significant except in 2015. Singapore is the only comparator country where the gender gap was statistically significant in PISA 2022.

Figure 6.9: Trends in gender gaps in science performance in England, comparator countries and on average across OECD trend countries



Country	2012	2015	2018	2022
England	* -14	0	-3	-7
Australia	-5	-2	-2	-2
Canada	-3	-1	3	1
Republic of Ireland (ROI)	-4	* -11	1	-6
Singapore	1	* -6	-4	* -7
OECD Trend Average	0	* -3	* 2	1

Base: All participating pupils in the included education systems
Gender gaps calculated as girls' science score – boys' science score.

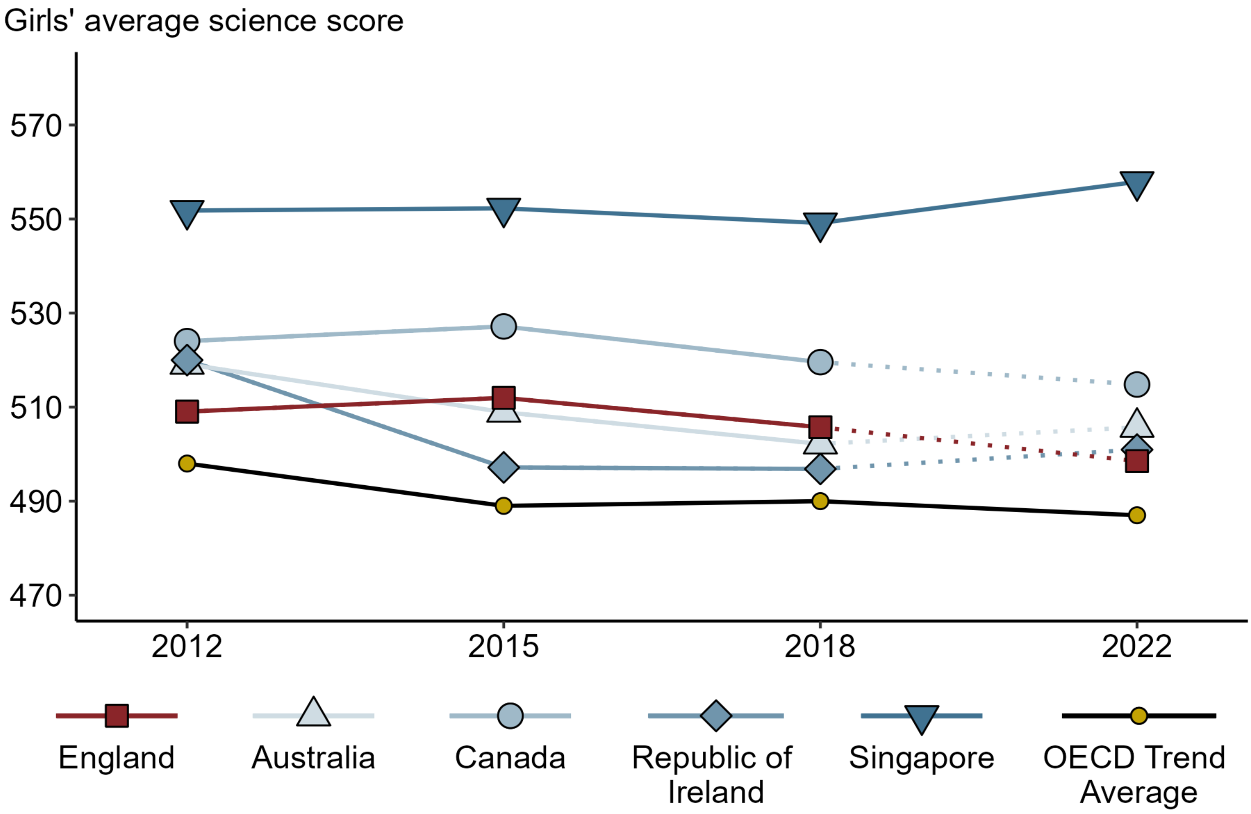
Asterisks (*) in the table indicate that the gender gap shown represents a statistically significant difference.
OECD trend averages calculated using OECD countries in PISA 2022 excluding Costa Rica, Luxembourg and Spain.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included education systems.

Source: OECD, PISA 2022

In England, the performance of boys has been relatively stable since 2015 as shown in Figure 6.11, dropping by 5 points over this period. This compares to a 13 point drop in the scores of girls over the same period, shown in Figure 6.10. Together these show that the widening gap between girls' and boys' science performance since 2015 in England has been driven by larger drops in girls' performance than the drop in boys' performance.

Across the comparator countries, the changes in the performance of girls in Australia, Canada and the Republic of Ireland between 2018 and 2022 were not statistically significant. In Singapore there was a significant increase in the girls' average science score between 2018 and 2022 but there were no significant differences between the average score in 2022 and the scores in 2015 and 2012.

Figure 6.10: Trends in girls' science performance in England, comparator countries and on average across OECD trend countries

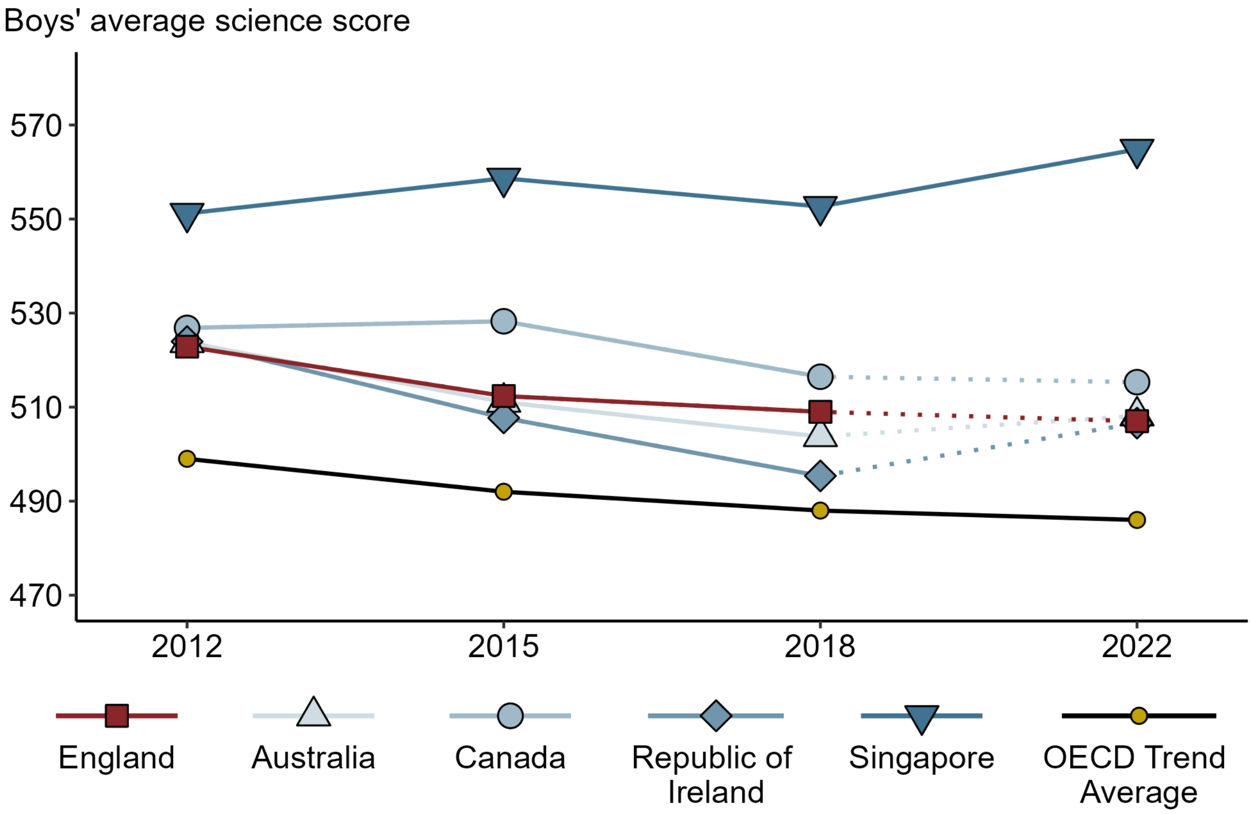


Country	2012	2015	2018	2022
England	509	512	506	499
Australia	* 519	509	502	506
Canada	524	* 527	520	515
Republic of Ireland	* 520	497	497	501
Singapore	552	552	* 549	558
OECD Trend Average	* 498	489	490	487

Base: All participating pupils in the included education systems
Asterisks (*) indicate that the score shown is significantly different to that system's score for PISA 2022.
Trend results between 2018 and 2022 in England, Australia, Canada, and the Republic of Ireland where PISA sampling standards were not all met indicated with dotted lines in the figure.
OECD trend averages calculated using OECD countries in PISA 2022 excluding Costa Rica, Luxembourg and Spain.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included education systems.

Source: OECD, PISA 2022

Figure 6.11: Trends in boys' science performance in England, comparator countries and on average across OECD trend countries



Country	2012	2015	2018	2022
England	523	512	509	507
Australia	* 524	511	504	508
Canada	527	* 528	516	515
Republic of Ireland	* 524	508	* 495	507
Singapore	* 551	* 559	* 553	565
OECD Trend Average	* 499	* 492	488	486

Base: All participating pupils in the included education systems
Asterisks (*) indicate that the score shown is significantly different to that system's score for PISA 2022.
Trend results between 2018 and 2022 in England, Australia, Canada, and the Republic of Ireland where PISA sampling standards were not all met indicated with dotted lines in the figure.
OECD trend averages calculated using OECD countries in PISA 2022 excluding Costa Rica, Luxembourg and Spain.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included education systems.

Source: OECD's PISA 2022

6.5 Socioeconomic background

This section reports on how mathematics, reading and science scores vary by pupils' socioeconomic background. Two measures of socioeconomic background are employed, PISA's economic, social and cultural status (ESCS) index, which is described below, and pupil eligibility for free school meals (FSM) in the last 6 years, which is derived from the National Pupil Database (NPD).

Socioeconomic 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' background and education and possessions in their homes. The Index is set to a mean of approximately 0 across OECD countries, with a standard deviation of 1. This index was calculated differently in PISA 2022 to previous cycles of PISA. Comparisons with previous cycles in this report are made using this new index rather than those reported in the previous national reports for England.

England's average score on the ESCS Index was +0.15 indicating that, on average, pupils in England had a higher socioeconomic status than the average across OECD countries. However, the data needed for the ESCS Index were missing for 23% of pupils in England. In 2018 using the new ESCS Index the average score in England was also +0.15. Data needed for the ESCS Index were missing for 8% of pupils in 2018 in England.

There are 2 different ways to think about the relationships between socioeconomic status and attainment. The first is to consider the difference in attainment between average pupils with high socioeconomic status and those with low socioeconomic status. This is referred to as the size of the effect and can be seen as the 'steepness of the slope' (the gradient of the line) when plotting the relationship between socioeconomic status and attainment. Another way to look at the size of the effect is to divide pupils into 4 equal groups (quartiles) according to their ESCS score[10] and examine the gap between pupils in the most disadvantaged group compared to the least disadvantaged group.

The second way to think about the relationships between socioeconomic status and attainment is to consider how much variation in attainment there is between pupils of the same socioeconomic status, or to put it another way, how strongly correlated socioeconomic status is with attainment. If there is a strong correlation, then there will be less variability in the attainment of pupils with the same socioeconomic status, which implies that socioeconomic status is the dominant factor in determining outcomes. A low

[10] These groups were based on the percentage of pupils after the application of weights, rather than before. In terms of the raw numbers of pupils, 1,009 pupils in England were classified as being in Quartile 4, compared to just 865 in Quartile 1. This is a consequence of schools with high percentages of Quartile 1 pupils being under-represented in the sample, and thus having larger weights. After the application of weights, there is an equal distribution of pupils in all four quartiles.

percentage of the variance in performance being explained by socioeconomic status means that socioeconomic status has less of an influence on performance in PISA. This is referred to as the strength of the effect.

6.5.1 Mathematics

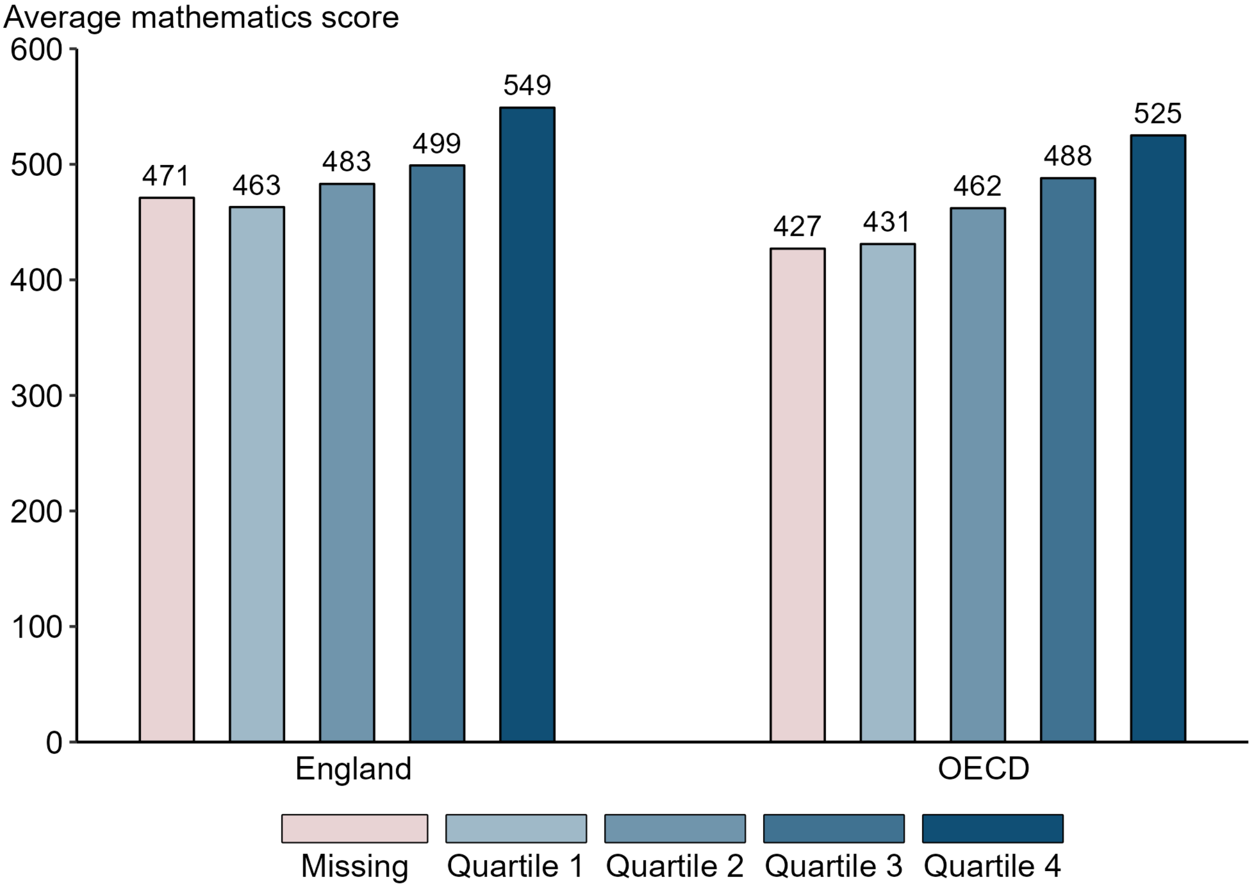
In England there was a 36 score point difference in mathematics performance associated with a one-unit increase in ESCS. On average across OECD countries[11], there was a 39 score point difference in mathematics performance associated with a one-unit increase in ESCS. The score point difference in England was significantly smaller than the average score point difference across OECD countries.

In Singapore there was a 51 score point difference in mathematics performance associated with a one-unit increase in ESCS and in Australia, this score point difference was 45. The score point difference in mathematics was statistically significantly larger in Singapore and Australia than in England. In Canada there was a 40 score point difference and in the Republic of Ireland there was a 35 score point difference in mathematics performance associated with a one-unit increase in ESCS. Neither Canada nor the Republic of Ireland had score point differences in mathematics that were significantly different from England.

In England there was an 85 score point difference in mathematics between the most disadvantaged group and the least disadvantaged group. This was not significantly different from the OECD difference of 93 score points. The mathematics scores for each ESCS quartile in England and on average across the OECD is shown in Figure 6.12. In England and on average across OECD countries, more disadvantaged pupils achieved lower mathematics scores than their less disadvantaged peers and this was true for each quartile. In Singapore and Australia there was a significantly larger score point difference between the most disadvantaged group and the least disadvantaged group, with a score point difference of 112 in Singapore and 101 in Australia. There were no significant differences between the score point difference in mathematics in England and in Canada (77) and the Republic of Ireland (74).

[11] There are 36 OECD countries in PISA 2022 with data for the ESCS Index.

Figure 6.12: Mathematics performance by ESCS Index quartile in England and on average across OECD countries



Country	Missing	Quartile 1	Quartile 2	Quartile 3	Quartile 4
England	471	463	483	499	549
OECD Average	427	431	462	488	525

Base: All participating pupils in the included education systems
'Missing' or unavailable ESCS data for around 23% of pupils in England and around 6% of pupils across the OECD.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met

Source: OECD, PISA 2022

The percentage of the variance in mathematics performance explained by socioeconomic status in England was 10%. On average across OECD countries 15% of the variance in mathematics performance was explained by the ESCS Index. England is one of the 10 education systems that combined high levels of fairness in terms of socioeconomic status with a level of pupil performance in mathematics that was significantly above the OECD average. Other education systems that combined high levels of fairness with a high level of pupil performance in mathematics include Canada (10%), Malta (10%), Iceland (10%), Norway (10%), Hong Kong (6%) and Macao (5%). Of the remaining comparator countries, 17% of the variance in mathematics performance was explained by the ESCS Index in Singapore, with 15% in Australia and 13% in the Republic of Ireland.

The ESCS Index also allows us to compare the percentage of pupils who succeed academically despite their socioeconomic background, that is, who are academically resilient. A pupil is classified as resilient if they are in the bottom quarter of the ESCS Index in the country of assessment and perform in the top quarter of pupils in that country. In England, 16% of pupils were academically resilient, while on average across OECD countries 10% of pupils were academically resilient. In the comparator countries, 13% of pupils in Canada, 10% of pupils in Australia, 10% of pupils in Singapore, and 12% of pupils in the Republic of Ireland were academically resilient in mathematics.

6.5.1.1. Mathematics performance by pupils' free school meal (FSM) eligibility

In England the national measure usually used to understand the effects of economic disadvantage is eligibility for free school meals (FSM). The measure used in this report is eligibility for FSM at some point in the last 6 years. Table 6.3 presents the average mathematics scores for pupils eligible for FSM in the past 6 years, and those who had not been eligible for FSM in the past 6 years. The analysis was carried out with pupil data which was matched to the National Pupil Database (NPD) in England. On average pupils eligible for FSM in the past 6 years scored 44 score points below pupils not eligible. The average score in mathematics for pupils who had been eligible for FSM at some point in the past 6 years was 453, significantly lower than the average score of 497 for pupils who had not been eligible for free school meals over this period.

Table 6.3: FSM eligibility in the past 6 years and average mathematics scores in England

FSM eligibility	Percentage of pupils	Average mathematics score
Not eligible for FSM in the past 6 years	79%	497
Eligible for FSM in the past 6 years	21%	453

Base: All pupils with known FSM eligibility (10% weighted percentage of pupils missing).
Caution is required when interpreting estimates because one or more PISA sampling standards were not met

Source: OECD PISA 2022

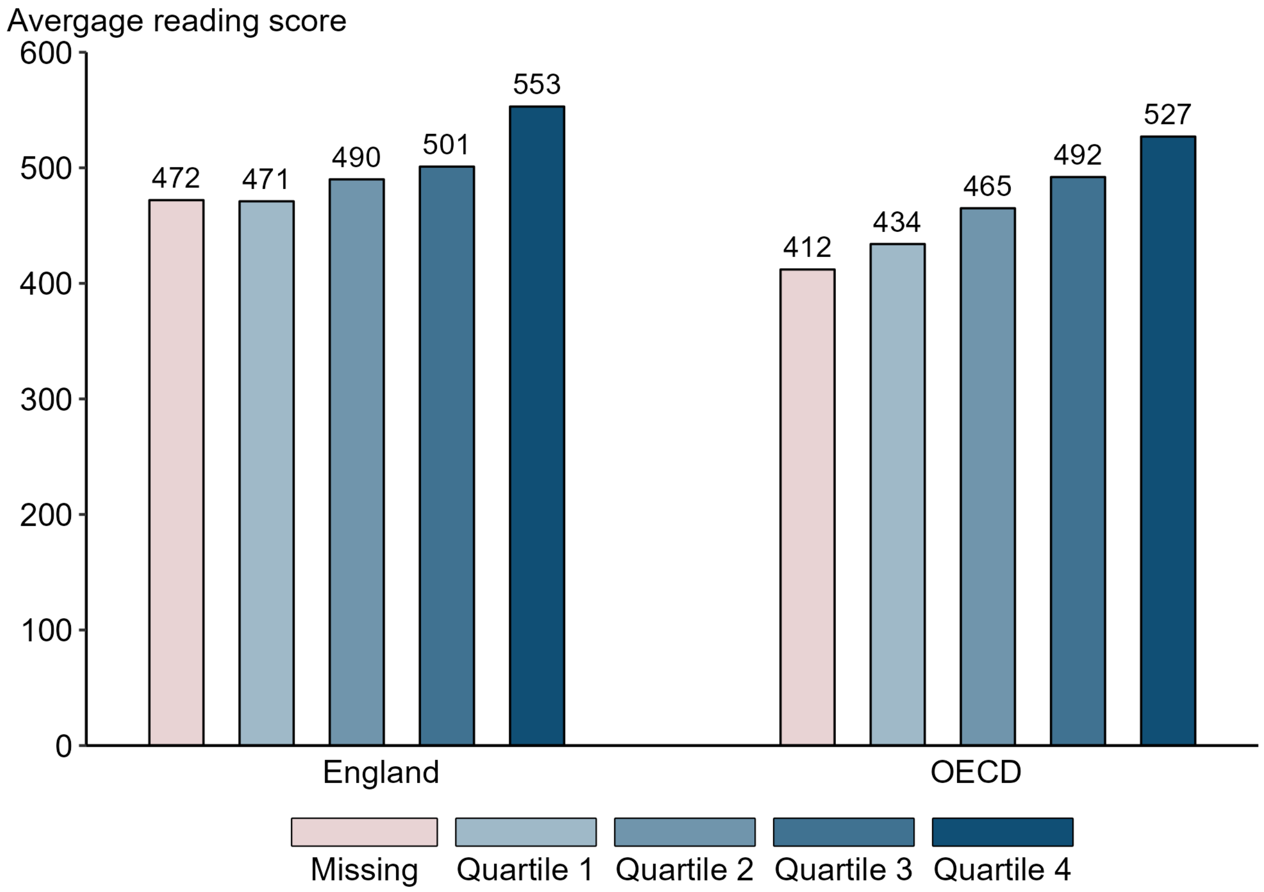
6.5.2 Reading

In England there was a 33 score point difference in reading performance associated with a one-unit increase in ESCS. On average across OECD countries there was a 39 score point difference in reading performance associated with a one-unit increase in ESCS.

The score point difference in England was significantly smaller than the average score point difference across OECD countries. The score point difference in reading performance in England (33) was also significantly smaller than the score point difference in Singapore (50) and Australia (43) but not significantly different from the score point difference in the Republic of Ireland (36) and Canada (39).

Figure 6.9 shows the overall reading performances of pupils in England and on average across the OECD countries broken down into the four ESCS quartiles described in the introduction to this chapter (labelled Quartile 1 – Quartile 4). Figure 6.13 shows that, both in England and across the OECD countries, relative socioeconomic advantage is associated with stronger performance in PISA reading. In England, the most disadvantaged group scored significantly lower in reading (471) than pupils in the least disadvantaged group (553), with a gap of 82 score points. On average across OECD countries the most disadvantaged group scored significantly lower in reading (434) than the least disadvantaged group (527), with a gap of 93 score points. The gap in performance between the most disadvantaged pupils and the least disadvantaged pupils in England was not significantly different from the gap in performance on average across OECD countries.

Figure 6.13: Reading performance by ESCS Index quartile in England and on average across OECD countries



Country	Missing	Quartile 1	Quartile 2	Quartile 3	Quartile 4
England	472	471	490	501	553
OECD Average	412	434	465	492	527

Base: All participating pupils in the included education systems
'Missing' or unavailable ESCS data for around 23% of pupils in England and around 6% of pupils across the OECD.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met

Source: OECD PISA 2022

The gap in performance in reading between pupils in the most disadvantaged group (Quartile 1) and pupils in the least disadvantaged group (Quartile 4) in England was 82 score points. This was not significantly different from the gap in performance in reading in Australia (95), Canada (74) or the Republic of Ireland (76) but was significantly smaller than the gap in performance between pupils in the lowest disadvantaged group and pupils in the highest disadvantaged group in Singapore (113).

The percentage of the variation in reading performance explained by the ESCS index in England was 8%. On average across OECD countries 13% of the variation in reading performance was explained by the ESCS index. The percentage of the variation in reading performance explained by the ESCS index in Singapore was 16%, in Australia and the Republic of Ireland it was 11% and in Canada was 7%. The percentage of academically resilient pupils in reading in England was 17% while on average across OECD countries 11% of pupils were academically resilient in reading. In Singapore this percentage was 9%, with 15% in Canada, 12% in Australia and 13% of pupils in the Republic of Ireland being academically resilient in reading.

6.5.2.1. Reading performance by pupils' free school meal (FSM) eligibility

On average pupils eligible for FSM in the past 6 years scored 41 score points below pupils not eligible as shown in Table 6.4. The average score in reading for pupils who had been eligible for FSM at some point in the past 6 years was 460, significantly lower than the average score of 501 for pupils who had not been eligible for FSM over this period.

Table 6.4: FSM eligibility in the past 6 years and reading scores in England

FSM eligibility	Percentage of pupils	Average reading score
Not eligible for FSM in the past 6 years	79%	501
Eligible for FSM in the past 6 years	21%	460

Base: All pupils with known FSM eligibility (10% weighted percentage of pupils missing).
Caution is required when interpreting estimates because one or more PISA sampling standards were not met

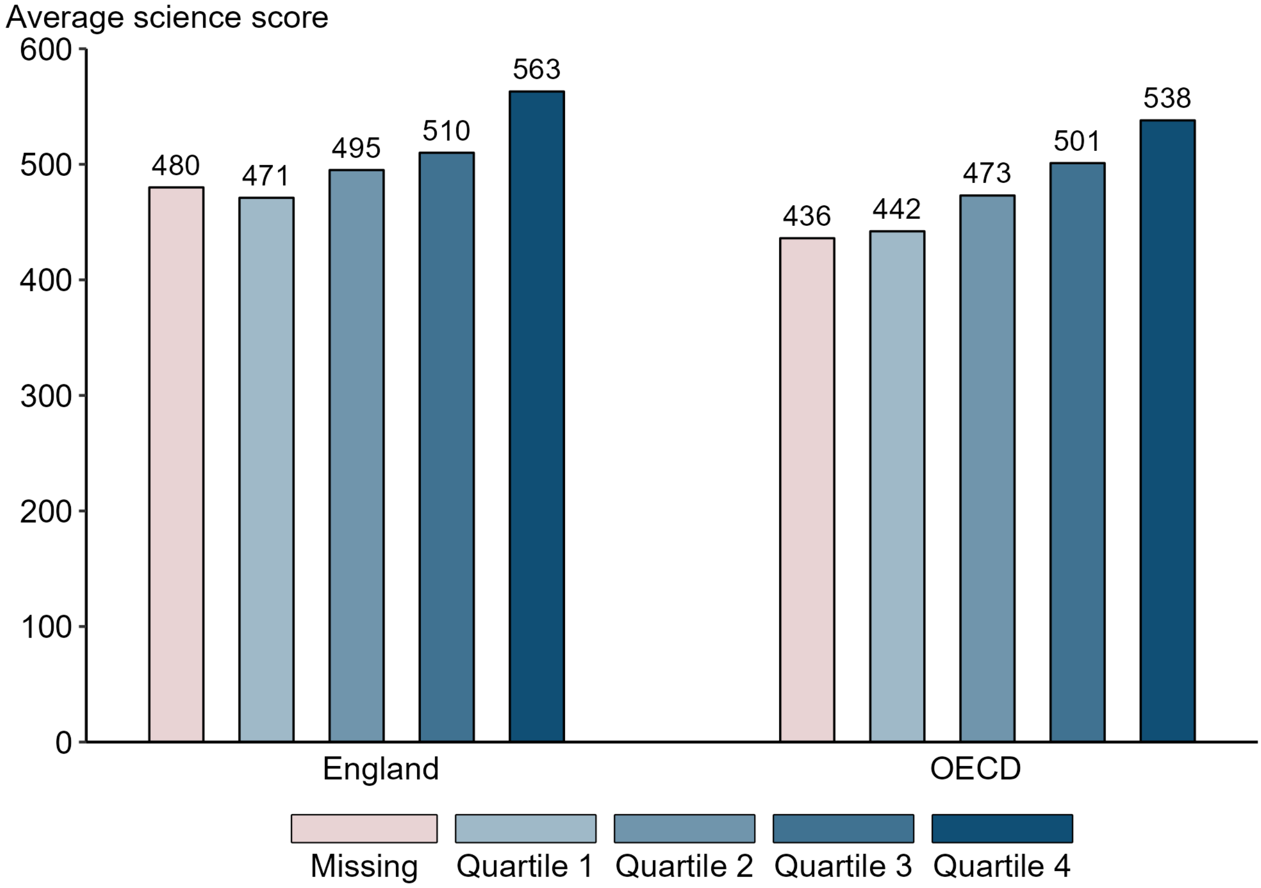
Source: OECD PISA 2022

6.5.3 Science

In England there was a 39 score point difference in science performance associated with a one-unit increase in ESCS. On average across OECD countries there was a 41 score point difference in science performance associated with a one-unit increase in ESCS. The score point difference in science performance in England was not significantly different from the average across OECD countries. The score point difference in England was significantly smaller than the score point difference in science performance in Singapore (49) and Australia (46) but was not statistically significantly different from the score point difference in the Republic of Ireland (37) or Canada (38).

Figure 6.14 shows that, both in England and across the OECD, relative socioeconomic advantage is associated with stronger performance in PISA science.

Figure 6.14: Science performance by ESCS Index quartile in England and on average across OECD countries



Country	Missing	Quartile 1	Quartile 2	Quartile 3	Quartile 4
England	480	471	495	510	563
OECD Average	436	442	473	501	538

Base: All participating pupils in the included education systems
'Missing' or unavailable ESCS data for around 23% of pupils in England and around 6% of pupils across the OECD.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met

Source: OECD, PISA 2022

The gap in performance in science between pupils in the most disadvantaged group (Quartile 1) and the least disadvantaged group (Quartile 4) in England was 92 score points which was not statistically different from the gap in performance on average across OECD countries of 96 score points. This gap in performance in science in England was also not significantly different from the gap in performance in Australia (102), Singapore (107) or the Republic of Ireland (78) but was significantly larger than the gap in performance in Canada (72).

The percentage of the variation in science performance explained by the ESCS index in England was 10%. On average across OECD countries 14% of the variation in science performance was explained by the ESCS index. The percentage of the variation in science performance explained by the ESCS index in Australia was 13%, in Singapore was 17%, in the Republic of Ireland was 11% and in Canada was 8%.

The percentage of academically resilient pupils in science in England was 16% while on average across OECD countries 11% of pupils were academically resilient in science. In Australia the percentage of academically resilient pupils in science was also 11%, while in Canada it was 14%, in the Republic of Ireland it was 13% and it was 9% in Singapore.

6.5.3.1. Science performance by pupils' free school meal (FSM) eligibility

On average pupils eligible for FSM in the past 6 years scored 43 score points below pupils not eligible. The average score in science for pupils who had been eligible for FSM at some point in the past 6 years was 464, significantly lower than the average score of 507 for pupils who had not been eligible for FSM over this period. These results are shown in Table 6.5.

Table 6.5: FSM eligibility in the past 6 years and science scores in England

FSM eligibility	Percentage of pupils	Average science score
Not eligible for FSM in the past 6 years	79%	507
Eligible for FSM in the past 6 years	21%	464

Base: All pupils with known FSM eligibility (10% weighted percentage of pupils missing).
Caution is required when interpreting estimates because one or more PISA sampling standards were not met

Source: OECD PISA 2022

6.6 Immigration background and language

The pupil questionnaire in PISA 2022 collects information which enables us to identify whether pupils are first- or second-generation immigrants. Immigrant background is defined in the OECD International report as:

- 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 pupils born in another country whose parents are also born in another country.

- Second-generation immigrant pupils are pupils born in the country of assessment but whose parents are both born in another country.

The International report notes that the percentage of pupils across the OECD countries with an immigrant background has increased slightly from 12% in 2018 to 13% in 2022. In England the percentage of pupils with an immigrant background was 16%, which was significantly more than the OECD average, though data were not available for the immigration status of 23% of pupils in England.

The performance of pupils with an immigrant background tends to be lower than their peers with a non-immigrant background. On average across OECD countries, the average mathematics score for pupils with an immigrant background was 447 which was 30 score points lower than the average performance of pupils with a non-immigrant background (479). In England the average mathematics score for pupils with an immigrant background was 496 which is similar to the average mathematics score for pupils with a non-immigrant background (499). However, in England pupils with a second-generation immigrant background had a higher average mathematics score (509) than both pupils with a first-generation immigrant background (485) and pupils with a non-immigrant background. Pupils with a first-generation immigrant background had an average score in mathematics significantly lower than both pupils with a non-immigrant background and pupils with a second-generation immigrant background.

Table 6.6 shows the average mathematics score for pupils with different immigration backgrounds in England. Similarly, on average across OECD countries pupils with a second-generation immigrant background had a higher average mathematics score (459) than pupils with a first-generation immigrant background (435) but pupils with a non-immigrant background had the highest mathematics performance with an average score of 479. The average scores for mathematics for pupils with different immigration backgrounds in England are all significantly higher than the corresponding average scores for mathematics across OECD countries.

Table 6.6: Immigration background and PISA mathematics scores in England

Immigration background	Percentage of pupils	Average mathematics score
Non-immigrant background	60%	499
First-generation immigrant background	7%	485
Second-generation immigrant background	10%	509
Immigrant status unknown	23%	469

Base: All pupils
Caution is required when interpreting estimates because one or more PISA sampling standards were not met

Source: OECD PISA 2022

In reading the average score for pupils with a non-immigrant background in England was 506 which was not significantly higher than the average score for pupils with a second-generation immigrant background (503) but was significantly higher than the average score in reading for pupils with a first-generation immigrant background (482). On average across OECD countries the average score for reading in PISA 2022 for pupils with a non-immigrant background was 483, with an average score of 461 for pupils with a second-generation immigrant background and an average score of 425 for pupils with a first-generation immigrant background.

The average score in science for pupils with a non-immigrant background was 511 which was the same as the average score for pupils with a second-generation immigrant background but was significantly higher than the average science score for pupils with a first-generation immigrant background (494). On average across OECD countries the average score for science in PISA 2022 for pupils with a non-immigrant background was 492, with an average science score of 466 for pupils with a second-generation immigrant background and an average score of 438 for pupils with a first-generation immigrant background.

Pupils were also asked about the language they spoke at home. Table 6.7 shows the mathematics, reading and science average scores of pupils who speak English at home compared with pupils who speak another language at home. Pupils who spoke a language other than English at home on average scored significantly lower in the mathematics (486), reading (482) and science (487) assessments than pupils who spoke English at home (498, 504 and 511 respectively).

Table 6.7: Language spoken at home and PISA domain scores in England

PISA 2022 domain	English spoken at home	Another language spoken at home
Mathematics	498	486
Reading	504	482
Science	511	487

Base: 3,842 pupils (80% weighted percentage of pupils)
Caution is required when interpreting estimates because one or more PISA sampling standards were not met

Source: OECD PISA 2022

6.7 Special education needs

In this section we report on the performance of pupils in mathematics, reading and science who have or do not have special educational needs (SEN) as recorded in the National Pupil Database.

Pupils with (SEN) performed significantly lower in all the PISA 2022 domains than pupils who did not have SEN. In mathematics pupils without SEN had an average score of 495 while pupils with SEN had an average score of 430. This was the same gap as in the reading domain where pupils without SEN had an average score of 499 compared to pupils with SEN who had an average score of 435. In science pupils without SEN had an average score of 504 while pupils with SEN had an average score of 446, as shown in Table 6.8. However, data was not available for 10% of the pupils participating in PISA, many of whom attend independent schools, and the average scores in mathematics, reading and science for these pupils were significantly higher than both pupils without SEN and pupils with SEN. Some pupils with SEN are ineligible to participate in PISA

Table 6.8: PISA 2022 domain scores for pupils with or without special educational needs in England

PISA 2022 domain	No special educational need	Special educational needs	Special educational need status unknown
Mathematics	494	430	543
Reading	499	435	541
Science	504	446	554

Base: All pupils in England
Caution is required when interpreting estimates because one or more PISA sampling standards were not met

Source: OECD PISA 2022

7 Pupil wellbeing, aspirations and experiences of teaching and learning

7.1 Chapter overview

This chapter focuses on how pupils in England responded to questions relating to their wellbeing, future aspirations and their experiences of teaching and learning in the student questionnaire, and how these relate to performance in PISA mathematics. The chapter begins by looking at how pupils in England rated their overall life satisfaction, as well as their experiences of bullying and perceptions of safety at school, and whether they feel like they socially belong at their schools. The chapter then looks at whether pupils in England have beliefs conducive to a growth mindset and looks at pupils’ academic aspirations. The chapter concludes by looking at pupils’ experiences of teaching and learning.

7.2 Key findings

- Pupils in England report significantly lower levels of overall life satisfaction than the average across OECD education systems (6.01 and 6.75 respectively).
- The majority of pupils in England (93%) reported that they felt safe in their classrooms at school. Pupils who reported feeling safe in their classrooms at school had a higher mathematics score on average than pupils who reported not feeling safe.
- Around two-thirds of pupils in England (63%) and three-quarters of pupils (75%) on average across OECD countries agreed or strongly agreed that they felt like they ‘belong’ at their school.
- On average pupils in England were more exposed to bullying at school than on average across OECD countries. About a fifth of pupils in England (20%) reported that they are made fun of at school at least a few times a month.
- Just over half of pupils in England (53%) and 65% of pupils on average across OECD countries reported that they believe that some people are just not good at mathematics, no matter how hard they try. Similar views were held with regard to English and creativity.
- The majority of pupils in England perceived that their quality of their mathematics instruction was good and that their mathematics teacher supported their learning.
- Pupils who spent between 30 minutes and 1 hour a day on mathematics or science homework had higher mathematics and science scores respectively than pupils who spent more or less time. Pupils who spent more than 1 hour a day had

higher reading scores than pupils who spent less than 30 minutes on English homework.

- Pupils who reported spending over 1 hour a day on all of their homework had significantly higher mathematics performance than pupils who reported spending less time than this.

7.3 Introduction

The PISA 2022 student questionnaire contains a large number of questions relating to pupils' attitudes and beliefs, experiences in school, hopes for the future and general wellbeing.

The questions used in the student questionnaire vary in how the question is asked, and the options that are available for pupils' responses. Most questions asked pupils to state how strongly they agreed with a given statement, e.g. "I feel nervous about approaching exams". In some cases, four options (strongly agree, agree, disagree, strongly disagree) could be chosen, and in others, pupils could also select a 'neither agree nor disagree' option. Other questions asked pupils to report the frequency of a given event, e.g. "Other pupils made fun of me" and were given 4 options to report their frequency; "never or almost never", "a few times a year", "a few times a month" or "once a week or more". In a few cases, such as when asked to rate their overall life satisfaction, pupils were asked to rate themselves on a scale, usually between 0 and 10. Throughout this chapter, we will report the types of questions pupils were asked, and how they were asked to respond.

It is important to note that the pupil response rate in England was below the rate required by the OECD (80%) as described in Section 1.4.2. This means that it is possible that the findings reported here do not reflect an accurate picture of the national situation. The pupil-level non-response bias analysis found that there was some evidence of non-response bias with pupils with higher prior attainment more likely to participate than pupils with lower prior attainment in mathematics and reading at Key Stage 2 (see Appendix A for more details).

It is also important to note that not all pupils who did respond to the questionnaire answered all possible questions. In order to mitigate this risk, this chapter only includes questions that had responses from at least 60% of the pupils in England who participated in PISA 2022. Each table includes information about the percentage of pupils that answered the questions included in the table. However, the national results reported in this chapter should still be interpreted with caution. In this chapter, we do not report whether differences between the percentage of pupils in England and the percentage of pupils on average across OECD countries were statistically significant because, due to the large sample sizes, small differences can be statistically significant but not meaningful in terms of policy or practice.

7.4 Pupils' wellbeing and aspirations

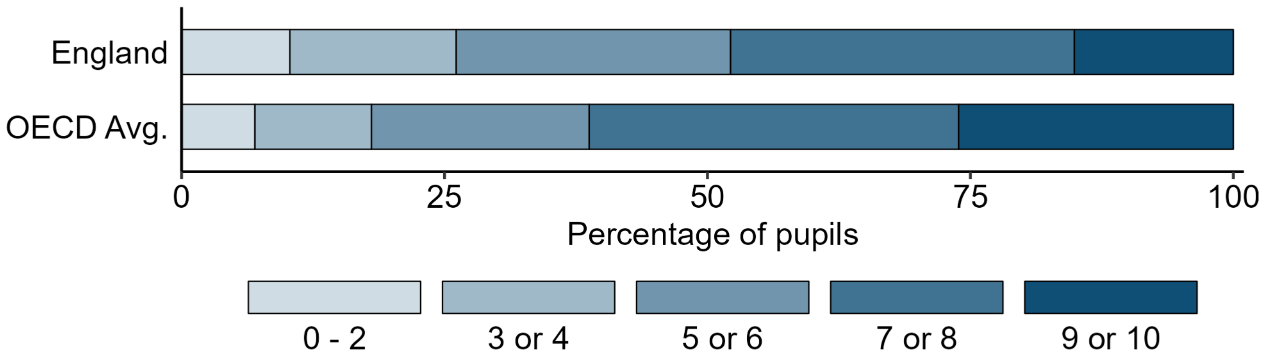
In this section, we focus on a number of questions relating to pupils' wellbeing and future aspirations. These include questions about pupils' satisfaction with different aspects of their lives, beliefs about their abilities, and feelings related to school.

7.4.1 Pupils' life satisfaction

Pupils were asked to rate their overall life satisfaction on a scale from 0 to 10, with 0 indicating very low life satisfaction, and 10 indicating very high satisfaction.

Figure 7.1 shows the percentage of pupils in England reporting each level of overall life satisfaction, compared to the average across all participating OECD countries. The individual ratings have been collapsed into five subdomains for the purpose of presentation: ratings of 0, 1 or 2 (not satisfied), 3 or 4 (slightly satisfied), 5 or 6 (somewhat satisfied), 7 or 8 (satisfied), or 9 or 10 (very satisfied).

Figure 7.1: Self-reported overall life satisfaction scores of pupils in England and on average across OECD countries



Education system	0 - 2	3 or 4	5 or 6	7 or 8	9 or 10
England	10%	16%	26%	33%	15%
OECD Average	7%	11%	21%	35%	26%

Base: England data based on responses from 3,799 pupils (78% weighted response rate). OECD average based on data from 31 OECD countries.
Because of rounding, some results may appear inconsistent.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022 ST016

Around half (48%) of pupils in England and on average across OECD countries (61%) rated their level of overall life satisfaction as 7 or more on this scale. Relative to the OECD average, pupils in England reported statistically significantly lower overall levels of life satisfaction (6.01). On average across OECD countries, pupils reported 6.75 on this life-satisfaction scale. In 2018 the average score was 6.1 in England and 7.0 on average across OECD countries (Sizmur et al., 2019).

Pupils in England who reported being satisfied with life (a rating of 7 or 8) had the highest average score in mathematics with an average score of 514. This was significantly higher than all other groups of pupils. There were no significant differences in the mathematics performance of pupils who reported being not satisfied (468) and pupils who were very satisfied (479). The average mathematics scores for pupils who gave each rating of life satisfaction are given in Table 7.1.

Table 7.1: Mathematics performance of pupils in England with different levels of life satisfaction

Life satisfaction	Rating	Average mathematics score
Not satisfied	0 to 2	468
Slightly satisfied	3 or 4	500
Somewhat satisfied	5 or 6	495
Satisfied	7 or 8	514
Very satisfied	9 or 10	479

Base: England data based on responses from 3,799 pupils (78% weighted pupil response rate). Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022

7.4.2 Pupils' perceptions of school safety

Pupils were also asked about whether they felt safe at school, including on their travel to and from school. Pupils were asked if they agreed with 4 statements shown in Table 7.2, ("strongly disagree", "disagree", "agree", "strongly agree"). In all 4 statements, the vast majority of pupils in England and on average across OECD countries agreed or strongly agreed that they felt safe at school.

Table 7.2: Percentage of pupils in England and on average across OECD countries agreeing with statements about their perceptions of safety at their school

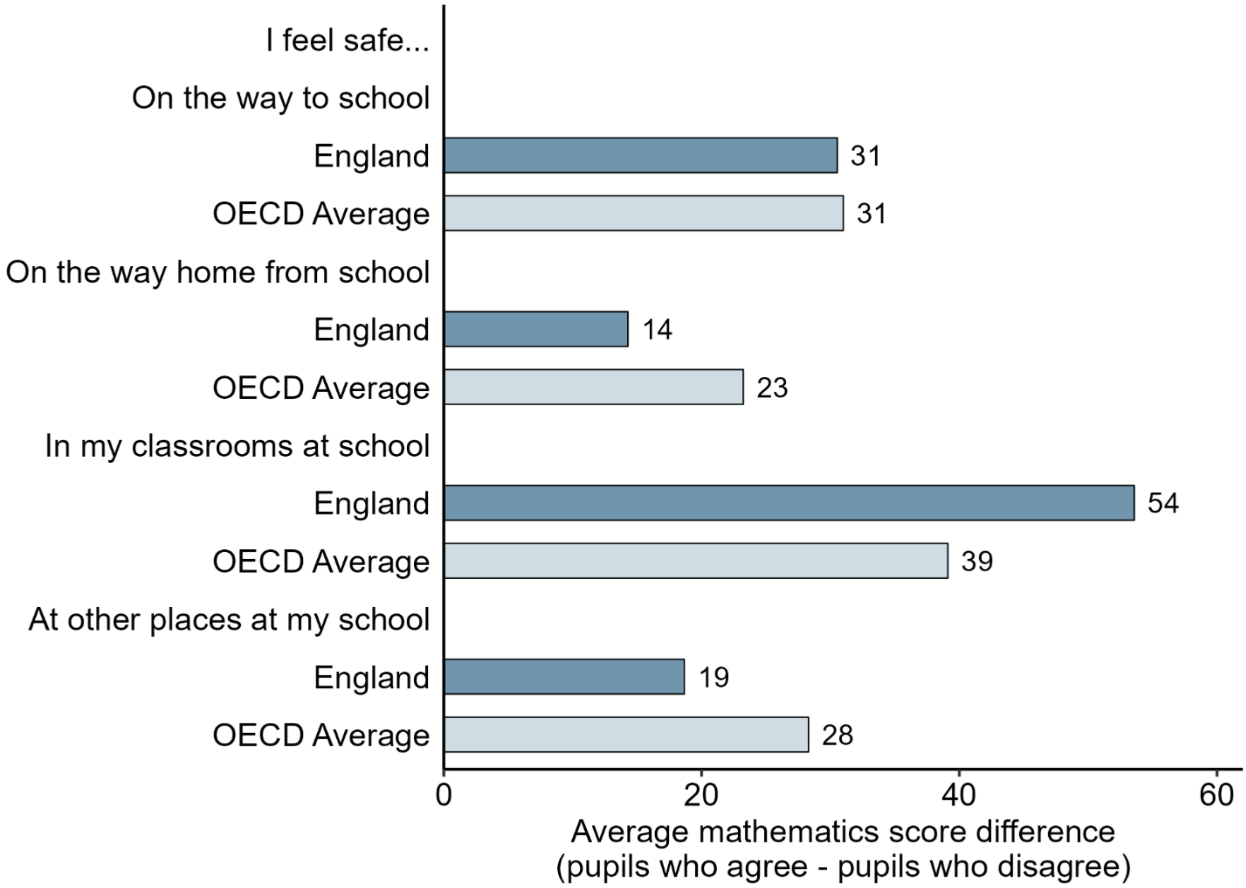
Statement	England	OECD
I feel safe on my way to school	94%	92%
I feel safe on my way home from school	90%	91%
I feel safe in my classrooms at school	93%	93%
I feel safe at other places at school (e.g. hallway, cafeteria, toilets)	87%	90%

Base: England data based on responses from between 3783 and 3787 pupils (78% weighted pupil response rate). OECD average percentage based on data from 32 OECD countries.
Percentages based on the percentage of pupils who agreed, or strongly agreed with the given statement.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022 ST265

For all the different places listed, pupils in England who reported feeling safe scored more highly in mathematics than pupils who did not. Pupils in England who agreed or strongly agreed that they felt safe in their classrooms in school had an average score in mathematics 54 score points higher than pupils who disagreed or strongly disagreed. On average across OECD countries this difference was 39 score points. Figure 7.2 shows the mathematics score point differences between pupils who agreed or strongly agreed and pupils who disagreed or strongly agreed with whether they feel safe in different locations in England and on average across OECD countries.

Figure 7.2: Mathematics performance score difference between pupils who felt safe in different places in England and on average across OECD countries



Statement	England	OECD
I feel safe on my way to school	31	31
I feel safe on my way home from school	14	23
I feel safe in my classrooms at school	54	39
I feel safe at other places at school (e.g. hallway, cafeteria, toilets)	19	28

Base: England data based on responses from between 3783 and 3787 pupils (78% weighted pupil response rate). OECD average based on data from 32 OECD countries.
Difference in score calculated as average score of pupils who agreed or strongly agreed – average score of pupils who disagreed or strongly disagreed.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022 ST265

7.4.3 Pupils' sense of belonging at school

Table 7.3 shows the extent to which pupils agreed with 6 statements relating to their sense of belonging in school, including statements about how easily they get along with their peers, and whether they experience feelings of isolation or loneliness.

Most pupils in England (84%) and on average across OECD countries (82%) agreed or strongly agreed that they were liked by other pupils. Similarly, a minority of pupils in England and on average across OECD countries reported that they felt awkward and out of place in their school (26% and 21% respectively), or like an outsider at school (20% and 17% respectively), or that they felt lonely at school (16% and 16% respectively).

Around two-thirds of pupils in England (63%) and three-quarters of pupils (75%) on average across OECD countries agreed or strongly agreed that they felt like they 'belong' at their school.

Table 7.3: Percentage of pupils in England and on average across OECD countries agreeing with statements about their sense of belonging at their school

Statement	England	OECD
I feel like an outsider (or left out of things) at school	20%	17%
I make friends easily at school	75%	76%
I feel like I belong at school	63%	75%
I feel awkward and out of place in my school	26%	21%
Other students seem to like me	84%	82%
I feel lonely at school	16%	16%

Base: England data based on responses from between 3,107 and 3,174 pupils (64% or 65% weighted pupil response rate). OECD average percentage based on data from 36 OECD countries.
Percentages based on the percentage of pupils who agreed, or strongly agreed with the given statement. Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022 ST034

Pupils in England who agreed or strongly agreed that they felt like they belonged at school had an average PISA mathematics score of 510, significantly higher than the average scores of 478 for pupils who either disagreed or strongly disagreed with the statement. On average across OECD countries pupils who agreed or strongly agreed that they felt like they belonged at school had an average mathematics score 21 points higher than pupils who disagreed or strongly disagreed. This was not significantly different from the gap in performance in England.

7.4.4 Pupils’ experiences of bullying at school

Pupils were asked how often they had experienced different forms of bullying in the past 12 months at school. The percentage of pupils in England reporting how often they experienced each of these types of bullying is presented in Table 7.4. The table also shows the average percentage of pupils across the OECD who reported experiencing each of these at least a few times a month.

The percentage of pupils in England who reported never or almost never experiencing other pupils leaving them out of things on purpose was 66% while on average across OECD countries 77% of pupils reported this. Similarly, the majority of pupils in England reported never or almost never experiencing physical forms of bullying such as other pupils taking away or destroying things that belonged to them (83%), getting hit or pushed around by other students (78%) or being involved in a physical fight on school property (90%). On average across OECD countries the percentage of pupils reporting these physical forms of bullying was 86%, 88% and 91% respectively. In England 48% of pupils reported that they never or almost never experienced other pupils making fun of them while 79% reported never or almost never being threatened by other pupils. On average across OECD countries 66% of pupils reported that they never or almost never experienced other pupils making fun of them while 89% reported never or almost never being threatened by other pupils. In England, around a fifth of pupils (20%) reported being made fun of at school at least a few times a month. On average across OECD countries 12% of pupils reported being made fun of at school at least a few times a month.

This set of statements was combined into a single index with approximately an average value of 0 and a standard deviation of 1 across OECD countries, where a positive value indicated that pupils are more exposed to bullying at school than on average across OECD countries. In PISA 2022 the average scale score for England was significantly different from the average across OECD countries (0.32 and -0.30 respectively), meaning that on average pupils in England were more exposed to bullying at school than on average across OECD countries.

Table 7.4: Percentage of pupils in England and on average across OECD countries reporting different experiences of bullying at school

Statement	Never or almost never	A few times a year	A few times a month or more	A few times a month or more (OECD average)
Other pupils left me out of things on purpose	66%	24%	10%	7%
Other pupils made fun of me	48%	32%	20%	12%
I was threatened by other pupils	79%	14%	6%	3%
Other pupils took away or destroyed things that belonged to me	83%	13%	4%	3%
I got hit or pushed around by other pupils	78%	15%	7%	4%
Other pupils spread nasty rumours about me	73%	20%	8%	7%
I was in a physical fight on school property	90%	8%	2%	2%
I stayed at home from school because I felt unsafe	90%	6%	3%	4%
I gave money to someone at school because they threatened me	98%	1%	2%	1%

Base: England data based on responses from 3,745 to 3792 pupils (77% to 78% weighted pupil response rate). OECD data based on responses from 36 OECD countries.
Because of rounding, some results may appear inconsistent.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022 ST038

Across the OECD, including in England, pupils who reported these happening regularly, particularly those reporting that these happened once a week or more, had lower average levels of PISA mathematics performance than those who reported less frequent instances of bullying. Across OECD countries, for a one-unit increase in the index of exposure to bullying there was a decrease on average of 8 score points in mathematics. In England the decrease was 4 score points.

7.4.5 Pupils' sense of relative family wealth

Pupils in England were also asked about their perceptions of their relative family wealth compared to other families in the country. On a scale from 1 to 10, pupils were told that people who earn the most money, receive the best education, and have the most respected jobs would be rated as a 10, whereas the least well-off families, who earn the least money, receive no education, and have no or the least respected jobs would be rated a 1. Pupils were asked to first rate where they would place their family on this scale, and then where they think they would end up on the scale at the age of 30.

Figure 7.3 shows that more than two-thirds (67%) of pupils in England placed their relative family wealth as a 7 or higher on the scale, and only around 7% placed their family wealth lower than a 5 on the scale now. On average across OECD countries[12] 67% of pupils placed their relative family wealth as a 7 or higher on the scale, and only around 8% placed their family wealth lower than a 5 on the scale now.

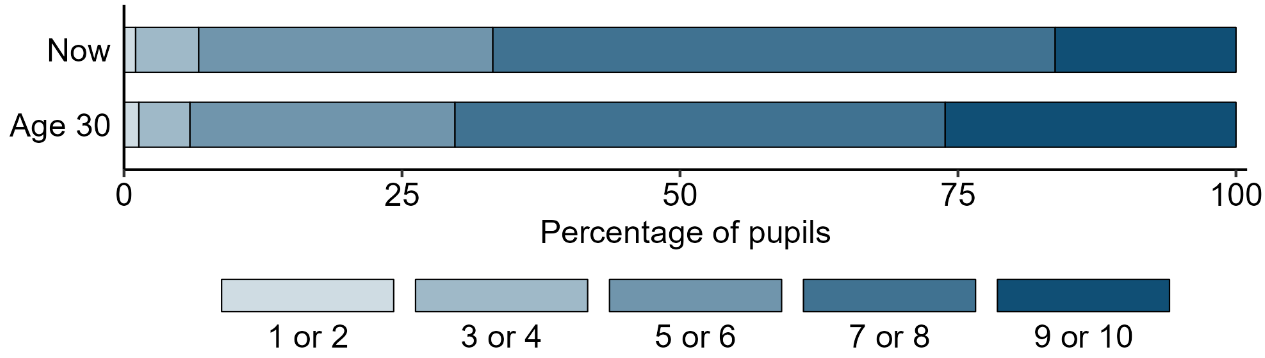
Pupils had positive expectations for their future relative wealth, with more than a quarter (26%) expecting to rate as a 9 or 10 on the scale by the age of 30, compared to 16% now. On average across OECD countries 34% expect to rate as a 9 or 10 on the scale by the age of 30.

Pupils who placed their relative family wealth as a 7 or higher on the scale also had a positive ESCS Index, and pupils who placed their relative family wealth as below 7 on the scale had a negative ESCS Index. This means that on average pupils in England who placed their relative family wealth as high also had a higher socioeconomic status than the average across OECD countries. Pupils in England who placed their relative family wealth as a 5 or 6, representing the middle of the scale, had an ESCS Index of -0.07.

Pupils' perceptions of their current relative family wealth were in general related to their performance in mathematics, with pupils placing their relative family wealth lower on the scale achieving a lower average score in mathematics. This was true for all groups except the group that placed their relative family wealth at 9 or 10 on the scale. Pupils in this group had an average mathematics score of 466 which was below the average score for all pupils in England.

[12] Data not available for 9 of the 37 OECD countries

Figure 7.3: Pupils' perceptions of their current relative family wealth, and expectations of their relative wealth by the time they are aged 30.



Time	1 or 2	3 or 4	5 or 6	7 or 8	9 or 10
Relative wealth now	1%	6%	26%	51%	16%
Expectation at age 30	1%	5%	24%	44%	26%

Base: England data based on responses from 3721 or 3,704 pupils respectively (76% or 77% weighted pupil response rate).
Because of rounding, some results may appear inconsistent.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022 ST259

Pupils were also asked about how often they did not eat in the past 30 days because there was not enough money to buy food. Table 7.5 shows the percentage of pupils in England who reported that this had never or almost never happened in the past 30 days, compared to the percentage who reported that this happened every day or almost every day. On average across OECD countries 3% of pupils, reported that they had to skip eating every day or almost every day because there was not enough money to buy food. In England this figure was 5% of pupils.

Pupils in England who reported never or almost never not eating because there was not enough money to buy food had average PISA mathematics scores 62 points higher than pupils in England who reported that they had to skip meals (504 compared to 442).

Table 7.5: Percentage of pupils in England reporting different regularity of not being able to afford to buy food.

Statement	Never or almost never	Between once a week and 5 times a week	Every day or almost every day
In the past 30 days, how often did you not eat because there was not enough money to buy food?	89%	5%	5%

Base: England data based on responses from 3,805 pupils (78% weighted pupil response rate).
Because of rounding, some results may appear inconsistent.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022 ST258

7.4.6 Pupils' growth mindsets

In addition to more general questions about pupils' wellbeing, the student questionnaire also asks pupils a variety of questions about their attitudes to learning, including whether they have views conducive to a 'growth mindset'.

A growth mindset refers to the view that intelligence is something that can be developed, rather than something static or predetermined. Dweck (2006; 2016) argues that pupils who see intelligence as something that can be developed are more willing to embrace educational challenges, persevere when challenged, acknowledge and learn from criticism, and be inspired by others who succeed. In turn, Dweck argues that pupils with a growth mindset are able to reach higher levels of achievement. By contrast, pupils who see their intelligence as fixed are likely to avoid challenge and give up easily, ignore negative feedback and feel threatened by the success of others, and may therefore not reach their academic potential.

Four questions, shown in Table 7.6, asked pupils about their views on statements relating to growth mindsets. Approximately one-third of pupils (36%) in England agreed or strongly agreed that intelligence could not be changed, while more than half of pupils (54%) felt this way about creativity. Additionally, a similar percentage of pupils agreed or strongly agreed that some people, regardless of how much they studied, would not be any good in either mathematics or English. On average across OECD countries, 42% of pupils agreed that your intelligence is something about you that you cannot change very much while 53% felt this way about creativity.

Table 7.6: Percentage of pupils in England and on average across OECD countries agreeing with statements about the flexibility of intelligence and subject-specific skills

Statement	England	OECD
Your intelligence is something about you that you cannot change very much	36%	42%
Some people are just not good at mathematics, no matter how hard they study	53%	65%
Some people are just not good in English*, no matter how hard they study	54%	60%
Your creativity is something about you that you cannot change very much	54%	53%

** Internationally, this question asked about the language of the test taken by the pupil, not always English.*
Base: England data based on responses from between 3,617 and 3,626 pupils (74% or 75% weighted pupil response rate). OECD average percentage based on 36 OECD countries.
Percentages based on the percentage of pupils who agreed, or strongly agreed with the given statement.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022 ST263

Pupils in England who disagreed or strongly disagreed that your intelligence is something about you that you cannot change very much scored significantly higher on average in mathematics than those who agreed or strongly agreed (517 and 473 respectively). Similarly on average across OECD countries pupils who disagreed or strongly disagreed that your intelligence is something about you that you cannot change very much also scored significantly higher on average in mathematics than those who agreed or strongly agreed, with an average difference of 24 score points. Similarly, pupils in England who disagreed or strongly disagreed that some people are just not good at mathematics or English, no matter how hard they study scored significantly higher in mathematics than pupils who agreed or strongly agreed, with a 30 score point difference for the statement that some people are just not good at mathematics, and a 21 score point difference for the statement that some people are just not good at English. There was no significant difference in mathematics performance for pupils in England who disagreed or strongly disagreed that your creativity is something about you that you cannot change very much compared to pupils who agreed or strongly agreed.

7.4.7 Pupil aspirations

Pupils were asked which qualifications they expected to complete. The results are shown in Table 7.7. Almost all pupils expected to complete GCSEs or equivalent qualifications. Over three-quarters of pupils in England (76%) expected to complete AS, A levels or an equivalent qualification. Just over half of the pupils in England (57%) and on average across OECD countries (53%) expected to complete a university degree, with slightly fewer than a third of pupils in England (29%) reporting that they did not know if they expected to complete a university degree.

Table 7.7: Percentage of pupils in England who expect to complete specific qualifications

Statement	Yes	No	I don't know
GCSEs or equivalent (e.g. BTEC First)	92%	3%	6%
AS or A levels, or equivalent qualifications (e.g. BTEC National)	76%	8%	15%
A university degree (e.g. BA, BSc, BEd)	57%	14%	29%

Base: England data based on responses from between 3,038 and 3,220 pupils (62% to 66% weighted pupil response rate).
Because of rounding, some results may appear inconsistent.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022 ST327

7.5 Pupil experiences of teaching and learning

This section reports on pupils' responses to questions about their experiences of teaching and learning in mathematics, English (or the language of the PISA assessment) and science, in England and on average across OECD countries.

7.5.1 Pupil attitudes towards mathematics, English and science

Almost all pupils in England reported that they wanted to do well in mathematics, English and science, though the majority of pupils did not consider these to be one of their favourites. The percentage of pupils in England who agreed or strongly agreed with the statements that mathematics (44%), English (43%) or science (45%) was one of their favourite subjects were similar to the percentage of pupils on average in OECD countries (39%, 39% and 47% respectively).

Around half of the pupils in England reported that they found mathematics easy (48%) or English easy (49%), with 41% of pupils reporting that they found science easy. The percentage of pupils on average across OECD countries who reported finding mathematics easy was 44%, while 50% reported finding science easy, and 57% reported finding English (or the language of the PISA assessment) easy. Almost all pupils in England and on average across OECD countries wanted to do well in each of mathematics (96% of pupils in England and 89% of pupils on average across OECD countries), science (94% and 88% respectively) and English (or the language of the PISA assessment) (96% and 89% respectively).

Table 7.8 shows the percentages of pupils agreeing or strongly agreeing with each of the statements from England and on average across OECD countries.

Table 7.8: Percentage of pupils in England and on average across OECD countries agreeing with statements about their attitudes towards core subjects

Statement	England	OECD
Mathematics is one of my favourite subjects.	44%	39%
English is one of my favourite subjects*.	43%	39%
Science is one of my favourite subjects.	45%	47%
Mathematics is easy for me.	48%	44%
English is easy for me*.	49%	57%
Science is easy for me.	41%	50%
I want to do well in my mathematics class.	96%	89%
I want to do well in my English class*.	96%	89%
I want to do well in my science class.	94%	88%

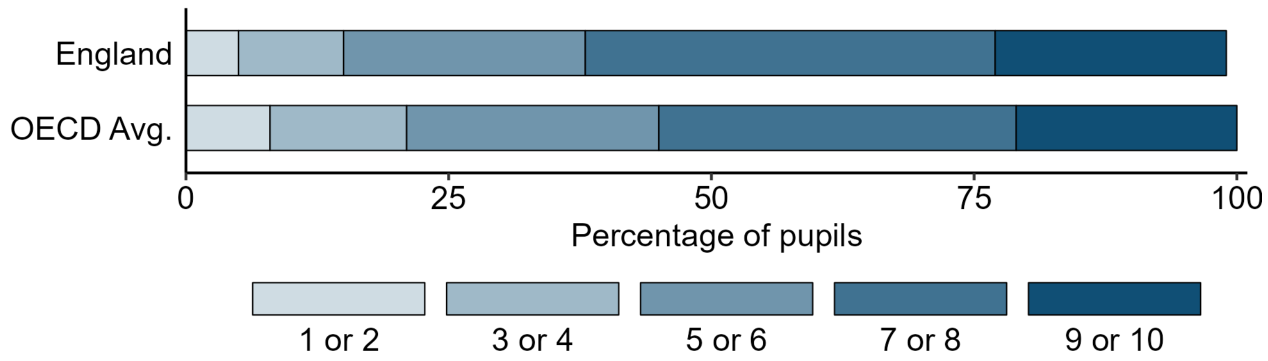
** Internationally, this question asked about the language of the PISA test taken by the pupil*
Base: England data based on responses from between 2,589 and 3,710 pupils (74% to 76% weighted pupil response rate).
Percentages based on the percentage of pupils who agreed, or strongly agreed with the given statement.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022 ST268

Pupils in England were also asked to rate the quality of their mathematics instruction this year on a scale of 1 to 10 where 1 was the worst mathematics instruction possible and 10 was the best mathematics instruction possible. In England, the average rating was 6.8 which was not significantly different from the OECD average of 6.4.

The distribution of ratings for pupils in England and for pupils across the OECD can be seen in Figure 7.4. The percentage of pupils in England who rated the quality of their mathematics instruction as 7 or higher on the scale was 62% while on average across OECD countries 55% of pupils rated the quality of their mathematics instruction as 7 or higher on this scale.

Figure 7.4: Pupils' perceptions of the quality of mathematics instruction in England and on average across OECD countries



Education system	1 or 2	3 or 4	5 or 6	7 or 8	9 or 10
England	5%	10%	23%	39%	22%
OECD	8%	13%	24%	34%	21%

Base: England data based on responses from 3,687 pupils (76% weighted pupil response rate). OECD average percentages based on data from 34 OECD countries.
Percentages based on the percentage of pupils who agreed, or strongly agreed with the given statement. Because of rounding, some results may appear inconsistent.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022, ST272

Pupils were also asked how often their teacher supports them in their mathematics lessons by stating how often each of the activities in Table 7.9 occurred.

The majority of pupils in England reported that their mathematics teacher gives extra help when needed in every or most mathematics lessons (80%) and that their mathematics teacher helps pupils with their learning in every or most lessons (82%). On average across OECD countries these figures were 70% and 72% respectively. Similarly, the majority of pupils in England also reported that their mathematics teacher showed an interest in every pupil's learning in every or most mathematics lesson (71%), as well as that they continue teaching until the pupils understand (72%). On average across OECD countries 63% of pupils reported that their mathematics teacher showed an interest in every pupil's learning in every or most mathematics lessons and 64% reported that their mathematics teacher continued teaching until the pupils understand.

Table 7.9: Percentage of pupils in England and on average across OECD countries who reported that each of these statements occurred in every or most mathematics lessons

Statement	England	OECD
The teacher shows an interest in every pupil's learning.	71%	63%
The teacher gives extra help when students need it.	80%	70%
The teacher helps students with their learning.	82%	72%
The teacher continues teaching until the students understand.	72%	64%

Base: England data based on responses from between 3,614 and 3,618 pupils (74% weighted pupil response rate). OECD average percentage based on data from 36 OECD countries.
Percentages based on the percentage of pupils who said the given statement happens in 'every' or in 'most' of their mathematics lessons.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022 ST270

7.5.2 Pupil time spent on learning-related activities

Pupils in England on average reported spending a similar amount of time each day on mathematics, English and science homework with around half of pupils reporting spending up to 30 minutes each day on each of these subjects as shown in Table 7.10. On average across OECD countries 53% of pupils reported that they spent up to 30 minutes a day on mathematics homework, 56% reported that they spent up to 30 minutes a day on homework related to the language of the PISA test, and 55% reported that they spent up to 30 minutes a day on science homework. Overall, the majority of pupils in England (57%) and on average across OECD countries (54%) reported spending more than 1 hour each day on homework.

Table 7.10: Time spent on homework as reported by pupils in England

Statement	Up to 30 minutes a day	More than 30 minutes and up to 1 hour a day	More than 1 hour a day
Mathematics homework	53%	30%	17%
English homework	52%	30%	18%
Science homework	49%	30%	21%
Total time for all homework in all subjects, including subjects not listed above	23%	19%	57%

Base: England data based on responses from between 3,574 and 3,604 pupils (73% or 74% weighted pupil response rate).
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022 ST296

Pupils in England who reported spending more than 30 minutes a day and up to 1 hour a day on mathematics homework had the highest average score for mathematics (508) which was significantly higher than pupils who reported spending less time than this (497). There was no significant difference in mathematics performance between pupils in England who reported spending more than 30 minutes and up to 1 hour a day and pupils who spent more than 1 hour a day on mathematics homework.

Similarly, pupils in England who reported spending more than 30 minutes a day and up to 1 hour a day on science homework had an average score for science of 531, which was significantly higher than the average score of pupils who reported spending less time than this (495). There was also no significant difference in science performance between pupils in England who reported spending more than 30 minutes and up to 1 hour a day and pupils who spent more than 1 hour a day on science homework.

In reading, pupils who reported spending more than 1 hour a day on English homework had an average performance of 515 which was significantly higher than the average score of pupils who reported spending less time than this (501). There were no significant differences in science performance between pupils who spent between 30 minutes and 1 hour and pupils who spent up to 30 minutes.

For the total time for all homework in all subjects, pupils in England who reported spending more than 1 hour a day in total had the highest average performance in mathematics (519), which was significantly higher than pupils who reported spending more than 30 minutes up to 1 hour (501), which was also significantly higher than pupils who reported that they spent up to 30 minutes a day in total on homework (460).

Pupils in England were also asked about additional mathematics learning activities that they participated in. Around one-fifth of pupils in England reported making use of Internet or computer tutoring with a programme or application (23%) or participating in large group study or practice (19%). On average across OECD countries 18% of pupils reported making use of Internet or computer tutoring with a programme or application and 10% reported participating in large group study or practice. Half of the pupils on average in OECD countries did not take part in any additional mathematics learning activities, with 38% of pupils in England reporting that they did not take part in any of these activities. Pupils' reported participation in these different additional mathematics learning activities are shown in Table 7.11.

Table 7.11: Percentage of pupils in England and on average across OECD countries who reported attending additional mathematics learning activities this school year

Statement	England	OECD
One-on-one tutoring with a person	18%	20%
Internet or computer tutoring with a programme or application	23%	18%
Video-recorded instruction by a person	14%	16%
Small group study or practice (2 to 7 students)	20%	18%
Large group study or practice (8 or more students)	19%	10%
I do not participate in additional mathematics learning activities	38%	50%

Base: England data based on responses from 3,852 pupils (79% weighted pupil response rate). OECD average percentage based on data from all OECD countries.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022 ST297

7.5.3 Pupil use of digital devices

Pupils in England were asked how many hours a day they usually used digital resources in a range of different situations in the last school year. Table 7.12 shows that around half of pupils in England reported using digital resources for learning activities before and after school and at weekends, with 46% using digital resources for learning activities in school for more than 1 hour.

Table 7.12: Time pupils in England reported using digital resources for learning activities.

Statement	None	Up to 1 hour	More than 1 hour
For learning activities at school	16%	39%	46%
For learning activities before and after school	22%	29%	49%
For learning activities on weekends	23%	24%	53%

Base: England data based on responses from between 3,525 and 3,610 pupils (72% to 74% weighted pupil response rate).
Because of rounding, some results may appear inconsistent.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022 ST326

A large percentage of pupils in England reported not using digital resources for leisure activities in school or using them for less than an hour a day (82%). The majority of pupils in England reported using digital resources for more than 4 hours for leisure on weekends (60%), as shown in Table 7.13. Around half of pupils in England (48%) reported that they did not use digital devices for leisure at school while on average across OECD countries this figure was 30%. A quarter of pupils in England (25%) also reported using digital devices for 2 hours or more a day for learning activities at school (25%) while 82% reported using digital devices for leisure on weekends. On average across OECD countries these figures were 35% and 71% respectively.

Table 7.13: Time pupils in England reported using digital resources for leisure activities.

Statement	None or up to 1 hour	More than 1 hour and up to 4 hours	More than 4 hours
For leisure at school	82%	15%	3%
For leisure before and after school	29%	42%	30%
For leisure on weekends	13%	27%	60%

Base: England data based on responses from between 3,531 and 3,552 pupils (72% or 73% weighted pupil response rate).
Because of rounding, some results may appear inconsistent.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022 ST326

Pupils were asked how often they used different digital devices or software at school and at home. Most pupils in England accessed the Internet in school at least once a week

(70%) and also used a desktop or laptop computer at least once a week (71%), as shown in Table 7.14. Educational software and school learning platforms were used less often with 52% of pupils reporting that they used educational software, games or apps, or other learning tools and 45% of pupils using a learning management system or school learning platform only once or twice a month or less often.

Table 7.14: How often pupils in England reported using digital devices or software in school

Statement	Once or twice a month or less often	About once or twice a week	Every day or several times a day
Desktop or laptop computer	28%	40%	31%
Smartphone (i.e. mobile phone with internet access)	50%	14%	30%
Tablet device (e.g. iPad, Galaxy Tab, Amazon Fire) or e-book reader (e.g. Amazon Kindle, Kobo)	73%	7%	11%
Internet access (except on smartphones)	28%	28%	42%
School portal (to consult timetable, absences, etc.)	48%	16%	31%
Educational software, games or apps, other learning tools (e.g. CK-12™ or Mathalicious online support)	52%	23%	21%
A learning management system or school learning platform (e.g. Blackboard, Edmodo, Moodle, Google® Classroom)	45%	20%	29%

Base: England data based on responses from between 3,528 and 3,622 pupils (73% to 75% weighted pupil response rate).
Table does not include pupils who reported that the resource was not available to them in school.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022 IC170

Out of school, the majority of pupils in England reported using a smartphone (85%) and a desktop or laptop computer (59%) every day or several times a day. The majority of pupils (81%) also reported accessing the Internet on a device other than a smartphone every day or several times a day. The majority of pupils in England (54%) also reported using educational software, games or Apps, or other learning tools at least once a week out of school. Table 7.15 shows how often pupils in England reported using different digital devices or software out of school.

Table 7.15: How often pupils in England reported using digital devices or software out of school

Statement	Once or twice a month or less often	About once or twice a week	Every day or several times a day
Desktop or laptop computer	18%	22%	59%
Smartphone (i.e. mobile phone with Internet access)	7%	6%	85%
Tablet device (e.g. iPad, Galaxy Tab, Amazon Fire) or e-book reader (e.g., Amazon Kindle, Kobo)	48%	13%	33%
Internet access (except on smartphones)	8%	10%	81%
Educational software, games or Apps, other learning tools (e.g. CK-12™ or Mathalicious online support)	43%	24%	30%
Video or online games (e.g. used with game consoles such as a Play Station 4 or Nintendo Switch, online gaming platforms such as Steam or gaming Apps such as Angry Birds)	29%	18%	50%

Base: England data based on responses from between 3,434 and 3,479 pupils (71% or 72% weighted pupil response rate).
Table does not include pupils who reported that the resource was not available to them out of school.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022 IC171

The majority of pupils in England and on average across OECD countries reported that a range of digital resources were available and used in school, as shown in Table 7.16.

Table 7.16: Percentage of pupils in England and on average across OECD countries agreeing with statements about the availability and use of digital resources in school

Statement	England	OECD
There are enough digital resources for every student at my school.	66%	71%
There are enough digital devices with access to the Internet at my school.	74%	74%
The school's Internet speed is sufficient.	54%	54%
Digital resources function properly at my school.	68%	71%
Digital resources are easily accessible within the classroom.	63%	67%
Digital learning resources available at my school make learning interesting.	71%	68%
The school provides sufficient technical support to help students in their use of digital resources.	73%	69%
Teachers at my school have the necessary skills to use digital devices during instruction.	74%	70%
Teachers at my school are willing to use digital resources for teaching.	78%	77%

Base: England data based on responses from between 3,426 and 3,516 pupils (70% to 72% weighted pupil response rate).
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022 IC172

In England, the majority of pupils reported that the used digital resources in less than half of their mathematics (70%), English (72%) and science (66%) lessons. Around one-fifth of pupils in England reported using digital resources in more than half their lessons or every lesson (19% in English lessons, 20% in mathematics lessons and 21% in science lessons).

Table 7.17: How often pupils in England reported using digital resources in lessons

Statement	Less than half of the lessons or never	In about half of the lessons	In more than half of the lessons or every lesson
English	72%	8%	19%
Mathematics	70%	9%	20%
Science	66%	12%	21%

Base: England data based on responses from between 3,455 and 3,499 pupils (71% or 72% weighted pupil response rate).
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022 IC173

8 Schools

8.1 Chapter overview

This chapter focuses on the responses from headteachers of pupils who participated in PISA 2022 to the school questionnaire. It discusses school management and policies, as well as aspects related to school climate. A description of variation in mathematics performance both within and across schools in England is also provided. Caution is required when interpreting percentages because one or more PISA sampling standards were not met and not all schools completed the school questionnaire.

8.2 Key findings

- In England the most common admissions criteria used by schools were residential area and preference to pupils who are family members of current or former pupils with 81% and 69% of pupils were in schools where headteachers respectively reported that these criteria were sometimes or always used, compared to 60% and 40% respectively on average across the OECD. Academic records were considered less often by headteachers (22% of pupils) but more often across the OECD on average (52% of pupils).
- Participating schools in England grouped their pupils by ability, for some or all subjects, more frequently than on average across OECD countries. More than 97% of pupils were in schools in England where headteachers reported that pupils were grouped by ability into different classes for some or all subjects, compared to 37% on average across OECD countries.
- Headteachers reported using a wide range of school monitoring and evaluation policies and practices, which were largely focused on school and teaching improvement. The most commonly reported approach to monitoring teachers, both in England and across the OECD, was the use of lesson observations by headteachers or senior staff (94% of pupils in England attend schools in which the headteachers reported this, and 77% across the OECD).
- Staffing shortages were reported as the top barrier to teaching in both England and across the OECD. Less than half of the pupils (46%) were in schools where the headteachers reported that instruction was hindered “very little” or “not at all” by a lack of teaching staff and 59% of pupils were in schools where a lack of assisting staff hindered teaching very little or not at all, compared to 53% and 64% respectively across the OECD.
- The majority of pupils were in schools where headteachers reported that issues such as pupil truancy or pupils lacking respect for teachers affected learning very

little or not at all. Pupils not paying attention was the most common behaviour that was reported as hindering pupils' learning, though 66% of pupils were in schools where the headteacher reported that this affected pupils' learning very little or not at all, compared to 39% across the OECD.

- Headteachers reported that extra-curricular activities were common and diverse in England. Sporting activities, volunteering, and music and arts programmes were the most commonly offered extracurriculars in England schools with over 92% of pupils being in schools where the headteacher reported that these activities were offered.
- The vast majority of schools in England offered some form of career guidance, primarily integrated into school hours, which included guidance on future careers, educational opportunities, internships, and financing.
- In England, 22% of the total variance in mathematics performance was between schools rather than within schools, which was lower than the OECD average of 32%.

8.3 School questionnaire

As part of PISA 2022, headteachers of participating schools were asked to complete a questionnaire. This questionnaire asked about aspects of school context, school management, teaching staff, assessment and evaluation policies and practices, school admission policies, grouping policies in school, the school climate and learning environment.

This chapter describes the questions that headteachers were asked, the possible response options for each question, and their responses to relevant sub-questions. As PISA is a study of pupils in schools and not schools directly, the results are reported in terms of the percentage of pupils in schools, with each headteacher representing a certain percentage of those pupils with their responses. In order to ensure that the answers from these headteachers remain confidential and anonymous, some figures are suppressed, such as responses where fewer than 10 pupils are represented by the figures. The results for England are presented and compared with averages across OECD countries to provide a perspective on how these factors in schools in England align with those on average in other education systems.

It is important to note that not all headteachers completed the school questionnaire and among those that did, individual questions had differing response rates. Additionally, the sample of schools in England participating in PISA in 2022 did not meet some of the PISA sampling standards (see Chapter 1 for further details). Consequently, the national results reported in this chapter should be interpreted with caution and a note is included below each table that shows the number of pupils whose headteacher responded to those questions, as well as the number of schools these pupils were in and the weighted pupil response rate. In order to provide information that presents the most reliable information available, this chapter only includes questions that had weighted school response rates from headteachers in England of at least 70% for the majority of items within a question (i.e., a minimum of 115 schools). In this chapter, we do not report whether differences between the percentage of pupils in England and the percentage of pupils on average across OECD countries were statistically significant because, due to the large sample sizes, small differences can be statistically significant but not meaningful in terms of policy or practice.

8.4 School management and policies

This section presents the responses of headteachers to questions regarding school type, characteristics of pupils who attend their schools, and policies regarding admissions, monitoring and evaluation and professional development at their school. The findings are presented in terms of the percentage of pupils that are represented by the response of their headteacher.

8.4.1 School characteristics

Headteachers of participating pupils were asked about the overall characteristics of Year 10 and 11 pupils in their schools. This reflected pupils' characteristics from the headteachers' perspective, compared to the pupils' perspectives as reported in Chapter 7. On average the percentage of pupils who were reported to have immigrated (not including refugees) in England was 6%. On average across OECD countries the percentage of pupils who were reported to have immigrated (not including refugees) was 8%. The percentage of Year 10 and 11 pupils who had a home language that was not English, who had parents who had immigrated, or who were refugees, as reported by the headteachers, were the same as the OECD averages (14%, 12% and 1% respectively). These percentages are shown in Table 8.1.

Table 8.1: Percentage of Year 10 and Year 11 pupils in England schools and OECD schools with particular characteristics as reported by the headteachers of these schools weighted by the number of pupils they represent

Student characteristic	England	OECD
Students whose home language is not English	14%	14%
Students with special educational needs	16%	11%
Students from socioeconomically disadvantaged homes	26%	22%
Students who are immigrants (not including refugees)	6%	8%
Students who have parents who have immigrated	12%	12%
Students who are refugees	1%	1%

Base: England data based on between 4,041 and 4,370 pupils from between 139 and 151 schools (85% to 93% weighted pupil response rate). OECD average percentage based on data from 36 or 35 OECD countries.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022, SC211

Headteachers of participating pupils in England reported that 16% of their Year 10 and 11 pupils had special educational needs and 26% came from socioeconomically disadvantaged homes. On average across OECD countries these figures were 11% and 22% respectively.

8.4.2 School admissions policies

PISA 2022 asked headteachers about their school's admissions criteria and their frequency of use. Different criteria used by schools and differences in their frequency of use can lead to greater between school variation (see section 8.6 for a discussion on between-school variation). The responses from headteachers in England describing the frequency at which each of the factors considered for admission to their school are shown in Table 8.2.

Schools in England reported that residence in a particular area was the factor most frequently used for admissions with 81% of pupils in schools where their headteacher reported that their school either sometimes or always considers residence of a particular area for admissions. Another factor that was frequently used as an admissions criterion included preference given to family members of current or former pupils, with 69% of pupils in schools where the headteacher reported that they used it either sometimes or always. On average across OECD countries, residential area was sometimes or always considered for admission for 60% of pupils and preference was given to family members of current or former pupils for 40% of pupils.

The pupil’s academic record was considered for admissions for 22% of pupils in England in schools where headteachers said this criterion was used either sometimes or always. On average across OECD countries this figure was 52% of pupils. Criteria related to pupils’ personal characteristics such as their cultural or ethnic background, their working status or their parental status were the least frequently considered criteria for admission in England and on average across OECD countries.

Table 8.2: Factors considered sometimes or always for pupils’ admission to school as reported by headteachers in England and on average across OECD countries weighted by the number of pupils they represent

Criteria	England	OECD
Pupil’s record of academic performance	22%	52%
Recommendation of feeder schools	25%	41%
Parents' or guardians' endorsement of the teaching or religious philosophy of the school	17%	26%
Whether the pupil requires or is interested in a special programme	28%	57%
Preference given to family members of current or former pupils	69%	40%
Residence in a particular area	81%	60%
Pupil’s disciplinary record in this or another school	36%	45%
Pupil’s parental status or pregnancy	3%	10%
Pupil’s working status	5%	14%
Pupil’s cultural or ethnic background	5%	9%

Base: England data based on between 3,882 and 3,959 pupils in between 134 and 137 schools (82% to 83% weighted pupil response rate). OECD average percentage based on data from between 27 and 37 OECD countries.
Percentage of pupils in schools where headteachers reported sometimes or always using each admission criteria.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022, SC012

8.4.3 Pupil grouping policies

Headteachers were asked to report on grouping policies at their schools by noting the prevalence of policies where pupils are grouped by ability either into different classes or within their class. Headteachers could respond to each type of grouping policy by stating if it was used: ‘for all subjects’, ‘for some subjects’ or ‘not for any subjects’. Table 8.3

shows the grouping policies as reported by the headteachers of participating pupils in England.

Table 8.3: Percentage of pupils in schools where headteachers report specific ability grouping policies for all or some classes in England and on average across OECD countries

Grouping policy	England	OECD
Pupils grouped by ability into different classes	97%	37%
Pupils grouped by ability within the same class	50%	49%

Base: England data based on 3,733 pupils from 128 schools (78% weighted pupil response rate). OECD average percentage based on data from 37 OECD countries.
Percentage of pupils in schools where the headteacher reported that they group pupils for all or some subjects.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022, SC042

In England, grouping policies were more regularly used to group pupils by ability into different classes than within the same class, with 97% of pupils being in schools where headteachers reported that, for some or all subjects, pupils were grouped by ability into different classes, while about 50% reported that pupils were grouped by ability within the same class for some or all subjects.

Ability grouping into different classes was less common on average across OECD countries than it was in England. On average across OECD countries, 37% of pupils were in schools where headteachers reported that pupils were grouped by ability into different classes for some or all subjects, and 49% reported that pupils were grouped by ability within the same class for some or all subjects. Responses to the school questionnaire also reveal that although grouping policies were common in England, they were subject-specific as only 5% of pupils were in schools where headteachers reported that they have ability grouping into different classes policies for all subjects.

Headteachers were also asked about the use of ability grouping practices in mathematics classes specifically. Table 8.4 shows the percentage of pupils in schools where headteachers report different types of ability grouping in mathematics classes in England. In England, the majority of pupils were in schools where headteachers reported that mathematics classes study similar content but at different levels of difficulty for all classes (70%) compared to 33% of pupils on average across OECD countries. The most common response to whether in mathematics classes teachers use pedagogy suitable for pupils with heterogeneous abilities in England was not for any classes (42% of pupils) while on average across OECD countries the most common response was that this happened for all classes (48% of pupils).

Table 8.4: Percentage of pupils in schools where headteachers report specific school grouping policies for mathematics classes in England

Grouping policy	For all classes	For some classes	Not for any classes
Mathematics classes study similar content, but at different levels of difficulty	70%	26%	4%
Different classes study different content or sets of mathematics topics that have different levels of difficulty	20%	52%	28%
Pupils are grouped by ability within their mathematics classes	49%	28%	23%
In mathematics classes, teachers use pedagogy suitable for pupils with heterogeneous abilities	30%	28%	42%

Base: England data based on 3,733 pupils from 128 schools (78% weighted pupil response rate). Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022, SC187

8.4.4 School assessment policies and practices

Headteachers were also asked to report how often pupils in Years 10 and 11 were assessed using each of the following methods: externally set and marked examinations (e.g. GCSEs), non-mandatory standardised tests (e.g. publicly or commercially available standardised test material), teacher-developed tests, and teachers' judgment ratings in general and for mathematics specifically. In England, these questions were responded to by between 126 and 132 headteachers of between 3,682 and 3,840 pupils (76% to 80% weighted pupil response rate). Headteacher reports in England revealed that there are marked differences in the frequency at which standardised tests (whether mandatory or not) are used when compared to teacher-based assessment methods. Externally set examinations for Years 10 and 11 were common in England, with 90% of pupils being in schools where headteachers reported that they were used once or twice a year. This is likely to be because most pupils in England take their GCSE examinations in Year 11. Non-mandatory standardised tests were reported by headteachers of 52% of pupils in England to be used only once or twice a year and 32% reported that they were never used. On average across OECD countries, 34% of pupils were in schools where headteachers reported that they never used non-mandatory standardised tests and 45%

were in schools where headteachers reported that they only used them once or twice a year.

Teacher-based assessments were typically used more frequently than standardised assessment methods in England, with 50% of pupils being in schools where headteachers reported that teacher-developed tests were used between 3 and 5 times a year, and 44% of pupils being in schools where the headteacher reported that they were used monthly or more. On average across OECD countries 28% of pupils were in schools where headteachers reported using teacher-developed tests between 3 and 5 times a year and 62% were in schools where headteachers reported that they were used monthly or more frequently.

In mathematics classrooms, headteachers reported that the most frequently used assessment method in England was teacher-developed tests with 55% of pupils being in schools where headteachers reported that they were used at least monthly. In England, 36% of pupils were in schools where headteachers reported that students were assessed in mathematics using teachers' judgment ratings at least monthly. In contrast, on average across OECD countries 61% of pupils were in schools where headteachers reported using teachers' judgement ratings at least monthly.

Headteachers were also asked to report on how the information gained from both standardised testing and teacher-developed tests was used by teachers and the school. In England, the majority of pupils were in schools where headteachers reported using standardised testing to monitor school progress year to year (84%), to compare school performance to national/district performance (83%) and to identify aspects of instruction or the curriculum that could be improved (78%). Teacher-developed tests, on the other hand, were more commonly reported to be used for the purposes of guiding pupils' learning, to inform parents or guardians about their child's progress and to adapt teaching to pupils' needs (over 96% of pupils).

8.4.5 Monitoring and evaluation

Headteachers in participating schools reported on the procedures, policies and practices associated with quality assurance and school improvements at their schools. They were asked to describe the quality assurance practices listed in Table 8.5 with the following response options "Yes, this is mandatory", "Yes, on the school's initiative" and "No".

The most frequent quality assurance and school improvement activities reported by headteachers in England are shown in Table 8.5. The majority of pupils in England and on average across OECD countries were in schools that used each of these quality assurance and school improvement activities. In England, 97% of pupils were in schools that used external evaluation while on average across OECD countries 78% of pupils were in schools that used external evaluation. Similarly, in England 89% of pupils were in schools that have regular consultation aimed at school improvement with one or more experts over a period of at least six months while on average across OECD countries 53% of pupils were in schools that have regular consultation aimed at school improvement with one or more experts over a period of at least six months.

The vast majority of pupils in England were in schools where the headteacher reported that internal evaluations, written specification of the school's curricular profile and educational goals or pupil performance, teacher mentoring, and systematic data collection or attendance and test results were used in their schools either because they were mandatory external or as a result of an internal school initiative.

Table 8.5: Quality assurance and school improvement activities used as reported by headteachers in England and on average across OECD countries weighted by the number of pupils they represent.

Quality assurance and school improvement activities	England	OECD
Internal evaluation / Self-evaluation	> 98%	95%
External evaluation	97%	78%
Written specification of the school's curricular profile and educational goals	> 98%	92%
Written specification of pupil performance standards	96%	86%
Systematic recording of data such as teacher or pupil attendance and professional development	> 98%	95%
Systematic recording of pupil test results and graduation rates	> 98%	95%
Seeking written feedback from pupils	83%	71%
Teacher mentoring	97%	81%
Regular consultation aimed at school improvement with one or more experts over a period of at least six months	89%	53%
Implementation of a standardised policy for mathematics subjects	81%	67%

Base: England data based on between 3,856 and 3,889 pupils from 133 or 134 schools (80% or 81% weighted pupil response rate). OECD average percentage based on data from 37 OECD countries. Percentages are the percentages of pupils in schools where the headteachers reported that these activities were used, either because they were mandatory or on the school's initiative.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022, SC037

Headteachers were also asked to report on the impact of external evaluations at their school by describing how the results of the evaluations are used. A majority of pupils were in schools where headteachers said that they use the data from external evaluations to plan specific actions for school development (93%) and to improve teaching (89%). Although a large percentage of pupils (93%) were in schools where headteachers reported that they put measures derived from the results into practice, 25% of pupils were in schools where the headteacher reported that the results of external evaluation have not led to changes in school policy.

Table 8.6: The percentage of pupils from participating schools in England and on average across OECD countries whose headteachers reported each impact of external evaluation

Impact of external evaluations	England	OECD
The results of external evaluation led to changes in school policies	75%	54%
We used the data to plan specific action for school development	93%	71%
We used the data to plan specific action for the improvement of teaching	89%	69%
We put measures derived from the results of external evaluations into practice	93%	67%

Base: England data based on 3,921 pupils from 135 schools (82% weighted pupil response rate). OECD average percentage based on data from 37 OECD countries.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022, SC200

Headteachers were also asked to state which approaches to monitoring teachers were used at their school in the last school year. The percentage of pupils in schools where headteachers in England and on average across OECD countries reported each approach are presented in Table 8.7.

Table 8.7: Approaches to monitoring teachers at school as reported by headteachers in England and on average across OECD countries weighted by the number of pupils they represent

Approach to monitoring teachers	England	OECD
Tests or assessments of pupil achievement	78%	73%
Teacher peer review (of lesson plans, assessment instruments, lessons)	91%	58%
Headteacher or senior staff observations of lessons	94%	77%
Observation of classes by inspectors or other persons external to the school	69%	33%

Base: England data based on 3,919 pupils from 135 schools (82% weighted pupil response rate). OECD average percentage based on data from 37 OECD countries.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022, SC032

Lesson observations by the headteacher or senior staff members were reported to be used in the last year to monitor teachers by the headteachers of 94% of the pupils in England and 77% of the pupils on average across OECD countries. Lesson observations by external inspectors were less commonly reported in England (69%) and only reported by the headteachers of 3% of pupils on average across OECD countries.

According to headteacher reports, teacher appraisals were not likely to have an impact on teachers' salaries or other financial rewards in England. However, teacher appraisals were reported to have moderate to large impacts on opportunities for professional development with around 80% of pupils being in schools where headteachers in England reported this.

8.4.6 Teacher professional development

Headteachers were asked to report the percentage of teachers at their school who had attended a formal programme of professional development in the three months before the study took place in autumn 2022. To qualify as a programme of professional development for this item, the session needed to be designed to enhance teaching skills or pedagogical practice, focused on teaching and education, and have lasted for at least one full day. It was not necessary for the professional development activities to lead to a recognised qualification.

In England, 82% of teachers in school had attended recent professional development sessions according to headteachers. On average across OECD countries, 51% of the teachers at schools had recently attended professional development according to headteachers.

Headteachers were also asked to state the percentage of mathematics teachers who had recently attended professional development. In England and on average across OECD countries, the average number of mathematics teachers who were reported to have attended recent professional development was very similar to the averages reported for all staff (80% and 48% respectively).

Headteachers also described the in-house professional development activities that took place at their schools. Table 8.8 shows the percentage of pupils in schools where headteachers reported that their school organised in-house professional development activities in the form of specialist training sessions, workshops for specific school issues, and/or workshops for specific groups of teachers. More than 97% of pupils in England were in schools where the headteacher reported that workshops specific to the issues that their school faces or that workshops for specific groups of teachers were organised. On average across OECD countries, 84% and 72% of pupils were in schools where the headteachers reported that these workshops were organised respectively.

Table 8.8: Type of in-house professional development activities as reported by headteachers in England and on average across OECD countries weighted by the number of pupils they represent

Type of professional development activity	England	OECD
Our school invites specialists to conduct in-service training for teachers	88%	80%
Our school organises in-service workshops which deal with specific issues that our school faces	97%	84%
Our school organises in-service workshops for specific groups of teachers	98%	72%

Base: England data based on 3,820 pupils from 132 schools (80% weighted pupil response rate). OECD average percentage based on data from 37 OECD countries.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022, SC027

8.5 School climate and the learning environment

This section describes the results from the school questionnaire items that examined school climate and the learning environment at participating schools. Headteachers were asked for their perspectives on different factors that might affect teaching and learning at their schools. Their responses describe issues related to key factors that might impact the overall school climate such as barriers to teaching, barriers to learning as well as pupil behaviours and the prevalence of issues such as vandalism or bullying.

8.5.1 Barriers to teaching and learning at school

There are numerous factors that might impact teaching and learning at schools. Headteachers were asked to describe the extent to which their school's capacity to provide teaching is hindered by the factors listed in Table 8.9.

Table 8.9: Percentage of pupils in schools where headteachers report specific issues faced by schools affecting teaching not at all or very little in England and on average across OECD countries

Instruction is hindered by:	England	OECD
A lack of teaching staff	46%	53%
Inadequate or poorly qualified teaching staff	80%	74%
A lack of assisting staff	59%	64%
Inadequate or poorly qualified assisting staff	81%	81%
A lack of educational material	88%	76%
Inadequate or poor quality educational material	91%	78%
A lack of physical infrastructure	78%	71%
Inadequate or poor quality physical infrastructure	77%	72%
A lack of digital resources	83%	76%
Inadequate or poor quality digital resources	80%	75%

Base: England data based on between 3,790 and 3,872 pupils from between 131 and 134 schools (79% to 81% weighted pupil response rate). OECD average percentage based on data from 37 OECD countries. Percentage of pupils in schools whose headteachers reported each statement happened very little or not at all.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022, SC017

For the majority of pupils, headteachers reported that a lack of or inadequate or poor quality resources such as education material, physical infrastructure or digital resources had very little or no impact on teaching. The most commonly reported barrier to teaching was a lack of teaching staff, with 54% of pupils in schools in England having headteachers who reported that this affected teaching to at least some extent. However, 80% of pupils were in schools where the headteacher reported that inadequate or poorly qualified teaching staff and very little or no impact on teaching. On average across OECD countries, the percentage of headteachers reporting that a lack of teaching staff hindered instruction was 47%. This indicates that headteachers feel that issues with having enough teaching and assistant staff are some of the greatest challenges affecting teaching in their schools.

Headteachers were also asked to describe the extent to which pupils' learning is hindered by factors relating to pupil and teacher behaviours. Table 8.10 presents the perspectives of headteachers of participating schools in England on issues hindering pupils' learning at their schools. There were very few reports from headteachers that any of these factors hindered learning 'a lot', with the majority of headteachers reporting that these factors had very little or no effect on learning. The most prevalent problem reported was pupil inattentiveness but the majority of pupils in England (66%), compared to 39% of pupils on average across OECD countries, were in schools where the headteachers said this hindered learning very little or not at all. Teacher absenteeism was reported by approximately three-quarters of headteachers in both England (73%) and on average across OECD countries (72%) as hindering learning very little or not at all.

Table 8.10: Percentage of pupils in schools where headteachers report specific issues faced by schools affecting learning very little or not at all in England and on average across OECD countries

Learning is hindered by:	England	OECD
Pupil truancy	79%	58%
Pupils skipping classes	82%	62%
Pupils lacking respect for teachers	81%	76%
Pupil use of alcohol or illegal drugs	96%	90%
Pupils intimidating or bullying other pupils	97%	87%
Pupils not paying attention	66%	39%
Teachers not meeting individual pupils' needs	81%	72%
Teacher absenteeism	73%	72%
Staff resisting change	91%	71%
Teachers being too strict with pupils	96%	87%
Teachers not being well prepared for classes	97%	89%

Base: England data based on between 3,827 and 3,859 pupils from 132 or 133 schools (80% weighted pupil response rate). OECD average percentage based on data from 37 OECD countries.
Percentage of pupils in schools with headteachers who reported each statement happened very little or not at all.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022, SC061

Headteachers were also asked to report on school climate in terms of the extent to which certain negative behaviours were a problem at their school. The responses from headteachers in England are shown in Table 8.11. Over three-quarters of pupils were in schools in England where headteachers reported that each of these problem behaviours happened very little or not at all. Overall, the reports suggest more extreme problem behaviours such as theft, vandalism, and physical harm were very uncommon in England. Profanity or verbal abuse and intimidation between pupils occurred in less than around one-quarter of schools with 81% of pupils in schools where the headteacher reported that profanity was not a problem at all or only to a small extent and 77% of pupils were in schools where headteachers reported that intimidation or verbal abuse among pupils was not a problem at all or only to a small extent.

Table 8.11: Percentage of pupils in schools where headteachers report specific problem behaviours at school that happened to a small extent or not at all in England and on average across OECD countries

Problem behaviour at school	England	OECD
Profanity	81%	71%
Vandalism	93%	86%
Theft	> 98%	95%
Intimidation or verbal abuse among pupils	77%	74%
Physical injury caused by pupils to other pupils	97%	96%
Intimidation or verbal abuse of teachers or non-teaching staff	96%	95%

Base: England data based on between 3,796 and 3,821 pupils from 131 to 132 schools (79% weighted pupil response rate). OECD average percentage based on data from 34 OECD countries.
Percentage of pupils in schools whose headteacher reported each statement happened very little or not at all.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022, SC172

8.5.2 Parental engagement

This section describes the headteachers' perspectives on the engagement between parents or guardians of pupils who participated in PISA 2022 and their school. Parental engagement is described in terms of activities such as participation in school activities, communication with teachers and support for learning at home. Headteachers were asked to report on the percentage of parents at their schools who participated in the school-related activities listed in Table 8.12.

Parents' discussions with teachers related to their child's behaviour and/or progress occurred more frequently than participation in school events or groups. In England, between 26% and 53% of pupils were in schools where headteachers reported that parents had discussions with teachers related to their child's behaviour and/or progress, compared to less than 10% of pupils in schools where headteachers reported that parents volunteered in physical or extra-curricular activities, participated in local school government, and/or assisted in fundraising for the school.

According to headteachers in England, teachers were more typically proactive in arranging discussions with parents than parents themselves. 36% and 53% of pupils were in schools where headteachers reported that parents had discussions about their child's behaviour and/or progress respectively that were initiated by teachers compared to 26% and 30% respectively of pupils where these discussions were initiated by parents themselves.

Table 8.12: Percentage of parents engaging in school-related activities as reported by headteachers in England and on average across the OECD countries weighted by the number of pupils they represent

Type of parental engagement	England	OECD
Discussed their child's behaviour with a teacher on the parents' or guardians' own initiative	26%	29%
Discussed their child's behaviour on the initiative of one of their child's teachers	36%	43%
Discussed their child's progress with a teacher on the parents' or guardians' own initiative	30%	33%
Discussed their child's progress on the initiative of one of their child's teachers	53%	52%
Volunteered in physical or extra-curricular activities	10%	11%
Participated in local school government	3%	15%
Assisted in fundraising for the school	10%	11%

Base: England data is based on between 3,657 and 3,746 pupils from between 126 and 129 schools (76% to 78% weighted pupil response rate). OECD average percentage based on data from 37 OECD countries. Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022, SC064

Headteachers were asked to describe further detail about the frequency of communication between school staff and parents. Reports of communication with parents from headteachers of schools in England with participating pupils are described in Table 8.13.

Communication with parents related to school programmes was reported for 59% of pupils to take place a few times a month or more often. Progress updates with parents about their child’s progress happened in almost all schools, but only 27% of pupils were in schools where headteachers reported this happened at least monthly with this usually occurring a few times a year (72% of pupils). Overall, headteachers reported varied but generally infrequent parental engagement regarding involvement in volunteering (3% of pupils), or school decision-making (less than 2% of pupils).

Table 8.13: Percentage of pupils in schools where engagement between school staff and parents in the last year happened at least monthly as reported by headteachers in England and on average across OECD countries

Type of communication	England	OECD
Invited parents or guardians to volunteer for school activities	3%	10%
Initiated communications with parents or guardians about school programmes	59%	29%
Initiated communications with parents or guardians about their child's progress	27%	49%
Included parents or guardians in making school decisions	> 2%	14%
Provided information to parents or guardians about how to help pupils with homework and other curriculum-related activities	32%	42%
Provided information to parents or guardians about how to help pupils improve their skills in mathematics	18%	31%

Base: England data based on between 3,681 and 3,706 pupils from 126 or 127 schools (76% or 77% weighted school response rate). OECD average percentage based on data from 37 OECD countries. Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022, SC192

8.5.3 Extra-curricular activities

This section describes information reported by headteachers of participating schools on the different extra-curricular activities offered at their schools. Table 8.14 displays the percentage of schools that offered various extra-curricular activities in the school year leading up to the PISA study in autumn 2022, as reported by headteachers.

In England, sporting and volunteering activities were reported for at least 98% of pupils by their headteachers. Sporting and volunteering activities were also commonly reported across OECD countries, with an average of 83% of pupils being in schools where headteachers reported offering sporting activities and 70% of pupils being in schools offering volunteering activities in the past year. Between 87% and 93% of pupils were in schools in England where headteachers reported that music, drama and art activities were offered at their school in the past year, compared to the OECD averages of between 50% and 59%.

The majority of pupils were in schools in England where headteachers reported that a mathematics club (79%) and mathematics competitions (88%) were offered at their school in the previous year, with 28% and 66% of pupils on average across OECD countries respectively.

Table 8.14: Percentage of pupils in schools where the headteacher reported specific extra-curricular activities offered at the school in 2022 in England and on average across OECD countries

Type of extra-curricular activity offered	England	OECD
Band, orchestra or choir	93%	57%
School play or school musical	87%	50%
School yearbook, newspaper or magazine	58%	42%
Volunteering or service activities	> 98%	70%
Mathematics club	79%	28%
Mathematics competitions	88%	66%
Chess club	74%	32%
Club with a focus on computers	80%	42%
Art club or art activities	92%	59%
Sporting team or sporting activities	> 98%	83%

Base: England data based on between 3,792 and 3,826 pupils from 131 or 132 schools (79% or 80% weighted school response rate). OECD average percentage based on data from 37 OECD countries. Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022, SC053

In addition to extra-curricular activities, the majority of schools also provided extra study support for pupils within the school. Table 8.15 shows headteachers’ reports of the type of study support offered at schools to 15-year-old pupils in England and across OECD countries.

The majority of pupils in England were in schools where the headteacher reported that they provided rooms for pupils to do homework and offered staff to support with homework (more than 94%). Peer tutoring programmes were less common, reported to be available for 55% of pupils in England by their headteacher. This was similar to the pattern on average across OECD countries where 74% of pupils were in schools where the headteachers reported that they provided a room where pupils could do their homework, 63% were in schools where the headteacher stated that they provided staff to help with homework, and 51% were in schools that provided peer-to-peer tutoring.

Headteachers were also asked whether or not they offered additional mathematics lessons apart from maths lessons offered during the usual school hours at their schools. In England, 86% of pupils being in schools where headteachers reported offering additional mathematics lessons and 62% of pupils on average across OECD countries.

Table 8.15: Percentage of pupils in schools where the headteacher report specific study support for pupils within the school in England and on average across OECD countries

Type of study support	England	OECD
Room(s) where the pupils can do their homework	96%	74%
Staff help with homework	94%	63%
Peer-to-peer tutoring	55%	51%

Base: England data based on between 3,830 and 3,858 pupils from 132 or 133 schools (80% weighted pupil response rate). OECD average percentage based on data from 37 OECD countries.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022, SC212

8.5.4 Career development activities

As well as extra-curricular and study support, headteachers were also asked about career guidance offerings that they provide at school. This section describes the information provided by headteachers in England on the prevalence, delivery, responsibilities and types of career guidance available to pupils in Years 10 and 11.

In England, over 98% of pupils were in schools where headteachers reported that they offered some form of career guidance at their school. Across OECD countries an average of 84% of pupils were in schools where the headteacher reported that they provided career guidance. Table 8.16 shows that of the career guidance offered, almost all pupils (95%) were in schools where the headteacher reported that it was formally scheduled into school hours and few (5%) were in schools where the headteacher reported that this was sought voluntarily by pupils in England. In contrast, an average of 29% of pupils across OECD countries were in schools where the headteacher reported that career guidance was voluntarily sought at their school. This indicates that the approach to career guidance in England was more structured than was typical internationally.

Table 8.16: Percentage of pupils in schools where the headteacher reported specific structures of career guidance support offered at the school in England and on average across OECD countries

Structure of career guidance	England	OECD
Career guidance is sought voluntarily by pupils	5%	31%
Career guidance is formally scheduled into pupils' time at school	95%	69%

Base: England data based on 3,776 pupils from 130 schools (78% weighted pupil response rate). OECD average percentage based on data from 37 OECD countries.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022, SC210

Table 8.17 shows the type of career information offered to Years 10 and 11 pupils in England. According to headteachers, the vast majority of pupils in England were in schools that provided information about future careers and educational opportunities, and information about internships was offered to 96% of pupils. In England, 78% of pupils were in schools where the headteacher reported giving information about pupil financing.

Table 8.17: Percentage of pupils in schools where the headteacher reported different types of information on careers offered to Year 10 and 11 pupils at the school in England and on average across OECD countries

Type of career information offered	England	OECD
Information about internships	96%	68%
Information about future careers	> 98%	89%
Information about future educational opportunities	> 98%	94%
Information about pupil financing	78%	63%

Base: England data based on 3,683 pupils from 127 schools (77% weighted pupil response rate). OECD average percentage based on data from 35 OECD countries.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022, SC171

On average across OECD countries, the majority of pupils were in schools where the headteachers reported their school offered information to their pupils about future careers (89%) and future educational opportunities (94%). Fewer had headteachers who reported that their school provided information about internships (68%) or pupil financing (63%).

Headteachers were also asked to report on who has responsibility for the career guidance offered at their school, with their responses described in Table 8.18.

Approximately half of the pupils in England (53%) were in schools where the headteacher stated that guidance counsellors who were employed by the school had the main responsibility for career guidance with another 10% of pupils being in schools where specific guidance counsellors who regularly visited the school had primary responsibility for career guidance, while 30% of pupils were in schools where the headteacher reported that certain teachers were primarily responsible. The distribution of responsibility for career guidance in England was consistent with the international pattern on average across OECD countries.

Table 8.18: Percentage of pupils in schools where the headteacher reported who had responsibility for career guidance at school in England and on average across OECD countries

Responsible for career guidance	England	OECD
All teachers share the responsibility for career guidance	7%	14%
Specific teachers have the main responsibility for career guidance	30%	30%
One or more specific career guidance counsellors employed at school have the main responsibility for career guidance	53%	48%
One or more specific career guidance counsellors who regularly visit the school have the main responsibility for career	10%	11%

Base: England data based on 3,745 pupils from 129 schools (78% weighted pupil response rate). OECD average percentage based on data from 37 OECD countries.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022, SC170

8.6 School-level variation in mathematics performance

PISA provides information about the extent to which mathematics performance varies across different schools, as well as how much it varies within each of the participating schools. School level variation in mathematics performance can provide insight into the level of heterogeneity at and across schools. On average across OECD countries, 32% of the total variance in mathematics performance in PISA 2022 was attributed to differences between schools, while the remaining 68% of the variance was attributed to differences within schools. In England, only 22% of the total variance in mathematics performance was between schools, which was lower than the OECD average, with the remaining 78% attributed to differences within schools. This suggests there was slightly less heterogeneity between schools in England compared to other OECD countries.

9 PISA across the United Kingdom

9.1 Chapter overview

This chapter compares the PISA mathematics, reading and science scores for England, Northern Ireland, Scotland and Wales. The analysis includes a comparison of how each nation scores across the mathematics sub-domains described in Chapter 3. This chapter also compares the relative performance of the highest and lowest achieving pupils in each UK nation, the relative gender differences in average scores, and the relative differences between the most and least disadvantaged socioeconomic groups. Caution needs to be taken in interpreting these findings as some of the sampling standards for PISA 2022 were not met in England, Scotland, Wales and Northern Ireland, as described in Chapter 1.

9.2 Key findings

- All UK nations had significantly lower average scores for mathematics and reading relative to their performance in 2018. In science there were no significant differences between the average scores in 2022 and in 2018 in England, Northern Ireland and Scotland, but in Wales there was a significant decrease in the average score.
- The average mathematics score for England (492) was significantly higher than the average scores for Northern Ireland (475), Scotland (471) and Wales (466).
- The difference between the highest and lowest scores on the mathematics subdomain scores was consistent across the different subdomains, suggesting that individual nations do not have particular strengths or weaknesses (relative to each other) in terms of the different areas of mathematics that were assessed in PISA 2022.
- The average reading score for England (496) was significantly higher than the average scores for Northern Ireland (485) and Wales (466) but not significantly different to the score for Scotland (493).
- The average science score for England (503) was significantly higher than the average scores for Northern Ireland (488), Scotland (483) and Wales (473).
- Gender differences in PISA 2022 were consistent across the nations of the UK, with boys having a significantly higher average score for mathematics and girls having a significantly higher average score for reading. In science there were no significant gender differences in any nation of the UK.

- Pupils from less disadvantaged socioeconomic backgrounds performed significantly better than those from more disadvantaged backgrounds across all domains and all UK nations.

9.3 Introduction

This chapter compares the PISA scores for England, Northern Ireland, Scotland and Wales. Although the OECD reports on the United Kingdom (UK) as a single participating country, schools and pupils from each of the constituent nations are sampled separately. This means that each UK nation samples enough schools and pupils to report their scores separately, allowing reasonably robust comparisons between scores to be made.

Though there are many similarities between England, Northern Ireland, Scotland and Wales, there are also substantive differences in terms of their education systems, culture, and demographic composition. This report does not attempt to explore possible explanations for the differing scores between the UK nations.

To this end, this chapter summarises and compares the scores for UK nations across the three domains of mathematics, reading and science. The chapter also compares performance across the mathematics sub-domains, thus providing insight into the relative strengths and weaknesses of each nation in terms of their performance in mathematics. It also compares the relative performance of high- and low-achieving pupils and relative differences in performance across socioeconomic groups and by gender across nations.

As has been noted throughout the previous chapters, England's school-level and pupil-level response rates did not meet some of the PISA sampling standards (as was the case with the other UK nations), and so caution is required when interpreting the analysis reported here. Please see Chapter 1 for more information about how to interpret the findings of this report.

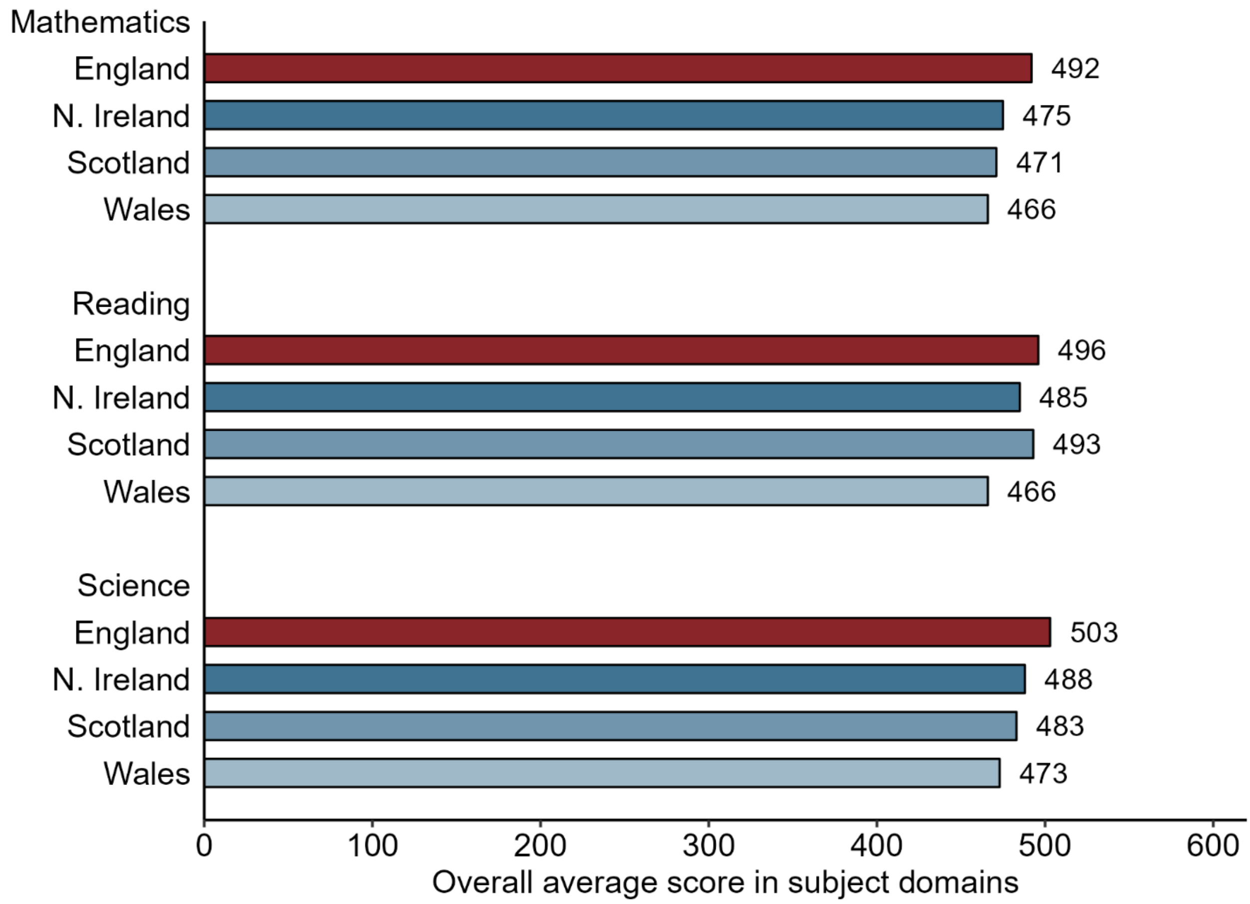
9.4 Comparing average scores across the UK

Figure 9.1 shows the average PISA scores for each nation in each of the three domains. It is important to note that not all differences between nations are statistically significant. The rank order of UK nations should therefore be interpreted with caution. Please see the data tables in Appendices B, C and D for more detailed statistical information about the nations. This section focuses on statistically significant differences between the average scores of England and the other UK nations.

For mathematics, the average score for pupils in England was 492. This was significantly higher than the average score for Northern Ireland (475), Scotland (471) and Wales (466).

For reading, the difference between the average score for England (496) and Northern Ireland (485) was significant, as was the difference between England and Wales (466). The difference between England and Scotland (493) was not significant.

Figure 9.1: Average PISA score by nation



Nation	Mathematics	Reading	Science
England	492	496	503
Northern Ireland	*475	*485	*488
Scotland	*471	493	*483
Wales	*466	*466	*473

Base: all participating pupils
An asterisk (*) indicates where a nation's score was significantly different to the equivalent score for England.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022

Finally, the average pupil score for science in England was 503. The differences between the average score of England and the other UK nations are all statistically significant, with Northern Ireland having an average score of 488, Scotland an average score of 483 and Wales an average score 473.

The scores for mathematics can be broken down into the 8 subdomains that are described in Chapter 3. Table 9.1 provides a summary of how each nation performed in each of these subdomains. As with the overall average scores, it is important to note that not all differences in scores in subdomains between nations are statistically significant, and the rank order of UK nations should be interpreted cautiously. Here, we focus on comparing England to the other UK nations. In this case, the difference in the subdomain specific average scores attained by pupils in England and those attained by each of the other UK nations are statistically significant in all cases.

Table 9.1: Average PISA mathematics subdomain score by nation

Mathematics subdomain	England	Northern Ireland	Scotland	Wales
Change and relationships	491	475	464	465
Quantity	491	478	474	462
Space and shape	480	461	461	451
Uncertainty and data	502	482	476	475
Mathematical reasoning	493	474	477	467
Employing	492	476	465	464
Formulating	488	471	462	461
Interpreting	495	479	477	467

Base: all participating pupils.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022

Similarly to the overall score for mathematics, England has the highest average scores for each of the subdomains. The disparity between the highest and lowest scoring nations was similar across the subdomains. This suggests that the differences between the nations in overall performance do not reflect disparities in specific subdomains but rather a consistent difference across all of them. In other words, though there are differences in how the nations performed in mathematics overall, these do not appear to stem from differences in particular subdomains.

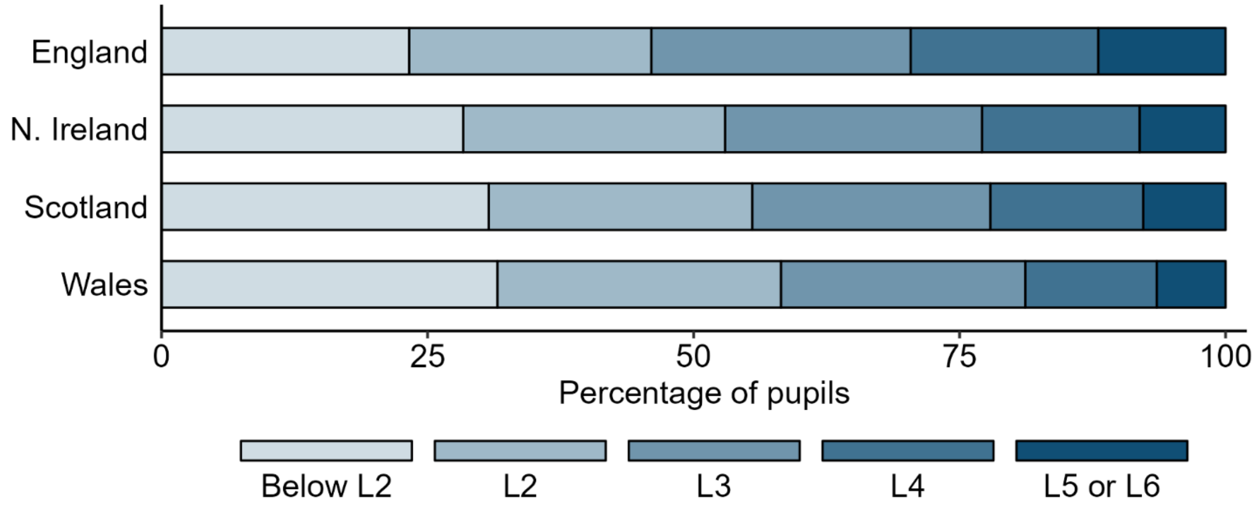
9.5 Performance across the PISA proficiency levels

The UK nations may also be compared in terms of the percentages of pupils performing at each of the PISA proficiency levels for mathematics, reading and science (see OECD assessment frameworks for an explanation of these levels). These proficiency levels range between 1 and 6, with Level 1 further divided into Levels 1a, 1b and 1c for mathematics and Levels 1a and 1b for reading and science (a score may also fall below the threshold for Level 1). In the following sections the UK nations are compared with regard to their percentage of top performing pupils (those pupils attaining Level 5 or Level 6) and low performing pupils (those pupils attaining below Level 2).

9.5.1 Mathematics

Figure 9.2 shows the percentage of pupils attaining at each PISA mathematics proficiency level for each nation of the UK. For England, 12% of pupils attained at Level 5 or 6, a significantly larger percentage of pupils than in Northern Ireland (8%), Scotland (8%) or Wales (6%). In terms of the lowest performing pupils, 23% of pupils in England attained below Level 2. This was significantly smaller than Wales (32%), Scotland (31%) and Northern Ireland (28%). In general, the percentages of pupils at each level reflect the differences in the overall average PISA mathematics scores that are discussed in section 9.4.

Figure 9.2: Percentage of pupils performing at each mathematics proficiency level by UK nation



Nation	Below L2	L2	L3	L4	L5 or L6
England	23%	23%	24%	18%	12%
Northern Ireland	* 28%	25%	24%	* 15%	* 8%
Scotland	* 31%	25%	22%	* 14%	* 8%
Wales	* 32%	* 27%	23%	* 12%	* 6%

Base: all participating pupils.
An asterisk (*) indicates where a percentage was significantly different to the equivalent percentage for England.
Percentages may appear inconsistent due to rounding.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

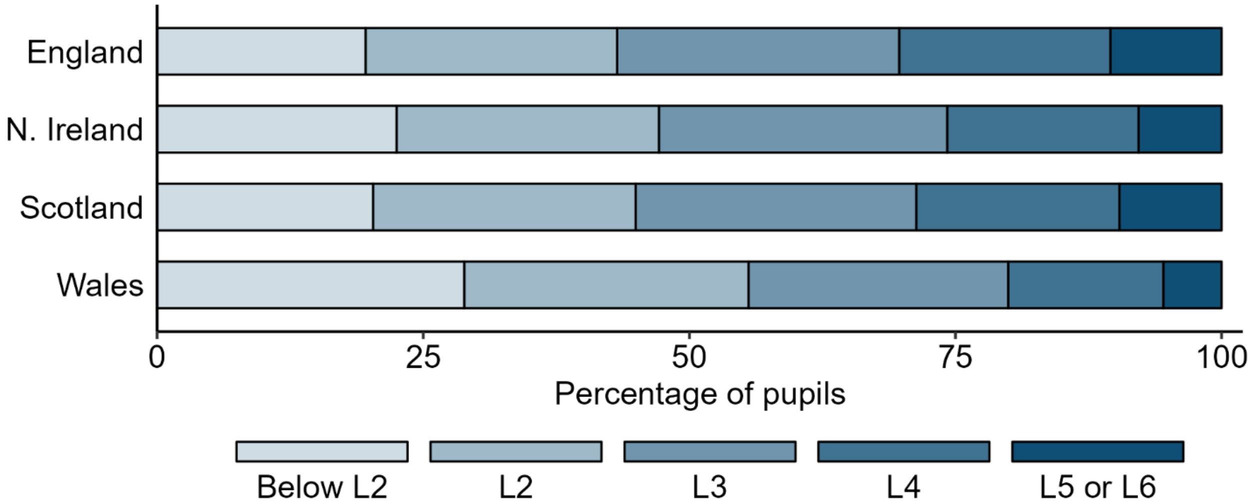
Source: OECD, PISA 2022

9.5.2 Reading

Figure 9.3 shows the percentage of pupils performing at each PISA reading proficiency level in each nation of the UK. When comparing the percentage of top performing pupils, 10% of pupils in England attained at Level 5 or 6, which was significantly more than in both Northern Ireland (8%) and Wales (5%), though not significantly different to Scotland (10%).

One-fifth (20%) of pupils were low performing, attaining below Level 2 in England, which was not significantly different to the percentages in either Northern Ireland (22%) or Scotland (20%), but was significantly smaller than the percentage in Wales (29%). As with mathematics, this broadly reflects the differences between each nation's overall average reading score.

Figure 9.3: Percentage of pupils performing at each reading proficiency level by UK nation



Nation	Below L2	L2	L3	L4	L5 or L6
England	20%	24%	26%	20%	10%
Northern Ireland	22%	25%	27%	18%	*8%
Scotland	20%	25%	26%	19%	10%
Wales	*29%	27%	24%	*15%	*5%

Base: all participating pupils
An asterisk (*) indicates where a percentage was significantly different to the equivalent percentage for England.
Percentages may appear inconsistent due to rounding.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

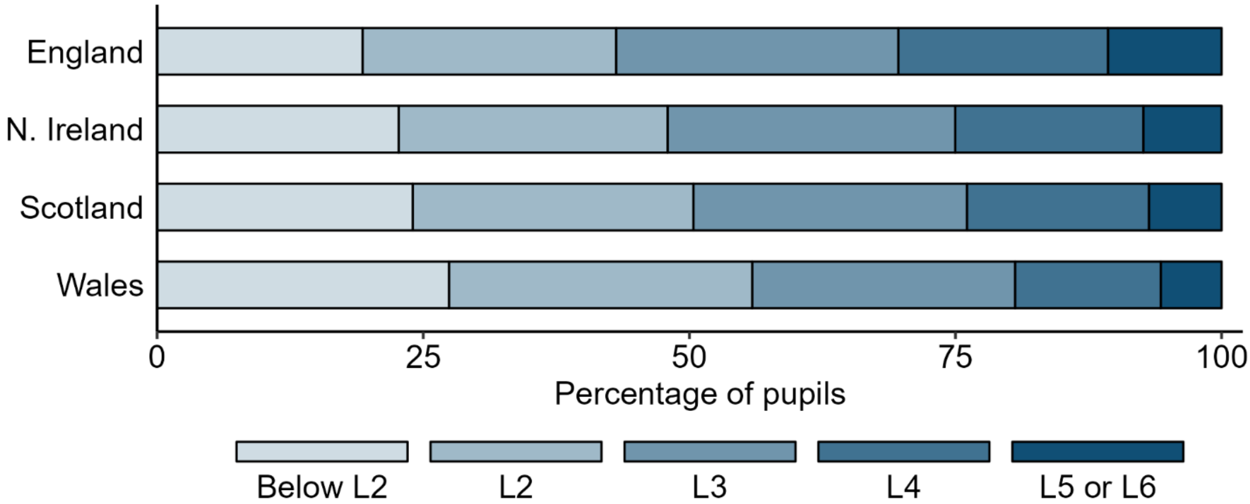
Source: OECD, PISA 2022

9.5.3 Science

Figure 9.4 shows the percentage of pupils attaining at each PISA science proficiency level in each nation of the UK. In England, 11% of pupils were top performing, attaining at Level 5 or at Level 6, which was significantly larger than the percentage of top performing pupils in each of Northern Ireland (7%), Scotland and Wales (6%).

Around one-fifth of pupils in England (19%) were low performing, attaining below Level 2. The percentage of pupils who attained below Level 2 in England was significantly smaller than the percentage for each of Northern Ireland (23%), Scotland (24%) and Wales (27%).

Figure 9.4: Percentage of pupils performing at each science proficiency level by UK nation



Nation	Below L2	L2	L3	L4	L5 or L6
England	19%	24%	27%	20%	11%
Northern Ireland	* 23%	25%	27%	18%	* 7%
Scotland	* 24%	26%	26%	* 17%	* 7%
Wales	* 27%	* 28%	25%	* 14%	* 6%

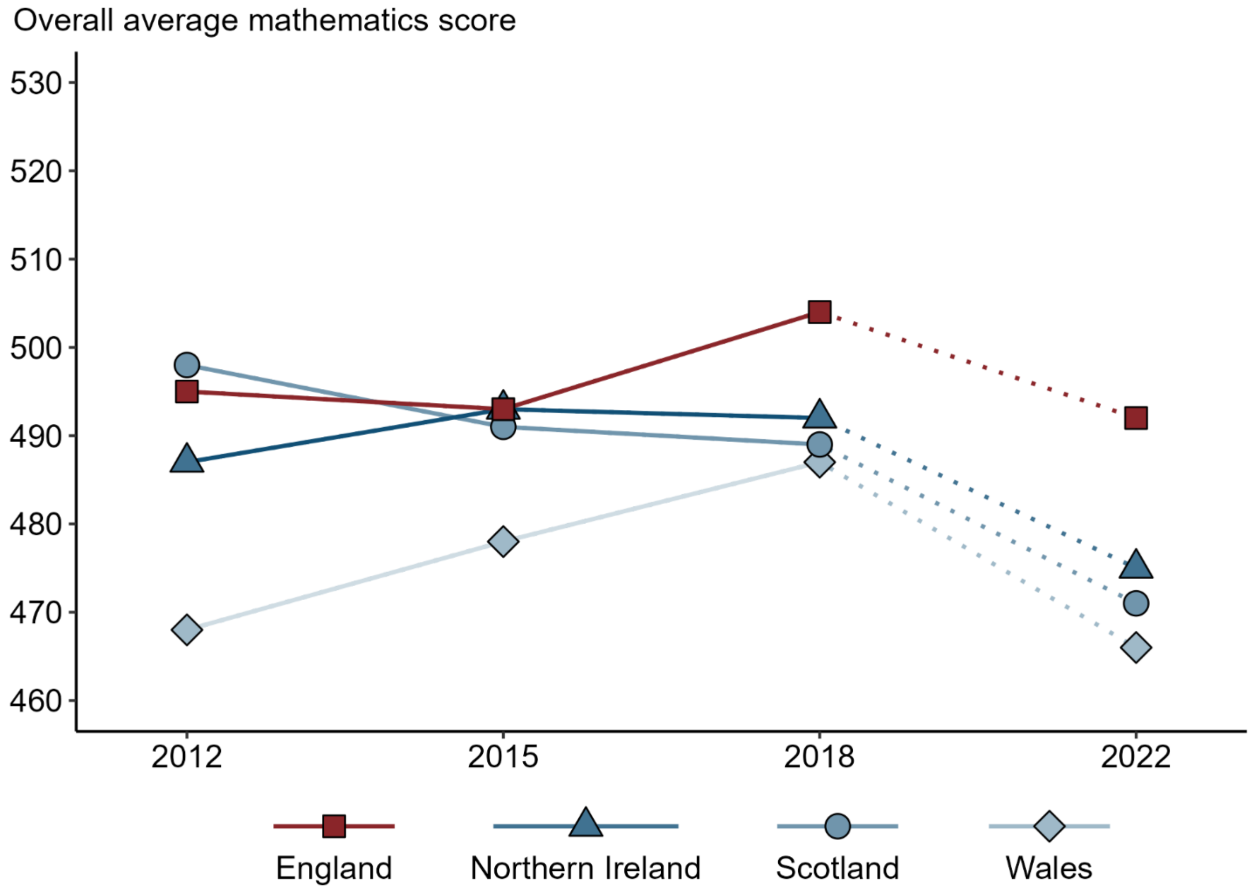
Base: all participating pupils.
An asterisk (*) indicates where a percentage was significantly different to the equivalent percentage for England.
Percentages may appear inconsistent due to rounding.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022

9.6 Performance over time

Figure 9.5 shows how average mathematics scores for each nation have changed over the ten-year period of 2012 to 2022. The differences between the 2018 and 2022 scores were statistically significant for England, Northern Ireland, Scotland, or Wales. In England, the average score for mathematics had decreased significantly by 12 points from 504 in 2018 to 492 in 2022 (but was not significantly different from the average scores in 2015 (493), 2012 (495), 2009 (493) or 2006 (495). Statistically significant decreases between 2018 and 2022 were also found for Northern Ireland (17 points), Scotland (18 points) and Wales (21 points).

Figure 9.5: Trends in average mathematics score by UK nation



Nation	2012	2015	2018	2022
England	495	493	*504	492
Northern Ireland	*487	*493	*492	475
Scotland	*498	*491	*489	471
Wales	468	*478	*487	466

Base: All participating pupils
Asterisks (*) indicate that the score shown is significantly different to that country's score for PISA 2022.
Trend results between 2018 and 2022 in all UK nations are indicated with dotted lines in the figure as some of the PISA sampling standards were not all met.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included education systems.

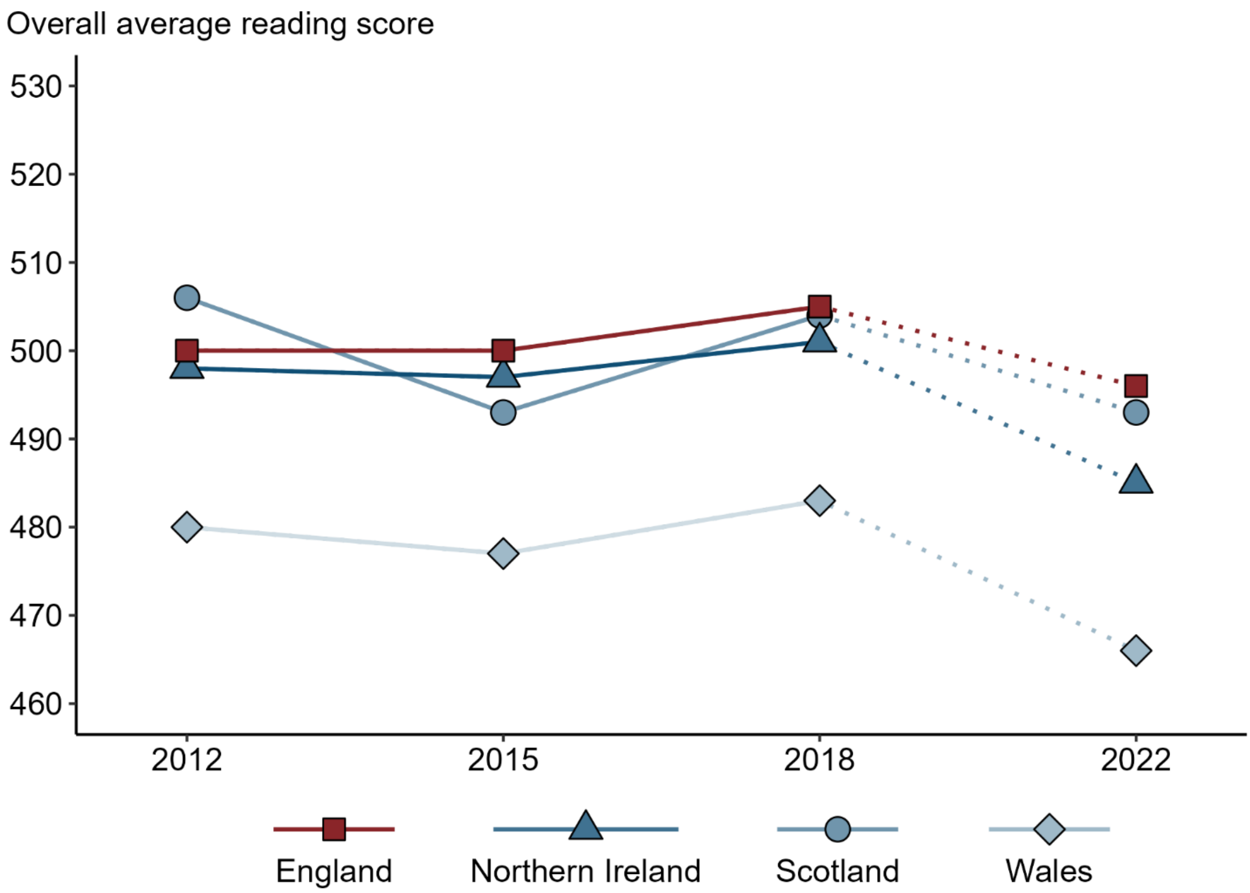
Source: OECD, PISA 2022

Over the 10-year period, the average mathematics score for England in 2022 (492) was not significantly different to the score in 2012 (495). The difference between the average scores in 2012 and 2022 was statistically significant for Scotland (a decline of 27 points) and Northern Ireland (a decline of 12 points) but not for Wales.

A similar, if less pronounced, pattern was apparent for reading (Figure 9.6). The average score for reading had significantly decreased by 9 points in England, falling from 505 in

2018 to 496 in 2022. Significant decreases were also found for Scotland (11 points), Northern Ireland (12 points) and Wales (17 points).

Figure 9.6: Trends in average reading score by UK nation



Nation	2012	2015	2018	2022
England	500	500	*505	496
Northern Ireland	498	497	*501	485
Scotland	506	493	*504	493
Wales	480	477	*483	466

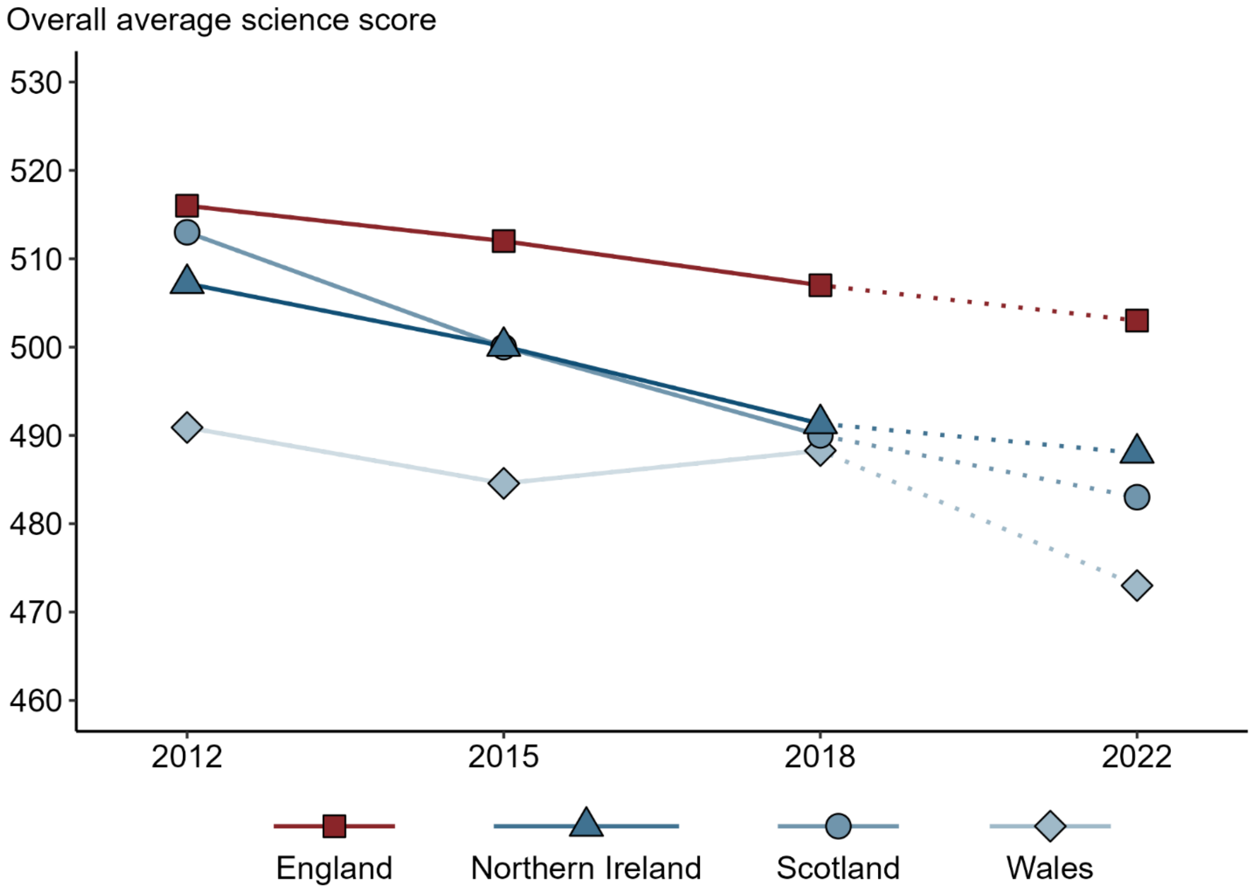
Base: All participating pupils
Asterisks (*) indicate that the score shown was significantly different to that country's score for PISA 2022.
Trend results between 2018 and 2022 in all UK nations are indicated with dotted lines in the figure as some of the PISA sampling standards were not all met.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included education systems.

Source: OECD, PISA 2022

When considering the longer-term comparison between the average scores in 2012 and those in 2022, none of the differences in any nation reached the threshold for statistical significance – scores in 2022 were not significantly different to scores in 2012 or 2015 for any of the UK nations.

Figure 9.7 shows how average science scores have changed over time for each UK nation. The average score for science in England (503) was not significantly different to the score in 2018 (507). There was also no significant change in the average science score for Northern Ireland between 2018 (491) and 2022 (488), nor was there one in Scotland, where the score was 490 in 2018 and 483 in 2022. However, in Wales there was a significant decrease of 15 points from 488 in 2018 to 473 in 2022.

Figure 9.7: Trends in average science score by UK nation



Nation	2012	2015	2018	2022
England	516	*512	507	503
Northern Ireland	*507	*503	491	488
Scotland	*513	*497	490	483
Wales	*491	*485	*488	473

Base: All participating pupils
Asterisks (*) indicate that the score shown was significantly different to that country's score for PISA 2022.
Trend results between 2018 and 2022 in all UK nations are indicated with dotted lines in the figure as some of the PISA sampling standards were not all met.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met in some of the included education systems.

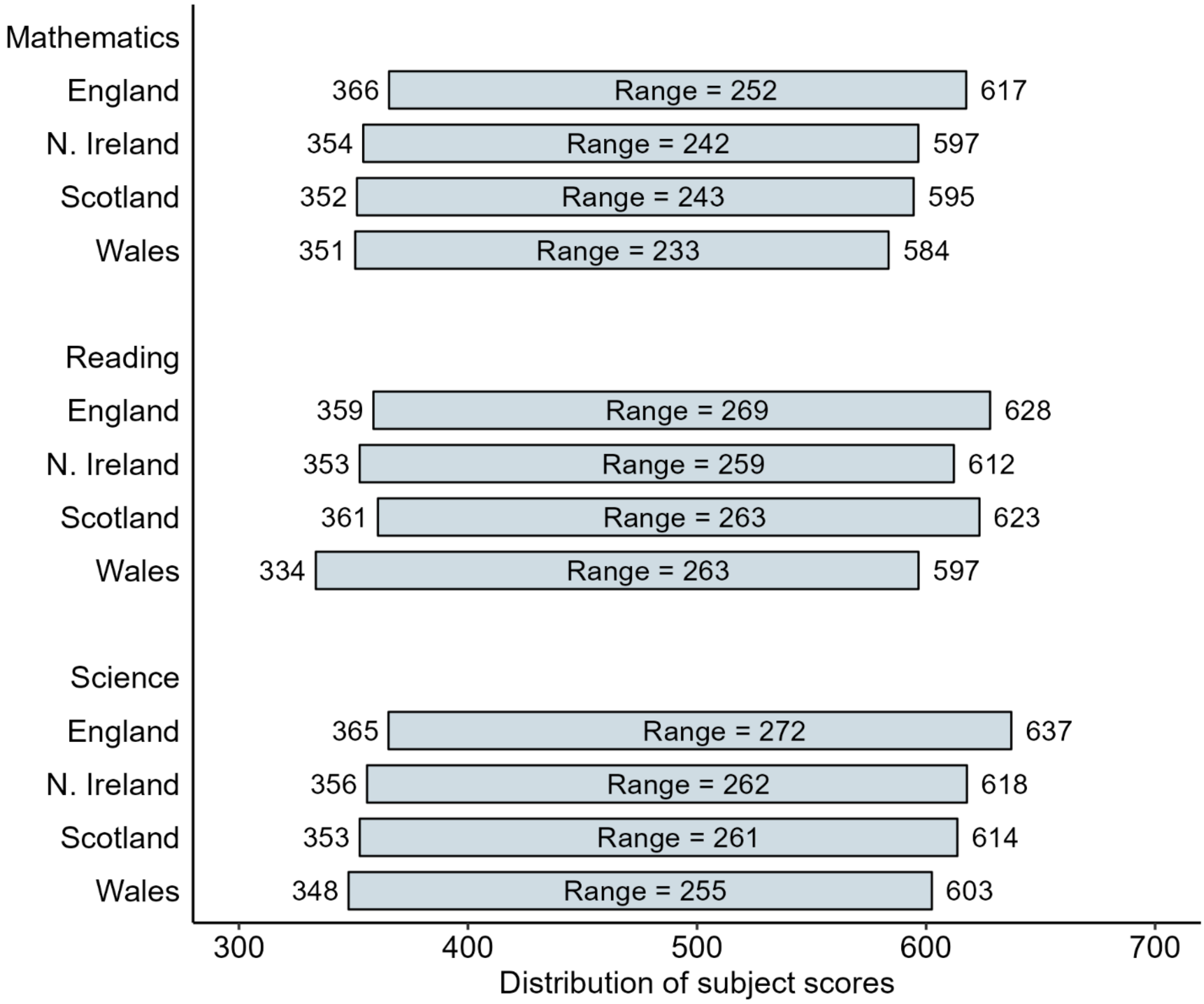
Source: OECD, PISA 2022

Over the longer term, the average science score for England in 2022 (503) was not significantly different from the scores in 2012 (516) or 2009 (515), though the difference to between 2022 and 2015 (512) did reach the threshold for statistical significance. The difference between the average scores in 2012 and 2022 was statistically significant for Scotland (a decline of 30 points), Northern Ireland (a decline of 19 points) and Wales (a decline of 18 points).

9.7 Scores of high and low achievers

This section compares the performance of the highest and lowest achieving groups in each nation. The 90th percentile is the score above which the highest-performing 10% of pupils obtain, while the 10th percentile is the score below which the lowest-performing 10% of pupils obtain. Figure 9.8 shows the 10th and 90th percentile scores for mathematics, reading and science for each UK nation and provides the difference (the gap) between these two scores.

Figure 9.8: Range between 10th and 90th percentile scores by domain and nation



Domain and Nation	10th percentile	90th percentile	Range
Mathematics - England	366	617	252
Mathematics - Northern Ireland	354	597	242
Mathematics - Scotland	352	595	243
Mathematics - Wales	351	584	233
Reading - England	359	628	269
Reading - Northern Ireland	353	612	259
Reading - Scotland	361	623	263
Reading - Wales	334	597	263
Science - England	365	637	272
Science - Northern Ireland	356	618	262
Science - Scotland	353	614	261
Science - Wales	348	603	255

Base: all participating pupils
Ranges calculated as 90th percentile – 10th percentile.
Ranges may appear inconsistent with percentile scores due to rounding.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022

When comparing the size of the gaps between the 90th and 10th percentile for each UK nation and each subject domain it is important to note that the differences between them were not statistically significant. The difference between the scores of the highest and lowest achieving pupils was therefore similar in each of the UK nations, with each nation exhibiting a similar range of scores across their pupils (the differences between the average scores of the UK nations therefore represent differences across the full attainment range).

9.8 Gender differences

This section provides the average PISA scores for girls and boys in each subject domain in each UK nation. In the following tables, the difference between these scores is determined by subtracting the boys' average score from the girls' average score. A positive difference represents a gender difference favouring girls and a negative difference represents a gender difference favouring boys.

Table 9.2 displays the average scores for mathematics, showing that, for all four UK nations, boys had a higher average score than girls. The difference in England was 15 points compared to 9 points in Wales, 12 points in Northern Ireland and 16 score points in Scotland.

Table 9.2: PISA mathematics score gender difference by nation

Nation	Girls average score	Boys average score	Difference
England	485	499	-15
Northern Ireland	469	481	-12
Scotland	463	478	-16
Wales	461	470	-9

Base: all participating pupils.
Difference calculated as girls' score minus boys' score
Differences may appear inconsistent with average scores due to rounding
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022

Table 9.3 shows the average PISA reading scores by gender for each nation. For reading, girls had a significantly higher average score than boys in all four UK nations. The difference was 16 points for England, which was similar for Northern Ireland (18 points), Scotland (18 points) and Wales (19 points).

Table 9.3: PISA reading score gender difference by nation

Nation	Girls average score	Boys average score	Difference
England	505	488	16
Northern Ireland	494	476	18
Scotland	502	484	18
Wales	475	456	19

Base: all participating pupils.
Difference calculated as girls' score minus boys' score
Differences may appear inconsistent with average scores due to rounding
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022

Table 9.4 shows the average PISA science scores by gender. Gender differences for science were not statistically significant for any of the UK nations.

Table 9.4: PISA science score gender difference by nation

Nation	Girls average score	Boys average score	Difference
England	499	507	-8
Northern Ireland	485	492	-6
Scotland	481	485	-4
Wales	469	477	-7

Base: all participating pupils
Difference calculated as girls' score minus boys' score
Differences may appear inconsistent with average scores due to rounding
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

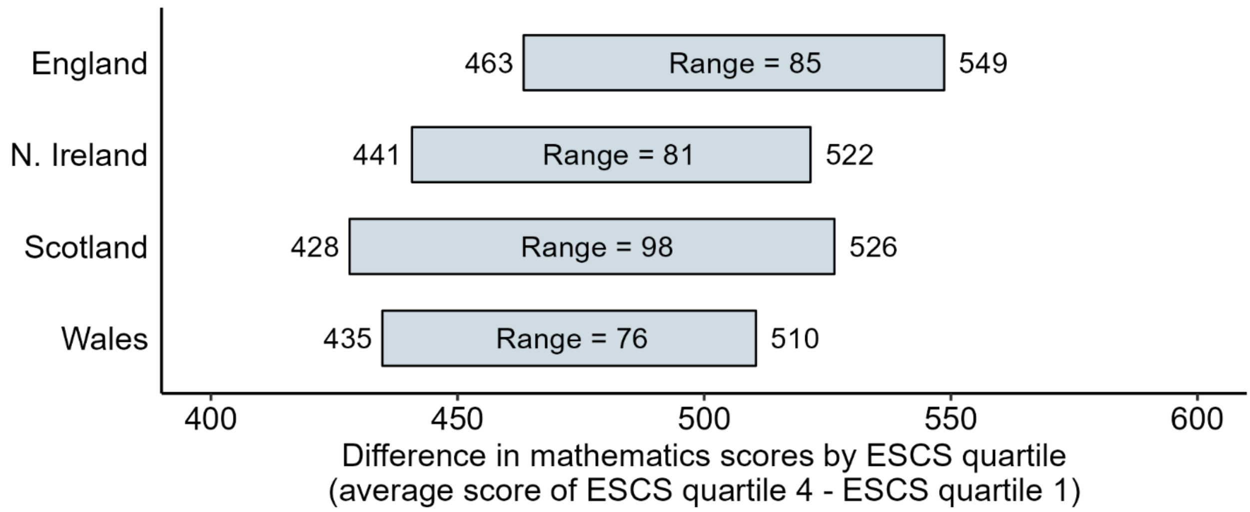
Source: OECD, PISA 2022

9.9 The relationship between socioeconomic status and performance

This section will explore how different socioeconomic groups perform relative to each other across the UK nations. As in previous chapters, pupils are divided into quartiles on the basis of their score on the PISA index of economic, social and cultural status (ESCS). The first quartile represents the most disadvantaged pupils and the fourth quartile the least disadvantaged pupils. The ESCS is derived from their responses in relation to questions about their family background (see the PISA 2022 Technical Report for details about the ESCS variable). Findings in this section should be considered particularly cautiously because, along with the persistent caveat about some of PISA's sampling standards not being met by the UK nations, some participating pupils did not provide sufficient information for their ESCS quartile to be determined (the percentage of pupils in each nation for which ESCS data was missing is presented under the following tables).

Figure 9.9 shows the average mathematics scores for pupils in the first and last ESCS quartiles for each of the UK nations (in 2022). Across all nations, there was a difference in the average performance of pupils from the most and least socioeconomically disadvantaged groups such that pupils from relatively disadvantaged backgrounds obtained lower scores than those from relatively less disadvantaged backgrounds. The gap in performance for England was 85 points. This gap in performance was not significantly different to those of any of the other UK nations.

Figure 9.9: Average mathematics scores for most and least disadvantaged groups



Nation	Most disadvantaged group	Least disadvantaged group	Difference
England	463	549	85
Northern Ireland	441	522	81
Scotland	428	526	98
Wales	435	510	76

Base: ESCS data was missing or unavailable for around 23% of pupils in England, 9% of pupils in Northern Ireland, 7% of pupils in Scotland and 16% of pupils in Wales.
Difference calculated as fourth ESCS quartile average mathematics score – first ESCS quartile average mathematics score
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022

Table 9.5 shows the average reading scores for pupils in the first and last ESCS quartiles for each of the UK nations. All within nation differences between the first and fourth ESCS quartiles (between the most and least disadvantaged groups) were statistically significant. When comparing the most disadvantaged group to the least disadvantaged group, the gap between average reading in England was 82 points. As was the case for mathematics, the gap in performance between the highest and lowest disadvantage groups was not significantly different to the gaps of Northern Ireland, Scotland or Wales.

Table 9.5: Average reading scores for the most and least disadvantaged group

Nation	Most disadvantaged group	Least disadvantaged group	Difference
England	471	553	82
Northern Ireland	452	530	78
Scotland	457	545	89
Wales	441	506	65

Base: ESCS data was missing or unavailable for around 23% of pupils in England, 9% of pupils in Northern Ireland, 7% of pupils in Scotland and 16% of pupils in Wales.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022

A similar pattern can again be observed for PISA science scores (Table 9.6). The difference between average science scores obtained by the lowest and highest ESCS quartiles for England was 92 points. As with mathematics and reading, the differences in average score between the first and fourth ESCS quartiles were statistically significant within all UK nations, but the gap in performances for Northern Ireland, Scotland and Wales were not significantly different to the gap for England.

Table 9.6: Average science scores for the most and least disadvantaged group

Nation	Most disadvantaged group	Least disadvantaged group	Difference
England	471	563	92
Northern Ireland	452	538	86
Scotland	444	536	92
Wales	441	522	81

Base: ESCS data was missing or unavailable for around 23% of pupils in England, 9% of pupils in Northern Ireland, 7% of pupils in Scotland and 16% of pupils in Wales.
Caution is required when interpreting estimates because one or more PISA sampling standards were not met.

Source: OECD, PISA 2022

10 References

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Appendix A
PISA 2022 England non-response bias analysis

Summary

The Programme for International Student Assessment (PISA) is an international study that assesses the knowledge, skills and competencies of 15-year-old pupils. It is impractical for the PISA assessment to be administered to every single pupil in each participating country. Participating countries therefore assess a sample of their eligible pupils.

How are pupils and schools selected?

Schools and pupils are randomly selected to participate in PISA through a two-stage sampling process. For PISA 2022, a representative sample of 201 eligible schools in England was selected by the international PISA Sampling organisation Westat. The sample design used considers the type of school, the region of England in which the school is located, whether the school is single-sex or mixed, and the schools' previous performance at key stage 4 to ensure that the sample is representative of the different schools across England. Larger schools also had a greater chance of being included in the sample because they had more 15-year-old pupils. Once schools agreed to participate, 40 eligible pupils were then randomly selected from each school. Westat also selected two replacement samples of schools with the using the same characteristics as the main sample. In the event that a school from the main sample was unable to participate, its replacement school (which would share the same characteristics used in generating the main sample) could participate instead if it was able to do so.

Data was collected from schools during November and December 2022. This was a difficult time for some schools and not all were able to take part. As a result, the final participating sample of schools and pupils in England did not meet the very strict international participation standards of 85% of sampled schools and 80% of pupils taking part, with 66% of the original sample of schools participating and 75% of all sampled pupils across responding schools. Where a response rate was below 85%, an acceptable response rate could still be achieved through the use of replacement schools, however the target then moves upwards. For example, with a main sample response rate of 75% the after-replacement target is 90% rather than 85%. The inclusion of replacement schools did not result in England meeting the PISA sampling standards with an after-replacement target of 94.3%.

What is a non-response bias analysis?

To determine how well the schools which participated in PISA 2022 in England reflect the population of all 15-year-old pupils in England, and to assess the quality of the sample, we compared the background characteristics of the schools and pupils taking part with the known characteristics of eligible schools and pupils in England.

This analysis can tell us if particular groups of schools or pupils were more or less likely to participate in PISA 2022 than other groups. For example, whether more boys chose to participate than girls or whether more schools in the north of England chose to participate than schools in London. If some groups were more or less likely to participate than others we would say that our data are biased and the analysis may not accurately represent all 15-year-old pupils in England.

What did we find out?

The final school sample of 165 schools which participated in PISA was largely representative of all schools in England with regard to many characteristics: school gender (mixed or single), average school attainment at GCSE, the percentage of pupils eligible for special educational needs support, percentage of pupils with English as their first language, and the percentage of pupils eligible for free school meals.

There was evidence of potential bias in relation to the small proportion of schools where the attainment data was not available, with these schools being overrepresented in the final sample. However, the small proportion of schools involved is likely to lessen the impact of this potential source of bias on the reported findings.

The final sample of pupils that participated (4,763 pupils) was found to be representative of the study population of 15-year-olds in relation to all of the school features used in the sample design. However, this sample was found to be biased in that more higher-achieving pupils participated than lower-achieving pupils. This means that the performance in mathematics, reading and science in PISA 2022 is likely to be higher than if we had an unbiased sample. The OECD estimate that the impact of this bias is likely to be around 7 or 8 score points though this does not necessarily translate directly to a particular score being 7 or 8 points higher than its ‘true’ value.

Pupils who were eligible for free school meals were also less likely to participate in PISA 2022. This means that the PISA 2022 measure of socioeconomic background, the ESCS Index, is likely to be higher than if we had an unbiased sample.

The bias identified by this analysis may also affect previous cycles of PISA and other education systems where a non-response bias analysis has not been required or has not been possible because the necessary data are not available. Caution is required when considering trend or country comparisons which may have been affected by this bias.

Interpreting the PISA 2022 results

There is always some uncertainty in the precision of what is being measured in survey research such as PISA. This uncertainty is taken into account in the analysis, for example when considering differences in performance between countries or groups of pupils.

Although the non-response bias analysis has identified some potential issues with regard to how much the pupils who participated in PISA 2022 can be said to represent all 15-year-old pupils in England, the PISA 2022 results for England can still provide a broad picture of their performance. Where the analysis shows stronger performance than in previous years or in comparison with other education systems, we cannot be certain of the extent to which this performance was due to general changes in the population of 15-year-olds in England or due to higher attaining pupils being overrepresented in the data. This is also the case for the previous PISA cycles or the other education systems that we are making comparisons with.

PISA 2022 England non-response bias analysis

A.1 Introduction

The Programme for International Student Assessment (PISA) is a large international comparative study of the knowledge, skills, and competencies of 15-year-old pupils in the domains of mathematics literacy, reading literacy, and science literacy. To provide valid estimates of pupils' achievement in these domains in each of the participating education systems, national samples of pupils are selected to participate in the study and represent their education system's full population of 15-year-old pupils. For England's national sample for PISA 2022 these pupils were in Year 11.

PISA uses a two-stage stratified sampling design. The first stage selects schools using a systematic probability-proportionate-to-size technique. School size is the estimated age-eligible enrolment of the school. In England schools are also grouped into two explicit strata, school-type and region, before being systematically sampled using probabilities proportional to the school size. For each school that is chosen in the initial sample, two replacement schools are also identified with similar characteristics to the originally sampled school.

The second stage randomly selects pupils within each sampled school that are age-eligible. The OECD require that participating pupils are aged between 15 years and 3 months and 16 years and 2 months at the beginning of the testing period. The England PISA sample consisted of 201 eligible schools having at least one pupil in this age range. Within each of the participating schools, up to 40 of the eligible pupils in the school are randomly selected to participate in PISA. Pupils may be excluded from participating in PISA 2022 if they have SEND that results in them being unable to take the test, or they have insufficient English language experience that results in them being unable to take the test. In England, 3,852 pupils from original sample schools and 911 pupils from replacement schools participated. Pupils in participating schools that did not participate are not replaced.

Data collection in England took place in November and December 2022. Of the 201 schools in the original sample, 159 agreed to participate, along with a further 32 replacement schools, but 16 schools withdrew before data collection. Data was therefore collected from 143 schools in the original sample and 32 replacement schools. Of this total, nine original sample schools and one replacement school were omitted from the response rate adjudication process, leaving a total of 134 schools from the original sample and 31 replacement schools.

The final weighted school response rates for England were 66.42% before replacement, and 81.97% after replacement. These rates mean that England did not meet the automatically acceptable response-rate targets set by the OECD (either 85% of original sample schools, or 94.3% after replacement given England's achieved original response-rate). The final weighted pupil response rate for England was 74.7% including pupils in replacement schools. This rate means that England also did not meet the automatically acceptable response-rate target set by the OECD of at least 80% of all sampled students across responding schools.

This non-response bias analysis report explores potential sources of bias due to non-response and determines the extent to which the weight adjustments alleviate any bias that is found. This report uses the full achieved sample of 165 schools (134 from the original sample) from which some pupil data was collected and the full achieved sample of 4,763 pupils (3,852 from the original sample) as the basis for this analysis.

A.2 Methodology

A.2.1. School level analysis

The non-response bias analysis at the school level compared the characteristics of the original sample of schools to those of the participating schools. This analysis was conducted in two parts:

1. Analysis of the original sample of schools (before replacement).
   The characteristics of the participating schools from the original sample (N=134) was compared with those of the original school sample (N=201). In each group, schools were weighted by their school base weights, excluding any non-response adjustment factor.
2. Analysis of the participating final sample (with replacements).
   The characteristics of all the participating schools (N=165), which includes 31 schools that were used as replacements for non-responding schools from the original sample, was compared to the original school sample (N=201). The participating schools were weighted by their non-response adjusted weights.

The first part of the analysis indicates the potential for non-response bias that was introduced through school non-response. The second indicates the potential for bias after accounting for the mitigating effects of both replacement and non-response weight adjustments.

In addition to weighting the schools by their school base weights or non-response adjusted final weights, the analysis also includes these weights multiplied by the school enrolment of 15-year-olds. This gives an estimate in terms of the survey population of 15-year-olds for each characteristic.

Participating schools and the total original school sample were compared using matched achievement data and school characteristic data from the Department for Education (DfE) school performance tables.

For the school level non-response bias analysis the matched variables used include:

- the arithmetic mean of school average Attainment 8 scores for pupils in 2022 (school Attainment 8). The Attainment 8 measures pupils' attainment across 8 qualifications including mathematics and English. More information about this variable is available on the DfE website13. Schools whose Attainment 8 score suggested that they do not use qualifications eligible for the Attainment 8 measure14 are treated as missing.
- The school Progress 8 measure after adjustment for extreme scores. This score shows how much progress pupils at this school made across 8 qualifications between the end of key stage 2 and the end of key stage 4.
- The percentage of pupils who achieved grade 5 or above in English and maths GCSEs.
- Percentage of pupils who are eligible for special educational needs (SEN) support15;
- Percentage of pupils with English as their first language;
- Percentage of pupils who have been eligible for free school meals (FSM) for any period in the last 6 years.

In addition, the analysis included the stratification variables (school gender[16] and school attainment band[17]) and the estimated number of 15-year-old eligible pupils enrolled from the school sampling frame.

[13] DfE. (2023). *Secondary accountability measures: Guide for maintained secondary schools, academies and free schools*. Department for Education. https://www.gov.uk/government/publications/progress-8-school-performance-measure
[14] Schools whose average Attainment 8 score per pupil was more than 3 standard deviations below the mean.
[15] Percentage of pupils who are eligible for special educational needs (SEN) support showed more variation across the schools than the percentage of pupils with a statement of SEN or an EHCP so was used to examine the potential school non-response bias. Preliminary analysis using this second measure also showed no evidence of potential non-response bias.
[16] Single and mixed. The Female and Male categories of the original stratification variables were collapsed into a single category to ensure that there were enough elements in each of the comparison categories.
[17] The original categories correspond to the quintiles of the average Attainment 8 measure of the schools in 2019 and one category for schools where these data were missing.

A.2.2. Pupil level analysis

The non-response bias analysis at the pupil level compared the characteristics of the original sample of pupils to those of the participating pupils. This analysis was conducted in two parts:

1. Analysis of the participating pupils: The distribution of the participating pupils (N = 4,763) was compared to the distribution of the sampled pupils that did not participate in PISA[18]. Note that these analyses only focus on pupils within the participating schools, and not pupils from sampled schools that did not participate in the study. Pupils were weighted by their pupil base weights, excluding any non-response adjustment factor. In addition, the distribution of the participating pupils was compared to the original sample schools weighted by the school base weights multiplied by the school enrolment of 15-year-olds. This gives an estimate in terms of the survey population of 15-year-olds for each characteristic.
2. Analysis of the participating final sample with non-response weight adjustments: The distribution of the participating pupils (N = 4,763) was compared to the same estimate of the survey population of 15-year-olds for each characteristic used in the previous part. The participating pupils were weighted by their non-response adjusted weights.

The first part of the analysis indicates the potential for non-response bias that was introduced through pupil non-response. The second indicates the potential for bias after accounting for the mitigating effects of both replacement and non-response weight adjustments at the school and pupil levels.

Pupils in participating schools were compared using matched achievement data and pupil characteristic data from the National Pupil Database (NPD).

For the pupil-level non-response bias analysis, the matched variables used include:

- the National Curriculum scores for key stage 2 (KS2) assessments in mathematics and reading in 2018. This was the year that the majority of pupils sampled for participating in PISA would have taken their KS2 assessments, with a few pupils in the original sample taking their KS2 assessments in 2019. These scores are scaled, with 80 being the lowest possible score and 120 being the highest possible score.
- Whether the pupil speaks English as their first language (EFL)
- Whether the pupil has been eligible for free school meals (FSM) for any period in the last 6 years.

[18] Pupils identified as ineligible have been excluded from the analysis.

- Whether the pupil has an Education, Health and Care plan (EHCP) or SEN support.

In addition, the analysis included the school-level stratification variables (school type[19], region[20], school gender[21] and school attainment band[22]), pupil gender taken from the datasets provided by Westat, and the estimated number of 15-year-old eligible pupils enrolled from the school sampling frame.

A.2.3. Statistical analysis

For categorical variables, the distribution of frame characteristics for participants was compared with the distribution for non-participants. The hypothesis of independence between the characteristic and participation status was tested using a Rao-Scott modified Chi-square statistic at the 5 percent level. For continuous variables, summary means were calculated and the difference between means was tested using a t-test. The p-values for the tests are presented in the tables. The statistical significance of differences between participants and non-participants is identical to that which would result from comparing participants and the total sample of which they are a subset. The bias and relative bias are also shown in each table. The bias is the difference between the respective estimates for the participants and the total sample. The relative bias is calculated as the bias divided by the estimate from the total sample. The relative bias is a measure of the size of the bias compared to the total sample estimate.

Pupils who were absent for or had missing data for the KS2 assessments were imputed using the school average score, but only if the majority of pupils in their school had valid KS2 data. Matched data for pupils in independent schools were missing for the majority of pupils, and so this imputation process was not possible. For each of the matched variables an additional category of unknown was added to account for the large number of pupils with these data missing. In the case of the Key Stage 2 assessments, this resulted five categories[23]: working at a higher standard, met the national expectation, working towards the national expectation, below the level of the assessment, and unknown.

In addition, linear and logistic regression models were used to provide a multivariate analysis that examined the relationship of participation status to the school average Attainment 8 score per pupil variable while controlling for school characteristics. The sec-

[19] Academy, independent, maintained and selective.
[20] Greater London, Midlands, North and South.
[21] Mixed, girls or boys.
[22] The original categories correspond to the quintiles of the average Attainment 8 measure of the schools in 2019 and one category for schools where these data were missing.
[23] Pupils working at a higher standard had a scaled score of 110 or above, pupils who met the national expectation had a scaled score between 100 and 110, pupils who were working towards the national expectation had a scaled score between 80 and 100.

ond implicit stratification variable (School attainment bands) was omitted from these analyses because it was derived from the school average Attainment 8 score per pupil variable. Logistic regression models were also used to provide a multivariate analysis that examined the relationship of participation status to the pupils' KS2 scores for mathematics and reading, as well as other pupil and school characteristics.

All statistical analyses were performed in R version 4.2.2 using the survey package[24] to account for the complex sample design. The analysis used the base weights, replicate weights and non-response adjusted weights provided by Westat. The international weighting procedures form non-response adjustment classes by cross-classifying the explicit and implicit stratification variables.

A.3 Comparisons of participating and non-participating schools

A.3.1. Original sample (before replacement)

This section presents the non-response bias analysis based on the original sample of 201 schools. The distribution of the participating schools from the original sample was compared to the total original sample. School base weights were used for both the total original sample and the participating schools.

A.3.1.1. Achievement variables

The mean and quartiles of the school average Attainment 8 score per pupil from the original sample are given in Table A.1 and Table A.2. There was a statistically significant relationship between the mean school average Attainment 8 score per pupil and participation status, when schools are compared on the basis of school weight and by the estimated enrolment of 15-year-old eligible pupils. Participating schools had a significantly higher mean school Attainment 8 score per pupil than original sample schools who did not participate. However, the relative bias for these schools was small. These significant differences are investigated further in the regression models.

[24] Lumley T (2020). "survey: analysis of complex survey samples." R package version 4.0.

Table A.1: Distribution of average Attainment 8 score per pupil of schools in England's original sample for PISA 2022

Average Attainment 8 score per pupil in 2022	Original sample	Participating schools	Bias	Relative bias	Non-participating schools	*t*-test *p*-value
Mean	48.1	49.4	-1.3	-0.03	45.4	0.03*
Lower quartile	41.3	42.0	-0.7	-0.02	40.4	0.43
Median	47.8	49.9	-2.1	-0.04	46.5	0.07
Upper quartile	54.9	55.4	-0.5	-0.01	52.6	0.20

**p<0.05, **p<0.01, ***p<0.001*
Base: Original sample: n = 199, missing = 2; Participating Schools: n = 132, missing =2; Non-participating schools: n = 67, missing = 0.
Note: Schools who average Attainment 8 score per pupil suggested that they do not use qualifications eligible for the Attainment 8 measure are treated as missing. Bias is calculated as the difference between the estimates of the participating schools and the total sample (= participating schools – total sample). Relative bias is calculated as the bias divided by the estimate from the total sample. The p-values for t-tests were calculated by comparing the participating and non-participating schools. Schools were weighted by their school base weights.

Source: OECD, PISA 2022, data matched to DfE NPD

Table A.2: Distribution of average Attainment 8 score per pupil of schools in England's original sample for PISA 2022, weighted by enrolment of 15-year-olds.

Average Attainment 8 score per pupil in 2022	Original sample	Participating schools	Bias	Relative bias	Non-participating schools	*t*-test *p*-value
Mean	48.4	49.5	-1.1	-0.02	46.2	0.03*
Lower quartile	43.2	43.5	-0.3	-0.01	41.9	0.44
Median	49.4	50.5	-1.1	-0.02	47.8	0.06

Upper quartile	54.3	55.0	-0.7	-0.01	52.8	0.12

**p<0.05, **p<0.01, ***p<0.001*
Base: Original sample: sum of weights = 37293, missing proportion = 0.9%; Participating Schools: sum of weights = 24606, missing proportion = 1.4%; Non-participating schools: sum of weights = 12687, missing proportion = 0%.
Note: Schools who average Attainment 8 score per pupil suggested that they do not use qualifications eligible for the Attainment 8 measure are treated as missing. Bias is calculated as the difference between the estimates of the participating schools and the total sample (= participating schools – total sample). Relative bias is calculated as the bias divided by the estimate from the total sample. The p-values for t-tests were calculated by comparing the participating and non-participating schools. Schools were weighted by their school base weights multiplied by the school enrolment of 15-year-old eligible pupils.

Source: OECD, PISA 2022, data matched to DfE NPD

The mean and quartiles of the school Progress 8 measure from the original sample are given in Table A.3 and Table A.4 There are no statistically significant relationships between these measures and participation status, whether schools are compared on the basis of school weight or by the estimated enrolment of 15-year-olds. The low relative bias between the original sample schools and the participating schools from the original sample also indicates minimal potential for bias due to non-response.

Table A.3: Distribution of school Progress 8 measure in England's original sample for PISA 2022

Average Attainment 8 score per pupil in 2022	Original sample	Participating schools	Bias	Relative bias	Non-participating schools	*t*-test *p*-value
Mean	0.0	0.0	0	0.32	-0.1	0.56
Lower quartile	-0.4	-0.3	0	0.13	-0.4	0.57
Median	-0.1	-0.1	0	0.25	-0.1	0.82
Upper quartile	0.4	0.4	0	-0.03	0.4	0.94

Base: Original sample: n = 178, missing = 23; Participating Schools: n = 118, missing = 16; Non-participating schools: n = 60, missing = 7.
Note: Schools who Progress 8 score suggested that they do not use qualifications eligible for the Progress 8 measure and schools for whom no Progress 8 scores are published are treated as missing. Bias is calculated as the difference between the estimates of the participating schools and the total sample (= participating schools – total sample). Relative bias is calculated as the bias divided by the estimate from the total sample. The p-values for t-tests were calculated by comparing the participating and non-participating schools. Schools were weighted by their school base weights.

Source: OECD, PISA 2022, data matched to DfE NPD

Table A.4: Distribution of school Progress 8 measure in England's original sample for PISA 2022, weighted by enrolment of 15-year-olds.

Average Attainment 8 score per pupil in 2022	Original sample	Participating schools	Bias	Relative bias	Non-participating schools	*t*-test *p*-value
Mean	0.0	0.0	0.0	-2.50	0.0	0.56
Lower quartile	-0.3	-0.2	0.0	0.11	-0.4	0.14
Median	0.0	0.1	-0.1	-6.00	0.0	0.14
Upper quartile	0.4	0.4	0.0	-0.05	0.3	0.29

Base: Original sample: sum of weights = 34073, missing proportion = 9.5%; Participating Schools: sum of weights = 22769, missing proportion = 8.7%; Non-participating schools: sum of weights = 11304, missing proportion = 10.9%.

Note: Schools who Progress 8 score suggested that they do not use qualifications eligible for the Progress 8 measure are treated as missing. Bias is calculated as the difference between the estimates of the participating schools and the total sample (= participating schools – total sample). Relative bias is calculated as the bias divided by the estimate from the total sample. The p-values for t-tests were calculated by comparing the participating and non-participating schools. Schools were weighted by their school base weights multiplied by the school enrolment of 15-year-old eligible pupils.

Source: OECD, PISA 2022, data matched to DfE NPD

The mean and quartiles of the percentage of pupils who achieved grade 5 or above in English and maths GCSEs from the original sample are given in Table A.5 and Table A.6. There are no statistically significant relationships between these measures and participation status, whether schools are compared on the basis of school weight or by the estimated enrolment of 15-year-olds. The low relative bias between the original sample schools and the participating schools from the original sample also indicates minimal potential for bias due to non-response.

Table A.5: Distribution of the percentage of pupils who achieved grade 5 or above in English and maths GCSEs in schools in England's original sample for PISA 2022

Average Attainment 8 score per pupil in 2022	Original sample	Participating schools	Bias	Relative bias	Non-participating schools	*t*-test *p*-value
Mean	51	52.6	-1.5	-0.03	47.8	0.11
Lower quartile	36	36.0	0.0	0.00	38.0	0.64
Median	50	53.0	-3.0	-0.06	47.0	0.11
Upper quartile	63	65.0	-2.0	-0.03	58.0	0.15

Base: Original sample: n = 199, missing = 2; Participating Schools: n = 132, missing =2; non-participating schools: n = 67, missing = 0.
Note: Bias is calculated as the difference between the estimates of the participating schools and the total sample (= participating schools – total sample). Relative bias is calculated as the bias divided by the estimate from the total sample. The p-values for t-tests were calculated by comparing the participating and non-participating schools. Schools were weighted by their school base weights.

Source: OECD, PISA 2022, data matched to DfE NPD

Table A.6: Distribution of the percentage of pupils who achieved grade 5 or above in English and maths GCSEs in schools in England's original sample for PISA 2022, weighted by enrolment of 15-year-olds.

Average Attainment 8 score per pupil in 2022	Original sample	Participating schools	Bias	Relative bias	Non-participating schools	*t*-test *p*-value
Mean	48.4	49.5	-1.1	-0.02	46.2	0.13
Lower quartile	43.2	43.5	-0.3	-0.01	41.9	0.78
Median	49.4	50.5	-1.1	-0.02	47.8	0.23
Upper quartile	54.3	55.0	-0.7	-0.01	52.8	0.22

Base: Original sample: sum of weights = 35144, missing proportion = 6.6%; Participating Schools: sum of weights = 23540, missing proportion = 5.6%; Non-participating schools: sum of weights = 11604, missing proportion = 8.5%.
Note: Bias is calculated as the difference between the estimates of the participating schools and the total sample (= participating schools – total sample). Relative bias is calculated as the bias divided by the estimate from the total sample. The p-values for t-tests were calculated by comparing the participating and non-participating schools. Schools were weighted by their school base weights multiplied by the school enrolment of 15-year-old eligible pupils.

Source: OECD, PISA 2022, data matched to DfE NPD

The distribution of schools from the original sample by the implicit stratification variables (school gender and school attainment band) are shown in Table A.7. There are no statistically significant relationships between participation status and any of the characteristics shown in Table A.7 or as shown in Table A.8. However, a relative bias greater than an absolute value of 10% was observed for schools and pupils within schools in the highest attainment band. A relative bias greater than an absolute value of 10% was also observed for pupils in schools in the missing attainment band. These potential sources of bias are investigated further in the student level non-bias response analysis.

Table A.7: Percentage distribution of schools in England's original sample for PISA 2022 original sample, by implicit stratification variables

School characteristic	Original sample %	Participating schools %	Bias	Relative bias	Non-participating schools %
School gender: Mixed	87.1	86.6	0.5	0.01	88.1
School gender: Single	12.9	13.4	-0.5	-0.04	11.9
Attainment band: Low 1	19.4	17.9	1.5	0.08	22.4
Attainment band: 2	18.4	17.2	1.2	0.07	20.9
Attainment band: 3	17.9	18.7	-0.7	-0.04	16.4
Attainment band: 4	18.9	17.9	1.0	0.05	20.9
Attainment band: High 5	20.4	23.1	-2.7	-0.13	14.9
Attainment band: Missing	5.0	5.2	-0.2	-0.05	4.5

Base: Original sample: n = 201; Participating schools: n = 134; Non-participating schools: n = 67.
School gender: χ^2(ndf = 1, ddf = 79) = .26, p = .61
School attainment band: χ^2(ndf = 4.4, ddf =348) = .56, p = .71
Note: Bias is calculated as the difference between the estimates of the participating schools and the total sample (= participating schools – total sample). Relative bias is calculated as the bias divided by the estimate from the total sample. The p-value for chi-square test was calculated by testing the difference in distributions between the participating and non-participating schools. Schools were weighted by their school base weights.

Source: OECD, PISA 2022, data matched to DfE NPD

Table A.8: Percentage distribution of schools weighted by enrolled eligible 15-year-old pupils in England's original sample for PISA 2022 by implicit stratification variables

School characteristic	Original sample %	Participating schools %	Bias	Relative bias	Non-participating schools %
School gender: Mixed	88.3	88.4	-0.1	0.00	88.1
School gender: Single	11.7	11.6	0.1	0.01	11.9
Attainment band: Low 1	15.5	14.2	1.3	0.08	18.1
Attainment band: 2	18.0	16.7	1.3	0.07	20.6
Attainment band: 3	20.5	20.5	0.0	0.00	20.6
Attainment band: 4	21.8	21.2	0.6	0.03	22.9
Attainment band: High 5	19.6	22.4	-2.7	-0.14	14.2
Attainment band: Missing	4.6	5.1	-0.5	-0.10	3.7

Base: Original sample: sum of weights = 37633; Participating schools: sum of weights = 24946; Non-participating schools: sum of weights = 12687.
School gender: χ^2(ndf = 1, ddf = 79) = .03 p = .86
School attainment band: χ^2(ndf = 4.8, ddf =379) = .44, p = .81
Note: Bias is calculated as the difference between the estimates of the participating schools and the total sample (= participating schools – total sample). Relative bias is calculated as the bias divided by the estimate from the total sample. The p-value for chi-square test was calculated by testing the difference in distributions between the participating and non-participating schools. Schools were weighted by their school base weights multiplied by the school enrolment of 15-year-old eligible pupils.

Source: OECD, PISA 2022, data matched to DfE NPD

A.3.2. School–level continuous variables

The mean values of the variables related to the percentage of pupils who are eligible for special educational needs (SEN) support, the percentage of pupils with English as their first language, and the percentage of pupils who have been eligible for free school meals (FSM) for any period in the last 6 years are given in Table A.9 and Table A.10. The differences in mean percentage of pupils who are eligible for special educational needs (SEN) support, pupils with English as their first language and pupils who have been eligible for free school meals (FSM) for any period in the last 6 years are not significantly different between participating and non-participating schools. The low relative bias between the original sample schools and the participating schools from the original sample also indicates minimal potential for bias due to non-response.

Table A.9: School average pupil characteristics of schools in England's original sample for PISA 2022

School level pupil characteristics	Original sample %	Participating schools %	Bias	Relative bias	Non-participating schools %	*t*-test *p*-value
Pupils eligible for special educational needs (SEN) support	12.8	12.5	0.3	0.02	13.4	0.31
Pupils with English as their first language	73.4	72.6	0.8	0.01	75.0	0.66
Pupils who have been eligible for free school meals (FSM) for any period in the last 6 years	28.1	26.9	1.2	0.04	30.5	0.09

Base: Original sample: n = 199, missing = 2 (n = 182, missing = 19 for FSM measures); Participating Schools: n = 132, missing =2 (n = 121, missing = 13 for FSM measures); Non-participating schools: n = 67, missing = 0 (n = 61, missing = 6 for FSM measures).
Note: Bias is calculated as the difference between the estimates of the participating schools and the total sample (= participating schools – total sample). Relative bias is calculated as the bias divided by the estimate from the total sample. The p-value for t- test was calculated by testing the difference in distributions between the participating and non-participating schools. Schools were weighted by their school base weights.

Source: OECD, PISA 2022, data matched to DfE NPD

Table A.10: Pupil characteristics of schools weighted by enrolled eligible 15-year-old pupils in England's original sample for PISA 2022

School level pupil characteristics	Original sample %	Participating schools %	Bias	Relative bias	Non-participating schools %	*t*-test *p*-value
Pupils eligible for special educational needs (SEN) support	12.4	12.0	0.4	0.03	13.1	0.16
Pupils with English as their first language	77.3	78.9	-1.5	-0.02	74.4	0.29
Pupils who have been eligible for free school meals (FSM) for any period in the last 6 years	26.8	25.9	1.0	0.04	28.7	0.17

Base: Original sample: sum of weights = 37293, missing proportion = 0.9% (sum of weights = 34977, missing proportion = 7.1% for FSM measures); Participating Schools: sum of weights = 24606, missing proportion = 1.4% (sum of weights = 23373, missing proportion = 6.3% for FSM measures); Non-participating schools: sum of weights = 12687, missing proportion = 0% (sum of weights = 11604, missing proportion = 8.5% for FSM measures).
Note: Bias is calculated as the difference between the estimates of the participating schools and the total sample (= participating schools – total sample). Relative bias is calculated as the bias divided by the estimate from the total sample. The p-value for t-test was calculated by comparing the participating and non-participating schools. Schools were weighted by their school base weights multiplied by the school enrolment of 15-year-old eligible pupils.

Source: OECD, PISA 2022, data matched to DfE NPD

A.3.3. Regression Models

Linear regression models were used to provide multivariate analyses of the relationships of participation status to the school average Attainment 8 score per pupil variable, while controlling for the school level variables. The model includes the school average Attainment 8 score per pupil as the dependent variables with participation status, the implicit stratification variables excluding attainment bands and the percentage of pupils who are eligible for special educational needs (SEN) support, the percentage of pupils with English as their first language and the percentage of pupils who have been eligible for free school meals (FSM) for any period in the last 6 years as the independent variables. Table A.11 and Table A.12 show that no significant relationship between response status and pupil achievement was detected at the school level.

Table A.11: Linear regression model of school average Attainment 8 score per pupil in England's original sample for PISA 2022

Variable	Estimate	Standard Error	t-value	p-value
Intercept	67.5	4.16	16.25	<0.001***
Response status: Respondent	0	0	-	-
Response status: Non-respondent	0.24	1.09	0.22	0.82
School gender: Mixed	0	0	-	-
School gender: Single	6.75	1.66	4.08	<0.001***
Mean percentage of pupils eligible for special educational needs (SEN) support	-0.35	0.16	-2.14	0.04*
Mean percentage of pupils with English as their first language	-0.07	0.04	-1.64	0.10
Mean percentage of pupils who have been eligible for free school meals (FSM) for any period in the last 6 years	-0.34	0.06	-5.95	<0.001***

**p<0.05, **p<0.01, ***p<0.001*
Note: Participating independent schools do not have school average Attainment 8 scores per pupil so are excluded from the analysis. Schools were weighted by their school base weights.

Source: OECD, PISA 2022, data matched to DfE NPD

Table A.12: Linear regression model of school average Attainment 8 score per pupil in England's original sample for PISA 2022 weighted by enrolled eligible 15-year-old pupils

Variable	Estimate	Standard Error	*t*-value	*p*-value
Intercept	69.04	2.55	27.04	<0.001***
Response status: Respondent	0	0	-	-
Response status: Non-respondent	-0.31	0.83	-0.38	0.71
School gender: Mixed	0	0	-	-
School gender: Single	5.88	1.31	4.48	<0.001***
Mean percentage of pupils eligible for special educational needs (SEN) support	-0.31	0.12	-2.67	0.009**
Mean percentage of pupils with English as their first language	-0.08	0.03	-2.98	0.004**
Mean percentage of pupils who have been eligible for free school meals (FSM) for any period in the last 6 years	-0.34	0.04	-7.86	<0.001***

**p<0.05, **p<0.01, ***p<0.001*
Note: Participating independent schools do not have school average Attainment 8 scores per pupil so are excluded from the analysis. Schools were weighted by their school base weights multiplied by the school enrolment of 15-year-old eligible pupils.

Source: OECD, PISA 2022, data matched to DfE NPD

The logistic regression models the probability of participation in PISA in relation to the school average Attainment 8 score per pupil, while controlling for the school level variables. Table A.13 and Table A.14 show that no significant relationship between response status and pupil achievement was detected when considered either by school base weight or by 15-year-old eligible pupil weight.

Table A.13: Logistic regression modelling relationship of response status to school average Attainment 8 score per pupil in England's original sample for PISA 2022

Variable	Estimate	Standard Error	*t*-value	*p*-value
Intercept	1.24	2.31	0.54	0.59
School average Attainment 8 score per pupil	-0.01	0.03	-0.20	0.84
School gender: Mixed	0	0	-	-
School gender: Single	0.06	0.55	0.12	0.91
Mean percentage of pupils eligible for special educational needs (SEN) support	-0.02	0.04	-0.39	0.70
Mean percentage of pupils with English as their first language	0.00	0.01	0.40	0.69
Mean percentage of pupils who have been eligible for free school meals (FSM) for any period in the last 6 years	-0.02	0.02	-0.71	0.48

**p<0.05, **p<0.01, ***p<0.001*
Note: Participating independent schools do not have school average Attainment 8 scores per pupil so are excluded from the analysis. Schools were weighted by their school base weights.

Source: OECD, PISA 2022, data matched to DfE NPD

Table A.14: Logistic regression modelling relationship of response status to school average Attainment 8 score per pupil in England's original sample for PISA 2022, weighted by school enrolment of 15-year-old eligible pupils

Variable	Estimate	Standard Error	*t*-value	*p*-value
Intercept	-0.50	0.21	-0.23	0.82
School average Attainment 8 score per pupil	0.01	0.03	0.37	0.71
School gender: Mixed	0	0	-	-
School gender: Single	-0.01	0.55	0.01	0.99
Mean percentage of pupils eligible for special educational needs (SEN) support	-0.02	0.04	-0.57	0.57
Mean percentage of pupils with English as their first language	0.01	0.01	1.09	0.28
Mean percentage of pupils who have been eligible for free school meals (FSM) for any period in the last 6 years	0.00	0.02	0.00	1.00

**p<0.05, **p<0.01, ***p<0.001*
Note: Participating independent schools do not have school average Attainment 8 scores per pupil so are excluded from the analysis. Schools were weighted by their school base weights multiplied by the school enrolment of 15-year-old eligible pupils.

Source: OECD, PISA 2022, data matched to DfE NPD

A.4 Non-response adjusted participating final sample (with replacements)

This section presents the non-response bias analysis based on the original sample of 201 schools. The distribution of the final participating sample (N = 165), including participating replacement schools, was compared to the schools in the original sample. School base weights were used for the original sample of schools, whereas non-response adjusted weights were used for the participating schools.

A.4.1. Achievement Variables

The mean and quartiles of the school average Attainment 8 score for pupils in the final participating sample are compared with the original sample in Table A.15. The low relative bias between the two samples indicates minimal potential for bias due to non-response.

Table A.15: Distribution of school Attainment 8 score in England's final participating sample for PISA 2022 compared with original sample

School average Attainment 8 score per pupil	Original sample schools	Participating schools	Bias	Relative bias
Mean	48.1	47.8	0.3	0.01
Lower quartile	41.3	41.1	0.2	0.00
Median	47.8	48.8	-1.0	-0.02
Upper quartile	54.9	54.9	0.0	0.00

Base: Original sample: n = 199, missing = 2; Participating Schools: n = 161, missing =4.
Note: Bias is calculated as the difference between the estimates of the participating schools and the total sample (= participating schools – total sample). Relative bias is calculated as the bias divided by the estimate from the total sample. Schools were weighted by their school base weights (original sample) and non-response adjusted school weights (final participating sample).

Source: OECD, PISA 2022, data matched to DfE NPD

A.4.2. Categorical variables

The distribution of schools from the original sample by the implicit stratification variables is shown in comparison with the participating final sample in Table A.16. The absolute value of the relative bias for schools in the missing attainment band was 10% indicating potential bias due to non-response in relation to schools whose average Attainment 8 score per pupil was not available in 2019 when the sample was chosen.

Table A.16: Percentage distribution of schools in England's final participating sample for PISA 2022 compared with original sample by implicit stratification variables.

School characteristic	Original sample	Participating schools	Bias	Relative bias
School gender: Mixed	87.1	86.1	1	0.01
School gender: Single	12.9	13.9	-1	-0.08
School attainment band: Low 1	19.4	17.6	1.8	0.09
School attainment band: 2	18.4	20.0	-1.6	-0.09
School attainment band: 3	17.9	17.0	0.9	0.05
School attainment band: 4	18.9	18.2	0.7	0.04
School attainment band: High 5	20.4	21.8	-1.4	-0.07
School attainment band: Missing	5.0	5.5	-0.5	-0.10

Base: Original sample: n = 210; Participating Schools: n = 165.
Note: Bias is calculated as the difference between the estimates of the participating schools and the total sample (= participating schools – total sample). Relative bias is calculated as the bias divided by the estimate from the total sample. Schools were weighted by their school base weights (original sample) and non-response adjusted school weights (final participating sample).

Source: OECD, PISA 2022, data matched to DfE NPD

A.4.3. Continuous Variables

The mean values of the variables related to the characteristics of each school in the final participating sample are shown in comparison with the original sample in Table A.17 for the percentage of pupils with English as their first language and the percentage of pupils who have been eligible for free school meals for any period in the last 6 years between schools in the final participating sample and the original sample[25]. The absolute values of the relative bias are all less than 10%, which indicates minimal potential bias due to non-response.

[25] The percentage of pupils eligible for special educational needs (SEN) support is not included as several special schools were included in the original sample but these schools were ineligible to participate.

Table A.17: Pupil characteristics of schools in England's final participating sample for PISA 2022 compared with original sample

Pupil characteristics	Original sample	Participating schools	Bias	Relative bias
Mean percentage of pupils with English as their first language	73.4	69.5	3.9	0.05
Mean percentage of pupils who have been eligible for free school meals (FSM) for any period in the last 6 years	28.1	26.9	1.2	0.04

Base: Original sample: n = 199, missing = 2 (n = 182, missing = 19 for FSM measure); Participating schools: n = 162, missing = 3 (n = 121, missing = 13 for FSM measure).
Note: Bias is calculated as the difference between the estimates of the participating schools and the total sample (= participating schools – total sample). Relative bias is calculated as the bias divided by the estimate from the total sample. Schools were weighted by their school base weights.

Source: OECD, PISA 2022, data matched to DfE NPD

A.5 Summary of school level analysis

Overall, this analysis provides reassurance that the final sample of schools which undertook PISA in 2022 was representative of all schools in England.

We investigated non-response bias at the school level, finding that the final sample does not differ in a statistically meaningful way from the original sample in terms of academic achievement, once a range of relevant school characteristics are accounted for. Importantly, the school-level measures of academic achievement that were used in this analysis were based on GCSE performance, and were therefore unrelated to PISA. Furthermore, there was no substantive evidence of non-response bias for any of the school characteristics that were investigated, namely: percentage of pupils eligible for special educational needs (SEN) support, percentage with English as their first language, and percentage eligible for free school meals (FSM) within the last 6 years.

Despite this broadly positive finding, there was evidence of potential bias in relation to the small proportion of schools in the missing category for the 'attainment band', which is another indicator of pupil attainment whereby schools are divided into quintiles (based on the academic performance of their pupils at GCSE in 2019). Although the application of non-response adjusted weights can reduce the risk of bias associated with this finding, further investigation as part of a pupil level non-response bias analysis was required to explore the issue further.

A.6 Comparisons of participating and non-participating pupils

This section presents the non-response bias analysis of the participating pupils: the distribution of the participating pupils (N = 4,763) was compared to the distribution of sampled pupils within participating schools that did not participate (N = 1,736). Pupils were weighted by their pupil base weights, excluding any non-response adjustment factor. In addition, the distribution of the participating pupils was compared to the original sample schools weighted by the school base weights multiplied by the estimated school enrolment of 15-year-olds from the school sampling frame. This gives an estimate in terms of the survey population of 15-year-olds for each characteristic.

A.6.1. School-level categorical variables

Table A.18 shows the proportion of participating pupils relative to the proportions of pupils in the original sample that attended schools based on the explicit stratification variables used in the school sampling – the type of school they attend, and the region within England.

Pupils attending independent schools made up 8.2% of the original sample but made up 9.2% of the pupils that participated in PISA. There was also a slight underrepresentation of pupils from the South of England and an overrepresentation of pupils from the North of England in the final participating sample of pupils relative to the proportion of these pupils in the original sample, but the relative bias was small.

Table A.18: Percentage distribution of pupils in England's final participating sample for PISA 2022 compared with the original sample by explicit stratification variables

Stratification variables	Final sample	Participating pupils	Bias	Relative bias	Non-participating pupils
School type: Academy	67.3%	66.7%	0.6	0.01	70.6%
School type: Independent	8.2%	9.2%	-1.0	-0.12	5.6%
School type: Maintained	20.3%	19.8%	0.4	0.02	20.2%
School type: Selective	4.2%	4.3%	-0.1	-0.02	3.7%
Region: Greater London	15.5%	15.9%	-0.4	-0.02	12.8%
Region: Midland	30.6%	30.2%	0.4	0.01	32.2%
Region: North	27.6%	29.0%	-1.4	-0.05	24.5%
Region: South	26.3%	24.9%	1.3	0.05	30.5%

Base: Original sample: n = 7,986; Participating pupils: n = 4,763; Non-participating pupils: n = 1,736.
School type: χ^2(ndf = 2.81, ddf = 222) = 3.26, p = .02
School region: χ^2(ndf = 2.86, ddf =226) = 3.85, p = .01
Note: Bias is calculated as the difference between the estimates of the participating pupils and the final sample. Relative bias is calculated as the bias divided by the estimate from the final sample. The p-values for chi-square tests were calculated by comparing the participating and non-participating pupils. Pupils were weighted by their pupil base weights. The final sample is weighted by the school base weight multiplied by the number of eligible pupils enrolled in the school.

Source: OECD, PISA 2022, data matched to DfE NPD

Table A.19 shows the proportion of participating pupils relative to the proportions of pupils in the original sample that attended schools based on the implicit stratification variables used in the school sampling – gender selectivity and school-attainment band.

A slightly higher proportion of the participating pupils came from single-sex schools (14%) than in the original sample (12.4%), but this did not represent a statistically significant difference. Similarly, although the differences based on school-attainment band did not meet the thresholds for statistical significance at the 95% confidence level, the proportion of participating pupils from the middle-achieving band 3 schools (15.5%) was lower than in the original sample (18.0%).

Table A.19: Percentage distribution of pupils in England's final participating sample for PISA 2022 compared with original sample by implicit stratification variables

Stratification variables	Final sample	Participating pupils	Bias	Relative bias	Non-participating pupils
School gender: Mixed	87.6%	85.9%	1.7	0.02	89.6%
School gender: Female	6.7%	7.5%	-0.8	-0.12	5.1%
School gender: Male	5.7%	6.5%	-0.8	-0.15	5.3%
School attainment band: Low 1	19.5%	18.9%	0.6	0.03	20.6%
School attainment band: 2	18.6%	20.1%	-1.5	-0.08	22.7%
School attainment band: 3	18.0%	15.5%	2.5	0.14	17.7%
School attainment band: 4	19.2%	18.8%	0.4	0.02	15.8%
School attainment band: High 5	19.7%	21.6%	-1.8	-0.09	18.5%
School attainment band: Missing	5.0%	5.1%	-0.1	-0.02	4.6%

Base: Original sample: n = 7,986; Participating pupils: n = 4,763; Non-participating pupils: n = 1,736.
School gender: χ^2(ndf = 1.54, ddf = 122) = 1.70, p = .19
School attainment band: χ^2(ndf = 4.34, ddf =343) = 1.98, p = .09
Note: Bias is calculated as the difference between the estimates of the participating pupils and the final sample. Relative bias is calculated as the bias divided by the estimate from the final sample. The p-values for chi-square tests were calculated by comparing the participating and non-participating pupils. Pupils were weighted by their pupil base weights. The final sample is weighted by the school base weight multiplied by the number of eligible pupils enrolled in the school.

Source: OECD, PISA 2022, data matched to DfE NPD

A.6.2. Pupil characteristics

Pupils may be excluded from participating in PISA 2022 if they have SEND that results in them being unable to take the test, or they have insufficient English language experience. Participating pupils who are ineligible due to these exclusion criteria have been identified and excluded from the analysis. However, it is not possible to identify further pupils who are ineligible if they did not participate which may contribute to the underrepresentation of pupils with SEND and pupils who do not have English as their first language in the final participating sample.

Table A.20 compares the proportions of pupils who participated and those that did not with respect to four different characteristics – their gender, whether they speak English as their first language, whether they receive any type of SEN support, and whether they have been eligible for free-school-meals (FSM) at any point in the past 6 years. For the last three of these characteristics, these comparisons were made possible by matching pupils' data from PISA with data from England's National Pupil Database (NPD). However, NPD matching was not possible for all pupils including the majority of pupils in independent schools. Table 3 includes information on differences between the participating and non-participating pupils who did not have the relevant data within the NPD.

Pupils without EAL, SEN or FSM data in the NPD were overrepresented in the group of participating pupils compared to those that did not participate. Focusing on those with known data, pupils who speak English as their first language were underrepresented among the participating pupils, with a higher proportion of first-language English pupils not participating (83.1%) than those that did (74.5%). Similarly, pupils who had been FSM eligible at any point in the past six years were also underrepresented among the participating pupils, making up 19.6% of the participating pupils but 29.9% of those that did not participate. Pupils with an Education, Health and Care plan (1.2%) or SEN support in school (8.4%) are also underrepresented among the participating pupils. The differences in the proportions of EAL, SEN and FSM eligibility between the participating and non-participating pupils represented statistically significant differences at the 99.9% confidence level. In contrast, while a slightly higher proportion of female pupils participated than male pupils, relative to expectation, this did not represent a statistically significant difference at the 95% confidence level or higher.

Pupils may be excluded from participating in PISA 2022 if they have SEND that results in them being unable to take the test, or they have insufficient English language experience. Participating pupils who are ineligible due to these exclusion criteria have been identified and excluded from the analysis. However, it is not possible to identify further pupils who are ineligible if they did not participate which may contribute to the underrepresentation of pupils with SEND and pupils who do not have English as their first language in the final participating sample.

Table A.20: Percentage distribution of pupils in England's final participating sample for PISA 2022 compared with the original sample by pupil characteristics

Stratification variables	Participating pupils	Non-participating pupils
Gender: Female	49.3%	48.0%
Gender: Male	50.7%	52.0%
English spoken as first language	74.5%	83.1%
English not spoken as first language	14.9%	9.1%
First language unknown	10.6%	7.8%
Has been eligible for Free School Meals in the last 6 years	19.6%	29.9%
Has not been eligible for Free School Meals in the last 6 years	70.1%	62.8%
Free School Meal eligibility unknown	10.3%	7.3%
Has an Education, Health and Care plan	1.2%	3.5%
Receives SEN support	8.4%	16.4%
No SEN	80.1%	72.8%
SEN status unknown	10.3%	7.3%

Base: Participating pupils: n = 4,763; Non-participating pupils: n = 1,736.
Gender: χ^2(ndf = 1, ddf = 79) = .51, p = .48
English as first language: χ^2(ndf = 1.99, ddf =157) = 15.2, p = <.001
FSM ever 6 eligibility: χ^2(ndf = 1.89, ddf = 149) = 25.2, p = <.001
SEN status: χ^2(ndf = 1.95, ddf = 154) = 47.7, p = <.001.
Note: Pupil characteristics are not available for the majority of pupils attending independent schools. Pupils were weighted by their pupil base weights.

Source: OECD, PISA 2022, data matched to DfE NPD

A.6.3. Achievement variables

The key stage 2 (KS2) assessments are the most recent national assessments taken by pupils participating in PISA. This includes assessments of mathematics and reading comprehension which are scored on a scale between 80 and 120. Pupils with a scaled score of 100 or higher are deemed to have met the 'expected standard' in that subject.

All the participating pupils and the majority of sampled pupils took these assessments in 2018, when they were aged 10 or 11.

Table A.21 and Table A.22 show the mean scores, as well as the scores at the first (lower), second (median), and third (upper) quartiles of performance in KS2 mathematics and KS2 reading respectively. In both subjects, there was a clear pattern of pupils who participated in PISA having higher average scores than pupils that did not participate in PISA. These differences were around 2-3 scale score points and represent statistically significant differences in average scores at the 99.9% confidence level.

Table A.21: Distribution of KS2 scaled score for mathematics for pupils in England's final participating sample for PISA 2022

KS2 scaled score in mathematics	Participating pupils	Non-participating pupils	*t*-test *p*-value
Mean	105	103	<.001***
Lower quartile	101	99	<.001***
Median	106	103	<.001***
Upper quartile	110	107	<.001***

**p<0.05, **p<0.01, ***p<0.001*
Base: Original sample: n = 7,986; Participating pupils: n = 4,088, missing = 675; Non-participating pupils: n = 1,518, missing = 218.
Note: KS2 scaled scores are not available for the majority of pupils in independent schools. Pupils were weighted by their pupil base weights.

Source: OECD, PISA 2022, data matched to DfE NPD

Table A.22: Distribution of KS2 scaled score for reading for pupils in England's final participating sample for PISA 2022

KS2 scaled score in reading	Participating pupils	Non-participating pupils	*t*-test *p*-value
Mean	106	104	<.001***
Lower quartile	101	99	<.001***
Median	107	105	<.001***
Upper quartile	112	109	<.001***

**p<0.05, **p<0.01, ***p<0.001*
Base: Original sample: n = 7,986; Participating pupils: n = 4,072, missing = 691; Non-participating pupils: n = 1,515, missing = 221.

Note: KS2 scaled scores are not available for pupils in independent schools. Pupils were weighted by their pupil base weights.

Source: OECD, PISA 2022, data matched to DfE NPD

Table A.23 and Table A.24 show the distribution of outcomes in KS2 mathematics and KS2 reading respectively. In both subjects, pupils working at a higher standard are overrepresented and pupils working towards the national standard are underrepresented. There was a statistically significant differences in distribution of pupil KS2 outcomes for reading and for mathematics at the 99.9% confidence level.

Table A.23: Distribution of KS2 outcomes for mathematics for pupils in England's final participating sample for PISA 2022

KS2 outcome in mathematics	Participating pupils	Non-participating pupils
Working at a higher standard	23.0%	14.1%
Met the national expectation	47.8%	46.9%
Working towards the national expectation	15.7%	27.2%
Below the level of the assessment	0.7%	1.5%
Outcome unknown	12.7%	10.4%

Base: Participating pupils: n = 4,763; Non-participating pupils: n = 1,736.
KS2 outcome in mathematics: $\chi2(ndf = 2.72, ddf = 215) = 38.5, p = <0.001$
Note: Pupils working at a higher standard had a scaled score of 110 or above, pupils who met the national expectation had a scaled score between 100 and 110, and pupils who were working towards the national expectation had a scaled score between 80 and 100. Pupils were weighted by their pupil base weights.

Source: OECD, PISA 2022, data matched to DfE NPD

Table A.24: Distribution of KS2 outcomes for reading for pupils in England's final participating sample for PISA 2022

KS2 outcome in reading	Participating pupils	Non-participating pupils
Working at a higher standard	27.4%	20.1%
Met the national expectation	43.4%	43.0%
Working towards the national expectation	15.6%	25.2%
Below the level of the assessment	0.9%	1.5%
Outcome unknown	12.6%	10.1%

Base: Participating pupils: n = 4,763; Non-participating pupils: n = 1,736.
KS2 outcome in reading: χ^2(ndf = 2.63, ddf = 208) = 29.3, p = <0.001
Note: Pupils working at a higher standard had a scaled score of 110 or above, pupils who met the national expectation had a scaled score between 100 and 110, pupils who were working towards the national expectation had a scaled score between 80 and 100. Pupils were weighted by their pupil base weights.

Source: OECD, PISA 2022, data matched to DfE NPD

A.6.4. Regression Models

In this section, we use an approach called logistic regression to model the likelihood that a pupil would participate in PISA based on their KS2 outcome in mathematics and reading. These logistic regressions also control for the other pupil characteristics previously discussed, free-school-meal eligibility, whether the pupil speaks English as their first or as an additional language, and whether the pupil has support for SEN or not. Table A.25 and Table A.26 show these regression analyses for KS2 mathematics and reading respectively and show that in both subjects, KS2 performance, as well as having an eligibility for FSM in the last 6 years, are significant positive predictors of PISA participation, after accounting for the other listed pupil characteristics. For KS2 outcomes in reading, pupils with an EHCP are significantly less likely to participate in PISA after accounting for the other listed pupil characteristics.

Table A.25: Logistic regression modelling relationship of participation status to pupil KS2 outcome for mathematics and other pupil characteristics

Variable	Estimate	Standard Error	*t*-value	*p*-value
Intercept	1.54	0.19	8.04	<.001***
KS2 mathematics outcome: met the expected standard	0	0	0	0
KS2 mathematics outcome: working at a higher standard	0.40	0.09	4.51	<.001***
KS2 mathematics outcome: working towards the expected standard	-0.46	0.09	-4.96	<.001***
KS2 mathematics outcome: below the level of the assessment	-0.62	0.25	-2.50	0.01*
KS2 mathematics outcome: Unknown	-0.18	0.13	-1.39	0.17
FSM eligibility unknown	0	0	0	0
Pupil not eligible for FSM in the last 6 years	-0.52	0.20	-2.52	0.01*
Pupil eligible for FSM in the last 6 years	-0.62	0.20	-3.06	0.00**
Pupil first language unknown	0	0	0	0
Pupil speaks English as their first language	0.18	0.46	0.39	0.70
Pupil does not speak English as their first language	0.80	0.48	1.67	0.10
Pupil SEN status unknown	0	0	0	0
Pupil has an EHCP	-1.04	0.55	-1.88	0.06
Pupil receives SEN support	-0.70	0.49	-1.44	0.15
Pupil does not receive support for SEN	-0.18	0.49	-0.37	0.71

**p< .05, **p< .01, ***p< .001*
Note: Pupil characteristics and KS2 outcomes are not available for the majority of pupils in independent schools.

Source: OECD, PISA 2022, data matched to DfE NPD

Table A.26: Logistic regression modelling relationship of participation status to pupil KS2 outcome for reading and other pupil characteristics

Variable	Estimate	Standard Error	*t*-value	*p*-value
Intercept	1.54	0.20	7.90	<.001***
KS2 mathematics outcome: met the expected standard	0	0	0	0
KS2 mathematics outcome: working at a higher standard	0.26	0.08	3.30	0.00**
KS2 mathematics outcome: working towards the expected standard	-0.41	0.07	-6.37	<.001***
KS2 mathematics outcome: below the level of the assessment	-0.37	0.26	-1.44	0.16
KS2 mathematics outcome: Unknown	-0.17	0.13	-1.30	0.20
FSM eligibility unknown	0	0	0	0
Pupil not eligible for FSM in the last 6 years	-0.52	0.21	-2.53	0.01*
Pupil eligible for FSM in the last 6 years	-0.62	0.20	-3.03	0.00**
Pupil first language unknown	0	0	0	0
Pupil speaks English as their first language	0.23	0.46	0.50	0.62
Pupil does not speak English as their first language	0.89	0.48	1.87	0.07
Pupil SEN status unknown	0	0	0	0
Pupil has an EHCP	-1.16	0.55	-2.12	0.04*
Pupil receives SEN support	-0.80	0.49	-1.65	0.10
Pupil does not receive support for SEN	-0.23	0.49	-0.48	0.63

**p*< .05, ***p*< .01, ****p*< .001*
Note: Pupil characteristics and KS2 outcomes are not available for the majority of pupils in independent schools.

Source: OECD, PISA 2022, data matched to DfE NPD

A.7 Non-response adjusted participating final sample

In this section, the distribution of the participating pupils (N = 4,763) before and after non-response weighting adjustments are compared. Where the data are available the distribution is also compared to estimated study population of 15-year-olds.

A.7.1. School level categorical variables

Table A.27 and Table A.28 show the differences in school-level characteristics between the final sample of pupils compared to the group of participating pupils after the application of non-response adjusted weights. These tables show that there was no evidence of bias in the participating sample of pupils after non-response weighting adjustments by school type or region (Table A.27), nor by school gender selectivity or the school attainment band (Table A.28).

Table A.27: Percentage distribution of pupils in the estimated study population of 15-year-olds compared to England's final participating sample for PISA 2022 after adjusting for non-response by explicit stratification variables

Explicit stratum	Final sample	Participating pupils	Bias	Relative bias
School type: Academy	67.3%	67.6%	-0.3	0.00
School type: Independent	8.2%	8.2%	0.0	0.00
School type: Maintained	20.3%	20.2%	0.1	0.00
School type: Selective	4.2%	4.1%	0.1	0.00
Region: Greater London	15.5%	15.1%	0.3	0.00
Region: Midlands	30.6%	30.9%	-0.3	0.00
Region: North	27.6%	28.0%	-0.4	0.00
Region: South	26.3%	25.9%	0.4	0.00

Base: Original sample: number of schools = 201; Participating pupils: n = 4,763.
Note: Bias is calculated as the difference between the estimates of the proportion of participating pupils and the estimates of the study-population proportion of pupils in the original sample. Relative bias is calculated as the bias divided by the estimate from the original sample. Pupils were weighted by their pupil base weights after adjusting for non-response. The final sample is weighted by the school base weight multiplied by the number of eligible pupils enrolled in the school.

Source: OECD, PISA 2022, data matched to DfE NPD

Table A.28: Percentage distribution of pupils in the estimated study population of 15-year-olds compared to England's final participating sample for PISA 2022 after adjusting for non-response by implicit stratification variables.

Implicit Stratum	Original sample	Participating pupils	Bias	Relative bias
School gender: Mixed	87.6%	86.9%	0.7	0.00
School gender: girls	6.7%	6.9%	-0.2	0.00
School gender: boys	5.7%	6.2%	-0.5	0.00
Attainment band: Low 1	19.5%	19.1%	0.3	0.00
Attainment band: 2	18.6%	20.8%	-2.2	0.00
Attainment band: 3	18.0%	16.0%	2.0	0.00
Attainment band: 4	19.2%	18.5%	0.7	0.00
Attainment band: High 5	19.7%	20.5%	-0.7	0.00
Attainment band: Missing	5.0%	5.1%	-0.1	0.00

Base: Original sample: number of schools = 201; Participating pupils: n = 4,763.
Note: Bias is calculated as the difference between the estimates of the proportion of participating pupils and the estimates of the study-population proportion of pupils in the original sample. Relative bias is calculated as the bias divided by the estimate from the original sample. Pupils were weighted by their pupil base weights after adjusting for non-response. The final sample is weighted by the school base weight multiplied by the number of eligible pupils enrolled in the school.

Source: OECD, PISA 2022, data matched to DfE NPD

A.7.2. Pupil characteristics

Table A.29 shows the distribution of pupil characteristics in the group of participating pupils after the application of non-response adjusted weights, compared to before the application of these weights and in comparison to the non-participating pupils in the participating schools. The table shows that the application of the non-response adjusted weights provided modest reductions in the differences in the proportions of English first-language and English additional-language pupils between participating and non-participating pupils, but there was continued evidence for the over-representation of pupils who have not been eligible for FSM in the last 6 years and the proportion of pupils who do not receive any support for SEN.

Table A.29: Percentage distribution of pupils in England's final participating sample for PISA 2022 before and after adjusting for non-response by pupil characteristics.

Pupil characteristic	Participating pupils (original base weights)	Non-participating pupils in participating schools	Participating pupils (non-response adjusted weights)
Pupil gender: Female	49.3%	48.0%	49.1%
Pupil gender: Male	50.7%	52.0%	50.9%
FSM eligibility unknown	10.3%	7.3%	9.3%
Pupil not eligible for FSM in the last 6 years	70.1%	62.8%	70.7%
Pupil eligible for FSM in the last 6 years	19.6%	29.9%	20.0%
Pupil first language unknown	10.6%	7.8%	9.6%
Pupil speaks English as their first language	74.5%	83.1%	75.9%
Pupil does not speak English as their first language	14.9%	9.1%	14.5%
Has an Education, Health and Care plan	1.2%	3.5%	1.2%
Receives SEN support	8.4%	16.4%	8.6%
No support for SEN	80.1%	72.8%	80.9%
SEN status unknown	10.3%	7.3%	9.3%

Base: Participating pupils: n = 4,763; Non-participating pupils: n = 1,736.
Note: Pupils were weighted by their pupil base weights both before and after adjusting for non-response.

Source: OECD, PISA 2022, data matched to DfE NPD

A.7.3. Achievement variables

The non-response adjustments have made little difference to the average KS2 scaled scores in mathematics (Table A.30) or reading (Table A.31). This suggests a continued possible bias with pupils with higher prior attainment being over-represented in the final sample.

Table A.30: Distribution of KS2 scaled score for mathematics for pupils in England's final participating sample for PISA 2022 before and after adjusting for non-response.

KS2 scaled score in mathematics	Participating pupils (original base weights)	Non-participating pupils in participating schools	Participating pupils (non-response adjusted weights)
Mean	105.0	102.1	104.9
Lower quartile	101.0	98.0	101.0
Median	105.0	103.0	105.0
Upper quartile	110.0	107.0	110.0

Base: Participating pupils: n = 4,763; Non-participating pupils: n = 1,736.
Note: Pupil characteristics are not available for the majority of pupils attending independent schools. Pupils were weighted by their pupil base weights before and after adjustments for non-response.

Source: OECD, PISA 2022, data matched to DfE NPD

Table A.31: Distribution of KS2 scaled score for reading for pupils in England's final participating sample for PISA 2022 before and after adjusting for non-response.

KS2 scaled score in reading	Participating pupils (original base weights)	Non-participating pupils in participating schools	Participating pupils (non-response adjusted weights)
Mean	106.0	103.8	106.0
Lower quartile	101.0	99.0	101.0
Median	107.0	105.0	107.0
Upper quartile	112.0	109.0	112.0

Base: Participating pupils: n = 4,763; Non-participating pupils: n = 1,736.
Note: Pupil characteristics are not available for the majority of pupils attending independent schools. Pupils were weighted by their pupil base weights before and after adjustments for non-response.

Source: OECD, PISA 2022, data matched to DfE NPD

Table A.32 and Table A.33 show the distribution of outcomes in KS2 mathematics and KS2 reading respectively before and after non-response adjustments. The non-response adjustments have made little difference to the KS2 outcomes in mathematics (Table A.32) or reading (Table A.33) with the exception of a smaller proportion of pupils working towards the national expectation and larger proportion of pupils for whom the KS2 outcomes are unknown. This suggests a continued possible bias with pupils with lower prior attainment being under-represented in the final sample.

Table A.32: Distribution of KS2 outcomes for mathematics for pupils in England's final participating sample for PISA 2022 before and after adjusting for non-response

KS2 outcome in mathematics	Participating pupils (original base weights)	Non-participating pupils in participating schools	Participating pupils (non-response adjusted weights)
Working at a higher standard	23.0%	14.1%	22.9%
Met the national expectation	47.8%	46.9%	48.5%
Working towards the national expectation	15.7%	27.2%	11.9%
Below the level of the assessment	0.7%	1.5%	0.7%
Outcome unknown	12.7%	10.4%	15.9%

Base: Participating pupils: n = 4,763; Non-participating pupils: n = 1,736.
KS2 outcome in mathematics: χ^2(ndf = 2.72, ddf = 215) = 38.5, p = <0.001
Note: Pupils working at a higher standard had a scaled score of 110 or above, pupils who met the national expectation had a scaled score between 100 and 110, and pupils who were working towards the national expectation had a scaled score between 80 and 100. Pupils were weighted by their pupil base weights.

Source: OECD, PISA 2022, data matched to DfE NPD

Table A.33: Distribution of KS2 outcomes for reading for pupils in England's final participating sample for PISA 2022 before and after adjusting for non-response

KS2 outcome in reading	Participating pupils (original base weights)	Non-participating pupils in participating schools	Participating pupils (non-response adjusted weights)
Working at a higher standard	27.4%	20.1%	27.4%
Met the national expectation	43.4%	43.0%	43.9%
Working towards the national expectation	15.6%	25.2%	11.9%
Below the level of the assessment	0.9%	1.5%	0.9%
Outcome unknown	12.6%	10.1%	15.9%

Base: Participating pupils: n = 4,763; Non-participating pupils: n = 1,736.
KS2 outcome in reading: χ^2*(ndf = 2.63, ddf = 208) = 29.3, p = <0.001*
Note: Pupils working at a higher standard had a scaled score of 110 or above, pupils who met the national expectation had a scaled score between 100 and 110, pupils who were working towards the national expectation had a scaled score between 80 and 100. Pupils were weighted by their pupil base weights.

Source: OECD, PISA 2022, data matched to DfE NPD

A.8 Summary of pupil level analysis

Overall, this analysis provides reassurance that the final sample of pupils participating in PISA 2022 was representative of the study population of 15-year-olds in relation to school type, region, school gender selectivity and school attainment band after non-response adjustments are made. However, there was some evidence of non-response bias with pupils with higher prior attainment more likely to participate than pupils with lower prior attainment in mathematics and reading at key stage 2.

We investigated non-response bias at the pupil level, finding that the final sample does differ significantly from the estimated study population of 15-year-olds in terms of prior attainment, the proportion of pupils eligible for FSM in the past 6 years, the category of SEN support, and the proportion of pupils whose first language is different from English. However, pupils whose first language is different from English and pupils who receive SEN were not statistically significantly less likely to participate after taking into account their KS2 attainment except for pupils with an EHCP when KS2 reading outcome was taken into account.

The non-response bias adjustments have slightly reduced the difference in average KS2 scaled scores in mathematics and reading between the final sample and the estimated population. Similarly, the non-response bias adjustments have slightly reduced the difference in the proportion of pupils whose first language is different from English. However, there remains evidence of potential bias in the prior attainment distribution of participating pupils, the proportion of pupils not eligible for FSM in the past 6 years and the proportion of pupils not receiving SEN support.

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