An Official Statistics Publication for Scotland

Education and Lifelong Learning

Programme for International Student Assessment (Pisa) 2012: Highlights from Scotland's Results

PROGRAMME FOR INTERNATIONAL STUDENT ASSESSMENT (PISA) 2012:
HIGHLIGHTS FROM SCOTLAND'S RESULTS

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We would like to thank the 2,945 students and their teachers from 111 schools who participated in the PISA 2012 survey in Scotland

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MAIN MESSAGES

Summary

- Scotland's scores in the PISA assessments were similar to the OECD average in maths, and above the average in reading and science. This was the same as in the 2009 survey.

- Scotland's own overall performance was similar to that in 2009 for all three domains.

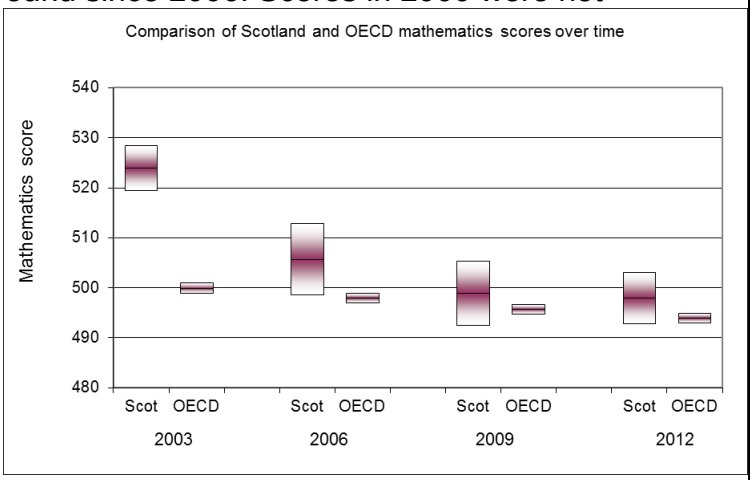
- Scotland's relative performance compared to other countries, including UK administrations, improved slightly since 2009 in maths, measured by the number of comparator countries that were significantly above and below Scotland.

- The proportion of pupils performing at highest levels of achievement ("Level 5 and above") and performing at the lowest levels ("below Level 2") were similar in Scotland to the OECD average for all three domains, except in reading where Scotland had significantly fewer below Level 2 in an improvement on the 2009 figure.

- There was a reduction in the performance gap between disadvantaged and less disadvantaged pupils for all three domains compared to 2009. There was also a reduction in the *likelihood* of disadvantage affecting a pupil's score in science, but no change in maths and reading.

Scotland's performance in maths:

- **In maths, Scotland's performance was similar to the OECD average**. This has been the case in each PISA round since 2006. Scores in 2000 were not comparable.



- There was clear evidence that **the decline in Scotland's own performance, seen between 2003 and 2006, has not continued**. The OECD average fell between 2009 and 2012.

- **Scotland's relative position** compared to OECD countries and UK administrations **improved slightly since 2009**, with fewer countries outperforming Scotland and a greater number performing significantly below Scotland.

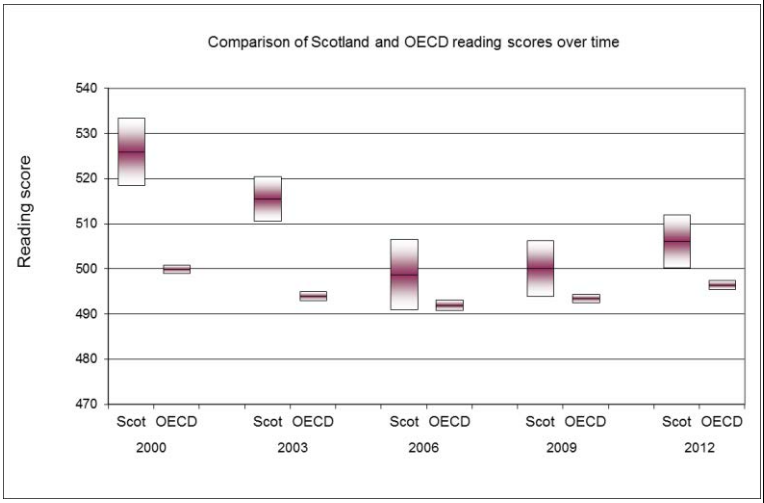
- **The *likelihood* of disadvantage affecting a pupil's score was similar in Scotland to the OECD average.** About 13 per cent of the variation in Scotland could be explained by socio-economic factors. This was also similar to the position for maths in 2009.

- **The *extent* to which disadvantage was related to performance in Scotland was also similar to the average across OECD countries** and amounted to around 37 points. **This represents an improvement on 2009** when the effect of deprivation was larger (45 points).

- Pupils in Scotland were **generally more likely than the OECD average to see the value in learning maths** (e.g. for future job prospects) and were generally **more likely to be in schools where maths lessons were organised on the basis of ability or difficulty of content**.

Scotland's performance in reading:

- **In reading, Scotland's performance in 2012 was above the OECD average**, as it was in 2009. The OECD average also improved between 2009 and 2012.



- **Scotland's own performance remained steady since 2006**, after falling between 2003 and 2006. There were signs of a general improvement in reading across the OECD between 2006 and 2012.

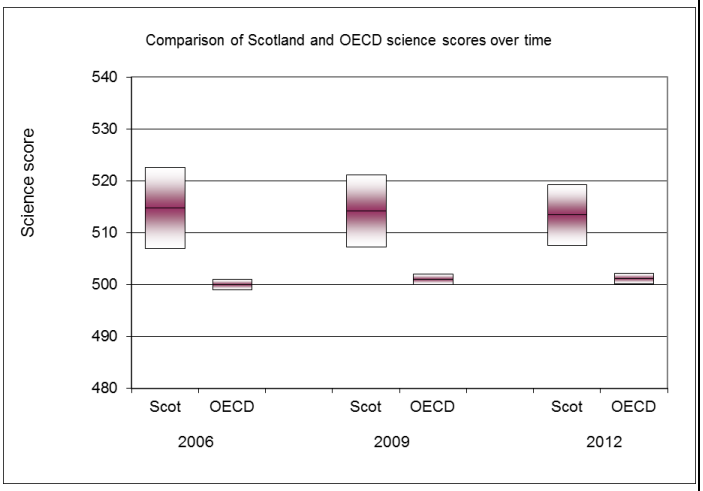
- **Scotland's relative position** compared to OECD countries and UK administrations **improved since 2009**, with a greater number of countries performing significantly lower than Scotland, and fewer countries performing similarly to Scotland.

- **The *likelihood* of disadvantage affecting a pupil's score was similar in Scotland to the OECD average.** About 11 per cent of the variation in Scotland could be explained by socio-economic factors. This was similar to the position for reading in 2009 (14 per cent).

- **The *extent* of the relationship between deprivation and reading performance in Scotland was smaller than it was in 2009**, at around 34 points, and was similar to the OECD average, which is better than the 2009 position (44 points).

Scotland's performance in science:

- In science, **Scotland has been above the OECD average in each PISA round since 2006**. Scores for previous rounds (2000 and 2003) were not comparable.



- **Scotland's own performance has not changed over that period**.

- With respect to Scotland's relative position in 2012 (compared to OECD countries and UK administrations) there were two additional countries now outperforming Scotland, compared to 2009.

- **The *likelihood* of disadvantage affecting a pupil's score was similar in Scotland to the OECD average.** About 11 per cent of the variation in Scotland could be explained by socio-economic factors. This was an improvement compared to the position for science in 2009 (16 per cent).

The *extent* to which disadvantage was related to performance in Scotland was also similar to the average across OECD countries and amounts to around 36 points. **This represents an improvement on 2009** when the effect of deprivation was larger (47 points).

1 INTRODUCTION AND METHODOLOGY

What is PISA?

1.1 The Programme for International Student Assessment (PISA) is an assessment of 15 year-olds' skills carried out under the auspices of the Organisation for Economic Co-operation and Development (OECD). The programme runs every three years across all OECD members and a variety of partner countries. Scotland has participated since the first wave of testing in 2000.

1.2 Each survey cycle focusses on one of three domains: reading, mathematics and science. In 2012 the main domain was maths, with reading and science as subsidiary domains.

Who Participates?

1.3 Around 510,000 students participated in the study worldwide. This includes the 34 member states of the OECD and 31 "partner countries and economies".

Fig. 1.1: Global coverage of PISA 2012

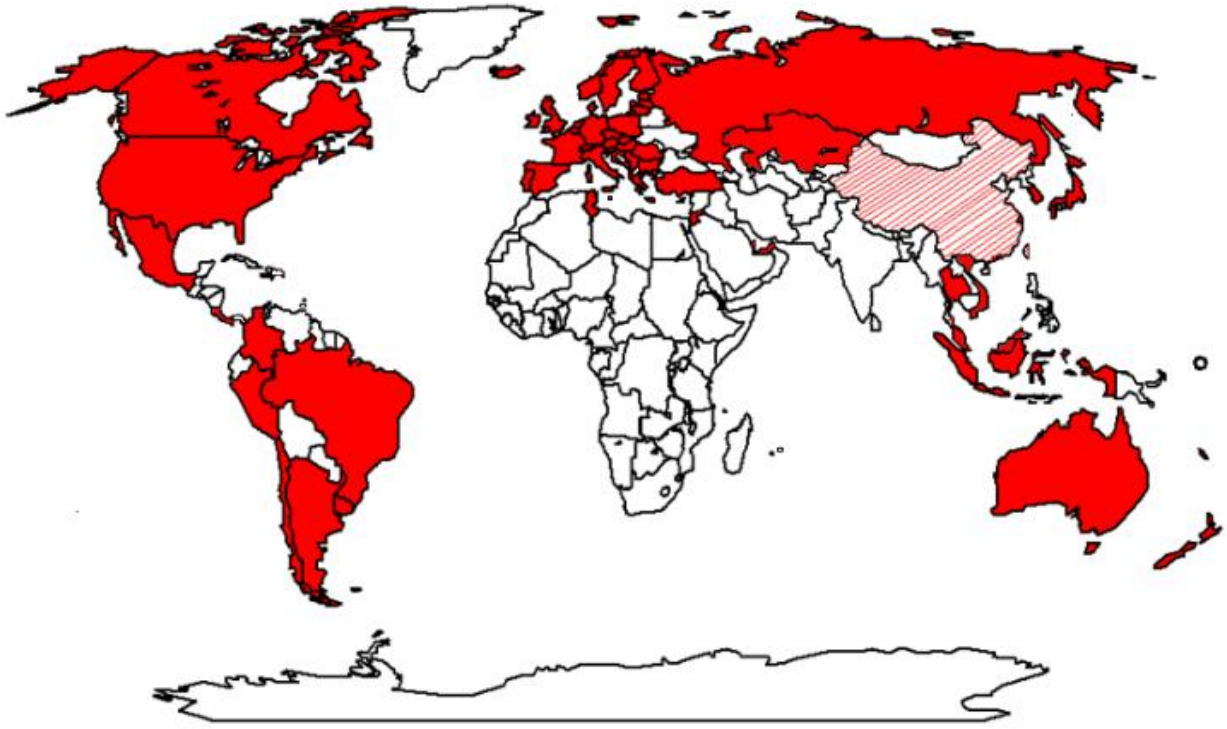


Table 1.1: OECD states and partner countries and "economies" participating in PISA 2012

OECD countries		Partner countries and economies in PISA 2012	
Australia	Japan	Albania	Malaysia
Austria	Korea	Argentina	Montenegro
Belgium	Luxembourg	Brazil	Peru
Canada	Mexico	Bulgaria	Qatar
Chile	Netherlands	Columbia	Romania
Czech Republic	New Zealand	Costa Rica	Russian Federation
Denmark	Norway	Croatia	Serbia
Estonia	Poland	Cyprus	Shanghai-China
Finland	Portugal	Hong Kong-China	Singapore
France	Slovak Republic	Indonesia	Chinese Taipei
Germany	Slovenia	Jordan	Thailand
Greece	Spain	Kazakhstan	Tunisia
Hungary	Sweden	Latvia	United Arab Emirates
Iceland	Switzerland	Liechtenstein	Uruguay
Ireland	Turkey	Lithuania	Vietnam
Israel	United Kingdom	Macao-China	
Italy	United States		

1.4 The United Kingdom is a member state of the OECD and its results are published in the main OECD publication. Scotland participates as an "adjudicated region", meaning that its results have full quality assurance from the survey contractors appointed by the OECD, and can publish its results separately. Within the UK, England, Wales and Northern Ireland have boosted samples as "non-adjudicated regions" which means they are able to produce country-level analysis within their reports.

1.5 Survey fieldwork is carried out separately in each participating state by "National Centres" according to strict quality standards set by the OECD.

What does PISA measure?

1.6 PISA is not simply a measure of accumulated knowledge or academic attainment. Rather it seeks to measure skills which are necessary for participation in society. Accordingly it seeks to assess how students apply the skills they have gained to the types of problem they may encounter in work or elsewhere. Pupils are assessed at age 15 as this is regarded as a reasonable point at which to test the impact of compulsory education throughout the developed world (most PISA 2012 participants in Scotland were attending S4). After this point students will typically move onto more specialised studies or enter the labour market. Box 1.1 contains the definitions of the domains tested by PISA.

1.7 We have included some details on how mathematics, the main focus of the 2012 PISA survey, was assessed in Chapter 2. Further details of how each domain was assessed can be found in the OECD volumes published on the PISA website, www.oecd.org/pisa.

Box 1.1: The PISA domains and their definition

Mathematics: "An individual's capacity to formulate, employ, and interpret mathematics in a variety of contexts. It includes reasoning mathematically and using mathematical concepts, procedures, facts and tools to describe, explain and predict phenomena. It assists individuals in recognizing the role that mathematics plays in the world and to make the well-founded judgements and decisions needed by constructive, engaged and reflective citizens."

Reading: "An individual's capacity to understand, use, reflect on and engage with written texts, in order to achieve one's goals, to develop one's knowledge and potential, and to participate in society."

Science: "An individual's scientific knowledge and use of that knowledge to identify questions, to acquire new knowledge, to explain scientific phenomena, and to draw evidence-based conclusions about science-related issues. It includes understanding the characteristic features of science as a form of human knowledge and enquiry, awareness of how science and technology shape our material, intellectual, and cultural environments, and willingness to engage in science-related issues, and with the ideas of science, as a reflective citizen."

1.8 The assessments are also supplemented by background questionnaires. Pupils are asked about their motivations for study, attitudes to school, confidence in using maths, studying and their socio-economic background. Headteachers are asked about the challenges facing their schools, organisation and factors that they believe affect their students' performance.

The Survey in Scotland

1.9 The survey was carried out in Scotland between 1 March and 30 April 2012. The pupils tested are generally described as "15 year-olds" although the actual age range was 15 years and 2 months to 16 years and 2 months as of 1 March. Students were mostly in the S4 year group.

1.10 The PISA survey was carried out by an international consortium led by the Australian Council for Educational Research (ACER). The Consortium developed the tests, questionnaires and survey documentation and ensured that all participating countries met quality standards. In Scotland, the National Foundation for Educational Research (NFER) was the "National Centre", responsible for local adaptations to the surveys, and administering the test in schools.

1.11 The school sample was randomly selected by the consortium using information provided by NFER and from routine Scottish Government

statistics. The sample was stratified on the basis of previous exam performance (split into five categories), whether schools were publicly funded or independent, urban/rural location and school size, and whether schools were single-sex or mixed.

1.12 In total 111 secondary schools participated in the survey. One hundred and eight of these were from the main sample (95.6 per cent response rate), and three from the back-up samples. This exceeded the OECD's minimum standard of 85 per cent participation.

1.13 Within each school 35 students were randomly sampled by NFER using software supplied by the Consortium. In total 3,944 students were drawn in the sample. Schools were able to withdraw a certain number of students where it was deemed that participation would be difficult due to special needs or language issues. Similarly students that had left the school in the interim were not considered part of the target sample. In total 3,607 students were deemed eligible participants. Of these a total of 2,945 students took part, with the balance being those who did not wish to take part (both students and their parents were given the opportunity to opt out of the survey), were absent on the day of the test or were withdrawn by the school because of their additional support needs.

1.14 The OECD had strict criteria for the level of exclusion that was acceptable, and the total exclusion rate of 4.78 per cent was within these bounds. Similarly, the final weighted participation rate, calculated by the consortium, was 83.1 per cent, exceeding the OECD requirement of 80 per cent.

1.15 The assessment items were rotated throughout 13 papers of which students each attempted one. Around half of the items assessed maths, while the rest were divided between science and reading. In addition the student questionnaire had three booklets, with one core section and two out of three rotated sections. The assessment took two hours and the background questionnaire a further 30 minutes. In total, including administration and breaks, the session took three and a half hours.

Interpreting the results

1.16 It should be understood that PISA is a sample survey. Like all surveys of this type, it is subject to sampling error. The necessity of surveying only a sample of students, even when chosen at random, runs the risk that such a group will not necessarily reflect the larger population of students. We must therefore be cautious in assuming that the values found in the survey would be the same as those in the population.

1.17 This means that being confident that there is a difference between Scotland and the OECD average, or between groups and countries, will depend on both the size of the observed difference and the standard error associated with the sample sizes used. Significance tests are used to assess the statistical significance of comparisons made.

1.18 Therefore, it is not possible to produce individual country rankings based on the absolute (mean) score. Accordingly this report shows results divided into those countries whose scores are statistically significantly higher than, similar to or lower than Scotland. By "significant" we mean that we are 95 per cent certain that there is a difference (or similarity).

Change over time

1.19 This report covers, as in previous publications, the position of Scotland relative to other countries, and how this has changed over time. The mathematics assessment changed radically in 2003 and for science in 2006, as they became "full domains" for the first time, so we are unable to make comparisons before those waves. The OECD average for mathematics was set at 500 in the 2003 survey – the first survey when it was the main domain.

1.20 One complication is that membership of the OECD changed in 2010, as Chile, Estonia, Israel and Slovenia were admitted to membership. This affected comparison of reading scores in 2009.[1] Scotland was above the OECD average when those four countries were included, but similar to the average of the pre-2010 membership.

Further Analysis of PISA

1.21 Much of this report focusses on changes to Scotland's headline score and the relative position internationally. However, PISA is not just a snapshot of student attainment, but a comprehensive data-gathering exercise which enables analysis not only of how well school systems around the world perform, but the factors that are behind this. The OECD publications present international analysis of students' abilities, motivations, attitudes, background, support at home and confidence. In addition, information is gathered on school structure and management and the OECD analyse how various aspects of school organisation may be related to attainment.

1.22 Periodically, the OECD also publish short reports in their "PISA in Focus" series at the following link: www.oecd.org/pisa/pisainfocus/

1.23 Further analysis of the Scottish PISA data will be published in order to build a deeper understanding of the factors behind our own performance, and how these compare with other countries. A series of published topic reports will be developed, starting in 2014, which will be based on more in-depth analysis of the data than the current report, and will initially focus on the following issues:

- Deprivation and attainment
- School ethos and health and wellbeing
- International comparisons with Scotland
- Key factors behind variation in results

[1] Although the four countries joined the OECD in 2010, they were included as OECD members in the PISA reports for the 2009 round.

- Behaviour.

Other surveys of performance in Scotland

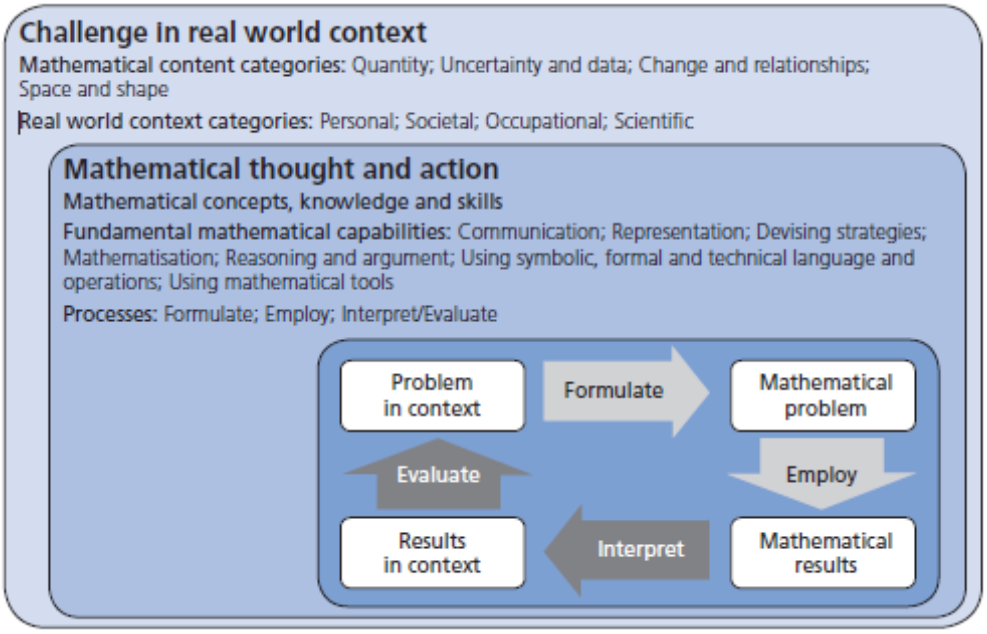
1.24 The Scottish Government, in partnership with Education Scotland, the Scottish Qualifications Agency (SQA) and the Association of Directors of Education in Scotland (ADES) also conducts the Scottish Survey of Literacy and Numeracy (SSLN), an annual survey which assesses student performance in numeracy and literacy in alternate years. The first numeracy survey was conducted in 2011 and the first literacy survey in 2012.

1.25 The SSLN provides Scotland-level performance data for pupils in primary stages 4 and 7 and in secondary stage 2. Results of the first numeracy and literacy surveys can be found on the Scottish Government website using the following link: www.scotland.gov.uk/ssln .

2 HOW MATHEMATICS IS ASSESSED

2.1 PISA is designed to measure the use of mathematics in the real world rather than abstract knowledge. Some of the processes will be simple, e.g. exchanges of money for goods and services, others will be more complex, such as use of mathematics to explain or predict complicated phenomena. Below, we summarise key features of the OECD's framework for measuring mathematics

Figure 2.1: Main features of the PISA 2012 mathematics framework



Source: OECD

Mathematics in context

2.2 Real-world challenges or situations are categorised in two ways: their ***context*** and the ***domain*** of mathematics involved. The four "context categories" identify the broad areas of life in which the problems may arise: personal, which is related to individuals' and families' daily lives; societal, which is related to the community – local, national, or global – in which an individual lives; occupational, which is related to the world of work; or scientific, which is related to the use of mathematics in science and technology

The types of mathematics

2.3 Figure 2.1 also shows that PISA reflects four categories of **mathematical content** that are related to the problems posed. These are explained by OECD as follows:

- ***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. It involves understanding measurements, counts, magnitudes, units, indicators, relative size, and numerical trends and patterns, and employing number sense, multiple representations of numbers, mental calculation, estimation, and assessment of reasonableness of results.

- ***Uncertainty and data*** cover two closely related sets of issues: how to identify and summarise the messages that are embedded in sets of data presented in many ways, and how to appreciate the likely impact of the variability that is inherent in many real processes. Uncertainty is part of scientific predictions, poll results, weather forecasts, and economic models; variation occurs in manufacturing processes, test scores, and survey findings; and chance is part of many recreational activities that individuals enjoy. Probability and statistics, taught as part of mathematics, address these issues.

- ***Change and relationships*** focuses on the multitude of temporary and permanent relationships among objects and circumstances, where changes occur within systems of interrelated objects or in circumstances where the elements influence one another. Some of these changes occur over time; some are related to changes in other objects or quantities. Being more literate in this content category involves understanding fundamental types of change and recognising when change occurs so that suitable mathematical models can be employed to describe and predict change.

- ***Space and shape*** encompasses a wide range of phenomena that are encountered everywhere: patterns, properties of objects, positions and orientations, representations of objects, decoding and encoding of visual information, navigation, and dynamic interaction with real shapes and their representations. Geometry is essential to space and shape, but the category extends beyond traditional geometry in content, meaning and method, drawing on elements of other mathematical areas, such as spatial visualisation, measurement and algebra. Mathematical literacy in *space and shape* involves understanding perspective, creating and reading maps, transforming shapes with and without technology, interpreting views of three-dimensional scenes from various perspectives, and constructing representations of shapes.

2.4 The smallest box of Figure 2.1 shows the stages through which a problem-solver may move when solving PISA tasks. PISA 2012 reports results according to these mathematical processes, formally named as:

Formulating situations mathematically - where the student has identified the problem and transforms it into one that can be solved using mathematics;

Employing mathematical concepts, facts, procedures and reasoning – where the student applies mathematical techniques to get results; and

Interpreting, applying and evaluating mathematical outcomes – where the student takes mathematical results they have obtained, and assesses how well they can be applied to the original “real-world” problem.

2.5 Questions are constructed to test each of these categories, and at varying levels of difficulty, in order to identify a student’s ability. Their score corresponds to levels of ability, which are summarised in Table 2.1 below.

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Table 2.1: Levels of performance in mathematics and what they mean

Level	Lower score limit	% (across OECD) able to perform tasks at each level or above	What students can typically do
6	669	3.3%	At Level 6, students can conceptualise, generalise and utilise information based on their investigations and modelling of complex problem situations, and can use their knowledge in relatively non-standard contexts. They can link different information sources and representations and flexibly translate among them. Students at this level are capable of advanced mathematical thinking and reasoning. These students can apply this insight and understanding, along with a mastery of symbolic and formal mathematical operations and relationships, to develop new approaches and strategies for attacking novel situations. Students at this level can reflect on their actions, and can formulate and precisely communicate their actions and reflections regarding their findings, interpretations, arguments, and the appropriateness of these to the original situation.
5	607	12.6%	At Level 5 students can develop and work with models for complex situations, identifying constraints and specifying assumptions. They can select, compare, and evaluate appropriate problem-solving strategies for dealing with complex problems related to these models. Students at this level can work strategically using broad, well-developed thinking and reasoning skills, appropriate linked representations, symbolic and formal characterisations, and insight pertaining to these situations. They begin to reflect on their work and can formulate and communicate their interpretations and reasoning.
4	545	30.8%	At Level 4 students can work effectively with explicit models for complex concrete situations that may involve constraints or call for making assumptions. They can select and integrate different representations, including symbolic, linking them directly to aspects of real-world situations. Students at this level can utilise their limited range of skills and can reason with some insight, in straightforward contexts. They can construct and communicate explanations and arguments based on their interpretations, arguments, and actions.
3	482	54.5%	At Level 3 students can execute clearly described procedures, including those that require sequential decisions. Their interpretations are sufficiently sound to be a base for building a simple model or for selecting and applying simple problem-solving strategies. Students at this level can interpret and use representations based on different information sources and reason directly from them. They typically show some ability to handle percentages, fractions and decimal numbers, and to work with proportional relationships. Their solutions reflect that they have engaged in basic interpretation and reasoning.
2	420	77.0%	At Level 2 students can interpret and recognise situations in contexts that require no more than direct inference. They can extract relevant information from a single source and make use of a single representational mode. Students at this level can employ basic algorithms, formulae, procedures, or conventions to solve problems involving whole numbers. They are capable of making literal interpretations of the results.
1	358	92.0%	At Level 1 students can answer questions involving familiar contexts where all relevant information is present and the questions are clearly defined. They are able to identify information and to carry out routine procedures according to direct instructions in explicit situations. They can perform actions that are almost always obvious and follow immediately from the given stimuli.

Source: OECD

2.6 Box. 2.1 and Figure 2.2 give an example of typical mathematics question from PISA with some explanation of what is being tested

Box 2.1: Example Question: "Which Car"?

The unit, "Which car", consists of three questions. It presents a table of data that a girl might use to choose a car and make sure that she can afford it.

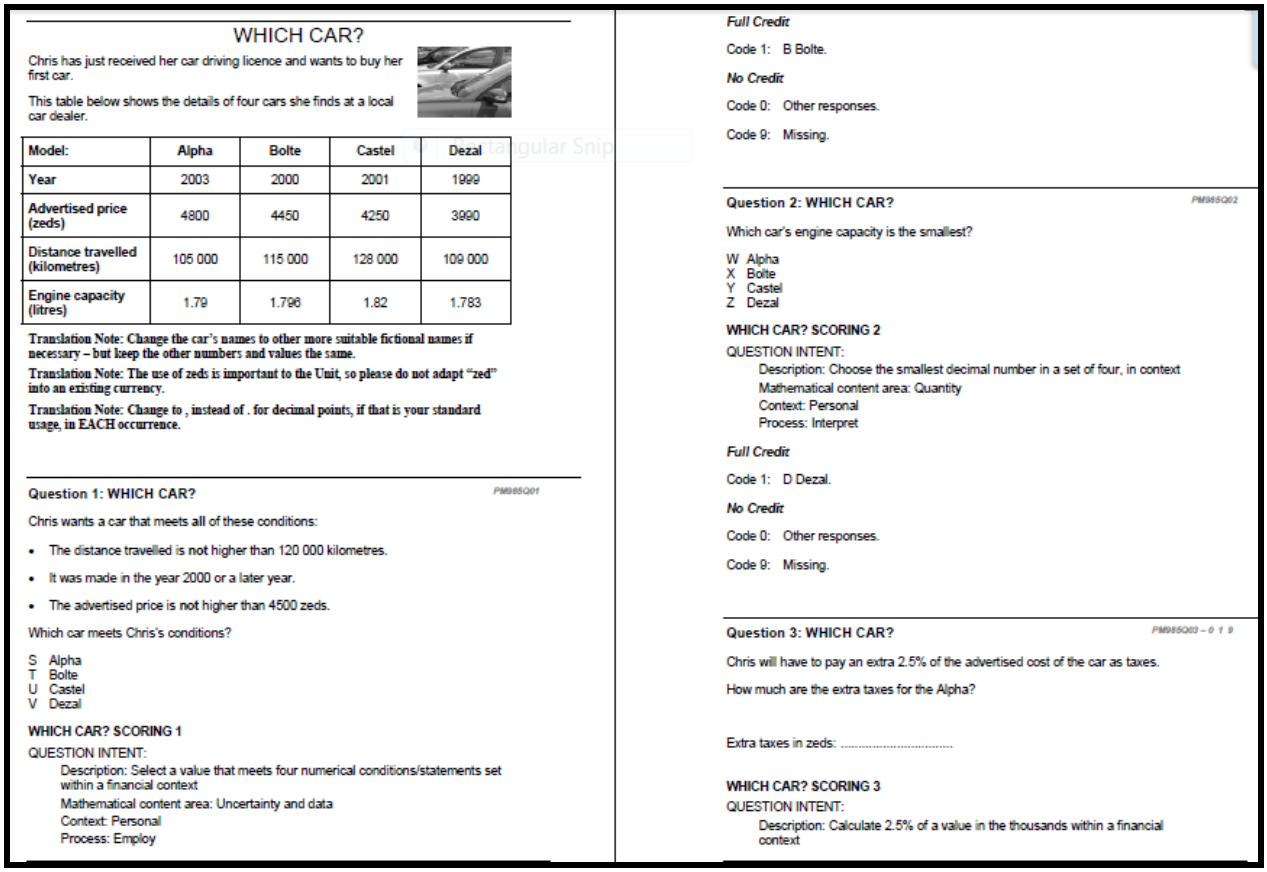
Context: Because buying a car is an experience that many people might have during their lifetimes, all three questions were allocated to the personal context category.

Response type: Question 1 and Question 2 are simple multiple-choice questions; Question 3, which asks for a single number, is a constructed response item that does not require expert scoring.

Content: Question 1 was allocated to the uncertainty and data content category. The item requires knowledge of the basic row-column conventions of a table, as well as co-ordinated data-handling ability to identify where the three conditions are simultaneously satisfied. While the solution also requires basic knowledge of large whole numbers, that knowledge is unlikely to be the main source of difficulty in the item. In contrast, Question 2 has been allocated to the quantity content category because it is well known that even at age 15, many students have misconceptions about the base ten and place value ideas required to order "ragged" decimal numbers. Question 3 is also allocated to the quantity content category because the calculation of 2.5% is expected to require more cognitive effort from students than identifying the correct data in the table. The difficulty for this age group in dealing with decimal numbers and percentages is reflected in the empirical results: Question 1 is considered an easy item, Question 2 is close to the international average, and Question 3 is of above-average difficulty.

Process: In allocating the items to process categories, their relation to "real-world" problems has been taken into consideration. The primary demand in items in the formulate category is the transition from the real-world problem to the mathematical problem; in the employ category, the primary demand is within the mathematical world; and in the interpret category, an item's primary demand is in using mathematical information to provide a real-world solution. Questions 2 and 3 are allocated to the employ category. This is because in both of these items, the main cognitive effort is made within mathematics: decimal notation and the calculation of a percentage. In Question 1, the construction of a table of data, including the need to identify key variables, is a mathematisation of a real situation. Question 1 is allocated to the interpret category because it requires these mathematical entities to be interpreted in relation to the real world

Figure 2.2: "Which Car" – a unit from the PISA 2012 main survey



WHICH CAR?

Chris has just received her car driving licence and wants to buy her first car.

This table below shows the details of four cars she finds at a local car dealer.

Model:	Alpha	Bolte	Castel	Dezal
Year	2003	2000	2001	1999
Advertised price (zeds)	4800	4450	4250	3990
Distance travelled (kilometres)	105 000	115 000	128 000	109 000
Engine capacity (litres)	1.79	1.796	1.82	1.783

Translation Note: Change the car's names to other more suitable fictional names if necessary – but keep the other numbers and values the same.

Translation Note: The use of zeds is important to the Unit, so please do not adapt "zed" into an existing currency.

Translation Note: Change to , instead of . for decimal points, if that is your standard usage, in EACH occurrence.

Question 1: WHICH CAR? PM985Q01

Chris wants a car that meets **all** of these conditions:

- The distance travelled is not higher than 120 000 kilometres.
- It was made in the year 2000 or a later year.
- The advertised price is not higher than 4500 zeds.

Which car meets Chris's conditions?

S Alpha
T Bolte
U Castel
V Dezal

WHICH CAR? SCORING 1

QUESTION INTENT:

Description: Select a value that meets four numerical conditions/statements set within a financial context
Mathematical content area: Uncertainty and data
Context: Personal
Process: Employ

Full Credit

Code 1: B Bolte.

No Credit

Code 0: Other responses.

Code 9: Missing.

Question 2: WHICH CAR? PM985Q02

Which car's engine capacity is the smallest?

W Alpha
X Bolte
Y Castel
Z Dezal

WHICH CAR? SCORING 2

QUESTION INTENT:

Description: Choose the smallest decimal number in a set of four, in context
Mathematical content area: Quantity
Context: Personal
Process: Interpret

Full Credit

Code 1: D Dezal.

No Credit

Code 0: Other responses.

Code 9: Missing.

Question 3: WHICH CAR? PM985Q03 – 0 1 9

Chris will have to pay an extra 2.5% of the advertised cost of the car as taxes.

How much are the extra taxes for the Alpha?

Extra taxes in zeds: .....

WHICH CAR? SCORING 3

QUESTION INTENT:

Description: Calculate 2.5% of a value in the thousands within a financial context

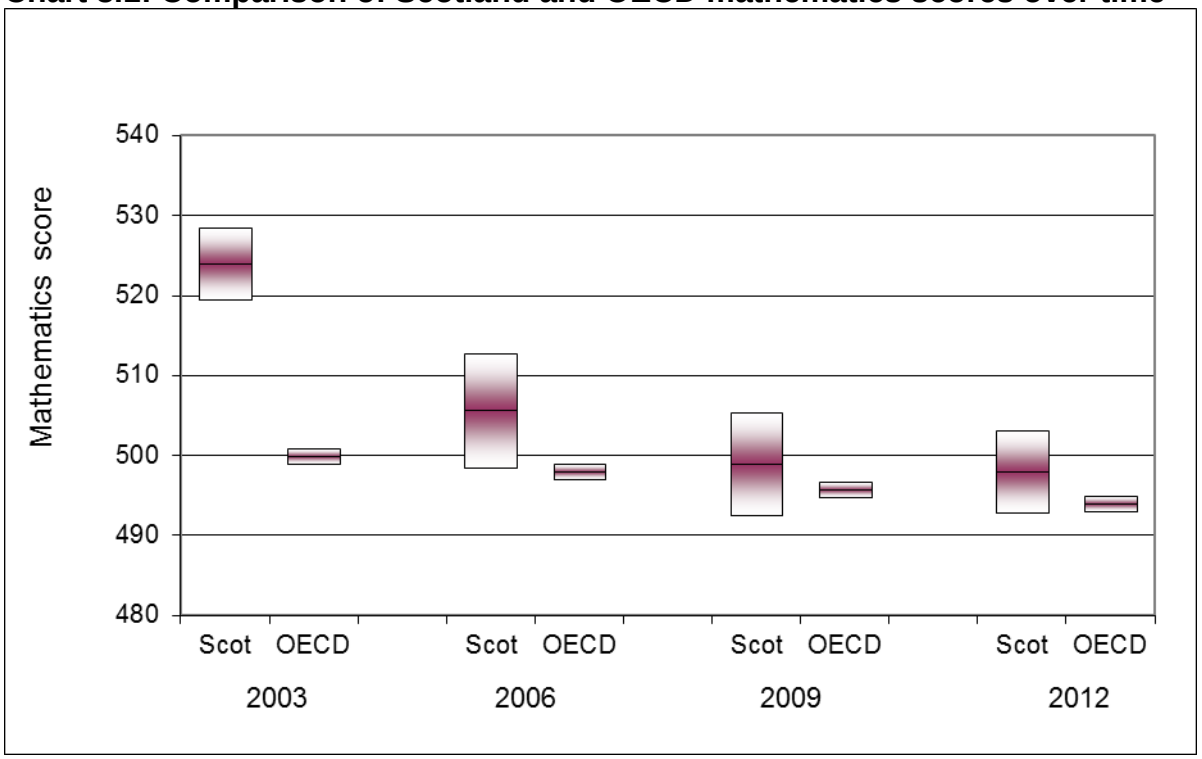
2.7 Further information on the testing on mathematics, including further example questions, can be found in the OECD volumes.

3 PERFORMANCE IN MATHEMATICS

Average scores

3.1 In maths, Scotland's score of **498** in PISA 2012 was similar to that in the 2006 (506) and 2009 (499) cycles, and below 2003 (524) (Table A.1). Comparisons are not possible with the 2000 maths score. Chart 3.1 illustrates Scotland's scores since 2003 with the 95 per cent confidence intervals[2] next to the scores for the OECD average. Note that Scotland, with a smaller sample, has larger confidence intervals than does the OECD average where the combined sample makes for more certainty.

Chart 3.1: Comparison of Scotland and OECD mathematics scores over time



3.2 Scotland's score was similar to the OECD average in 2012, as it was in 2009. As OECD membership has remained constant between the 2009 and 2012 surveys,[3] this result was unaffected by changes in those countries taking part in PISA. Across the OECD, the chart suggests that there has been a decline in average scores. When comparing OECD averages over time it is necessary to adjust for changes in participation by states over time, but even looking at states with comparable data going back to 2003, there has been an average decline by 0.3 score points per year.

[2] These are confidence intervals were we can be 95 per cent certain the "true" value lies. Where the intervals overlap, for example between Scotland and the OECD average, we cannot be sure that the true values are different.

[3] Chile, Estonia, Israel and Slovenia joined the OECD in 2010, but were included as OECD members in the PISA reports for the 2009 round.

3.3 Compared to the 33 OECD countries, plus the three other UK administrations, Scotland performed similarly to ten countries, including England and above 16 countries including Wales, Northern Ireland, Sweden and Italy. Ten countries performed above Scotland, including Canada, Germany, Poland and Korea. Table 3.1 below shows which countries were statistically significantly above, similar to and below Scotland in 2012. Table A.2a, located in the annex, shows each country's score.

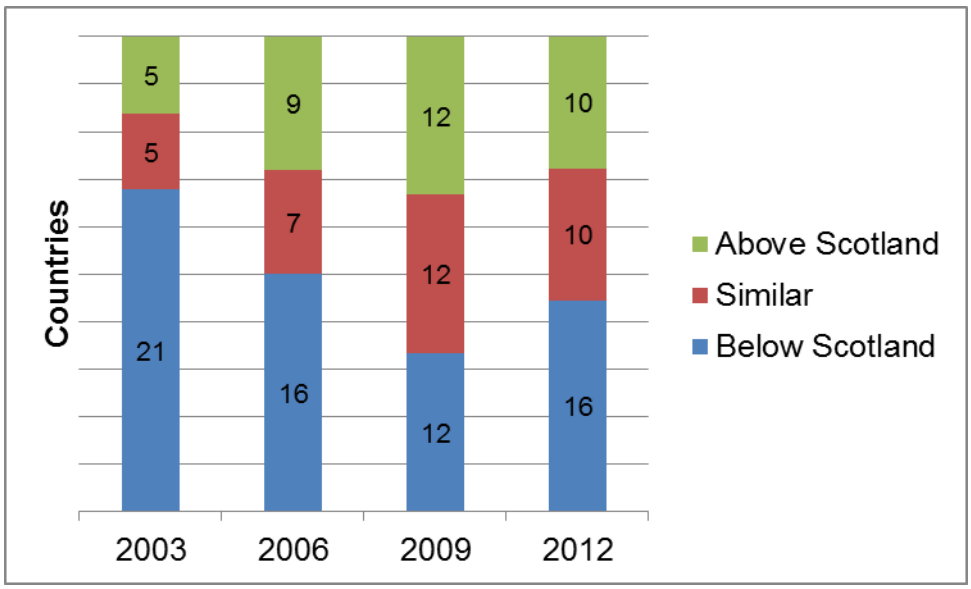
Table 3.1: OECD countries and UK administrations, higher than, similar to and lower than Scotland in mathematics

Higher score than Scotland	Similar score to Scotland	Lower score than Scotland
Belgium	Australia	Chile
Canada	Austria	Greece
Estonia	Czech Republic	Hungary
Finland	Denmark	Israel
Germany	France	Italy
Japan	Iceland	Luxembourg
Korea	Ireland	Mexico
Netherlands	New Zealand	Norway
Poland	Slovenia	Portugal
Switzerland	England	Slovak Republic
	OECD average	Spain
		Sweden
		Turkey
		United States
		Northern Ireland
		Wales

3.4 This was a measure of *relative* performance. Broadly, and in most PISA rounds, more countries perform significantly below Scotland in maths than above. Chart 3.2 below illustrates the numbers of countries (OECD members plus the UK administrations) that have been found to be significantly above, similar to and below Scotland in the comparable maths assessments since 2003.

Chart 3.2: Numbers of OECD countries and UK administrations scoring above, below or similar to Scotland in maths in PISA since 2003[4]

[4] The chart is not adjusted for constant OECD membership.



3.5 Scotland's relative position has improved slightly since 2009, with fewer countries outperforming Scotland and a greater number performing significantly below. The number of countries who performed above Scotland in maths had increased between 2003 and 2009, whilst fewer countries performed less well than Scotland over the same period, suggesting a decline in Scotland's relative performance.

3.6 A number of notable changes have taken place since the 2009 survey. In particular, Poland moved from similar to above Scotland, due to substantial improvements in their estimated mean score (also in reading and science). Australia and New Zealand moved from above Scotland to being similar, due to falls in their estimated mean scores. Sweden moved from similar to below Scotland, due to a fall in its estimated mean score. Further exploration of these issues will form the basis of the future publication on international comparisons.

3.7 Among the participating non-OECD economies, Chinese Taipei, Hong Kong-China, Shanghai and Singapore were amongst the seven economies above Scotland (those four were also the highest performers out of all participants). Twenty-four economies were below Scotland (Table A.2b). The OECD reports published at the same time as this report have full details on all countries' scores, and also those for which data has been collected on a "regional" basis (including Scotland).

Performance by type of mathematics

3.8 With respect to the "fundamental processes" tested, Scotland's students scored:

- 490 on the "formulating" process subscale (OECD = 492);
- 496 on the "employing" process subscale (OECD = 493); and
- 510 on the process "interpreting" subscale (OECD = 497).

Of these, Scotland's score was significantly higher than the OECD average on "Interpreting", but similar on the others. Table A.4 has each OECD country and UK administration's score on mathematical processes.

3.9 Looking at the mathematical content categories, Scotland's average score was:

- 497 on "Change and Relationships" (OECD = 493);
- 482 on "Space and Shape" (OECD = 490);
- 501 on "Quantity (OECD = 495); and
- 504 on "Uncertainty and data" (OECD = 493).

Of these Scotland was significantly ahead of the OECD average on "Uncertainty and data", similar for "Quantity" and "Change and relationships", and below the average on "Space and Shape". Table A.5 has each OECD country and UK administration's score on mathematical content category.

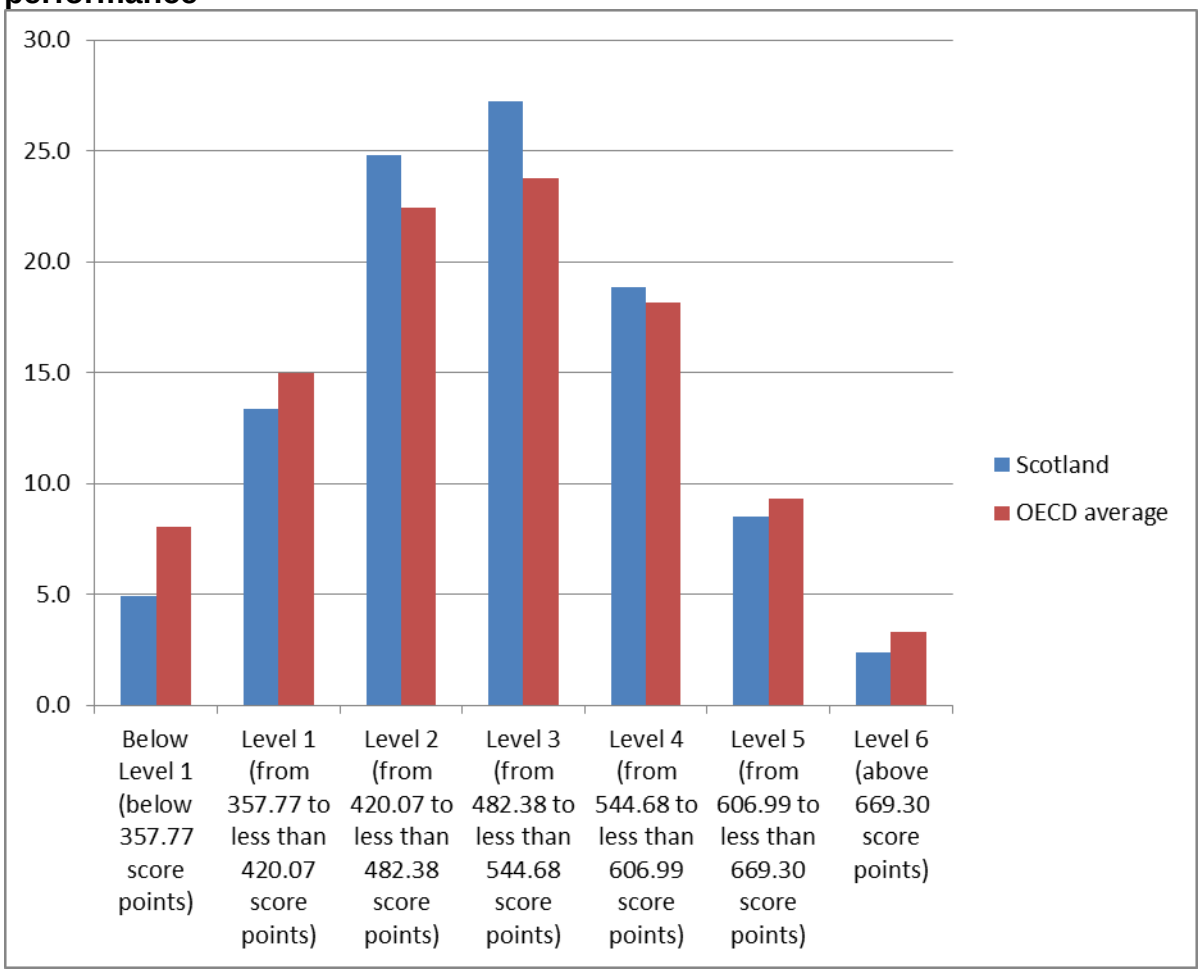
Distribution of scores

3.10 As well as comparison between countries' mean scores, it is important to look at how these are distributed within a country. It is likely that there is much more variation within than between countries. Scotland's spread of performance in 2012, as measured by standard deviation of the scores (86), was less than the OECD average (92). Four countries had a narrower distribution, and 22 greater. Between 2009 and 2012, Scotland's spread of attainment has decreased (2009 = 93).

High and low achievers

3.11 The proportion of 15 year old students in Scotland below Level 2 (the OECD's baseline of ability to participate effectively in society) was 18.3 per cent – statistically similar to the OECD average of 23.0 per cent. At the other end of the distribution, the proportion of students who were "higher" achievers (Level 5 and above) was 10.8 per cent, similar to the OECD average of 12.6 per cent. Chart 3.3 below shows the distribution of scores in Scotland compared to the OECD average. Table A.3 shows each OECD country and UK administration's distribution of scores by proficiency level.

Chart 3.3: Percentage of Scottish students by level of mathematics performance



Gender

3.12 In terms of gender, boys performed significantly better than girls. The average score in maths was 491 for female students, and 506 for male students - a gap of 14 points which was statistically significant. The size of the gap was similar to the OECD average and 26 countries[5]. The gap in performance in maths by gender was similar to that in 2009. In terms of the gender share of higher and lower achievers, 9.4 per cent of girls and 12.2 per cent of boys achieved at Level 5 and above (significant difference) and 16.2 per cent of boys and 20.4 per cent of girls were below Level 2 (no significant difference).

3.13 In the "formulating" scale there was a gender difference of 18 points (boys outperformed girls). For "employing" this was 16, and "interpreting" was 12. All three of these differences were statistically significant.

Social background

[5] 26 countries from a pool of 33 OECD countries and three remaining UK administrations.

3.14 The OECD analyse social background using the *Index of Economic, Social and Cultural Status* (ESCS). It is constructed from the responses given by students in their background questionnaire and collects information on parental education and occupation, learning resources in the home and access to IT. This index is not comparable to the measure commonly used in Scotland – the Scottish Index of Multiple Deprivation (SIMD) - however it does have the advantage of being generated directly from information provided by the student on their own background, rather than being based on their home address, so avoiding issues of more affluent students being resident in areas which are disadvantaged, and vice versa. It is also consistent across all countries who participate in PISA, enabling comparable analysis.

3.15 The share of variation in test scores that was explained by students' background was around 13 per cent, this was similar to the OECD average, and similar to 2009. This means that Scotland remained about average in terms of how much pupils break away from the pattern of background affecting performance. Although there was still a clear link between background and performance, there are other things that affect performance, and many pupils do not follow the pattern.

3.16 Another way of looking at the variation by social background, is to look at the *degree to which* average attainment changes as social background changes.[6] In 2012 the OECD calculate the impact of a one point[7] improvement on the Index of Economic, Social & Cultural Status to have been 37 points in the maths assessment for Scotland. This was similar to the OECD average of 39 points – roughly equivalent to 1 year's education. This was a reduction on the estimated impact in the 2009 survey (45 points), and was greater than in four countries, similar to 25, and less than seven others.

3.17 Table A.6 has each OECD country and UK administration's scores on these measures, as well as estimates of the "adjusted mean score" if a country's students were assumed to have a social background similar to the OECD average.

3.18 Further discussion of social background, student attitudes and how they relate to the variation in performance scores will be covered in a topic report to be published during 2014.

[6] This is measured by calculating the gradient of the slope of the line when attainment is plotted against background. The higher the number, the steeper the gradient, and the greater the amount that the mathematics score changes with social background.

[7] The Index is set to zero for the mean student across the OECD by background. A score of one is a standard deviation above the mean (roughly one third of the distribution from the mean). A score of minus one is a standard deviation below.

4 PERFORMANCE IN READING

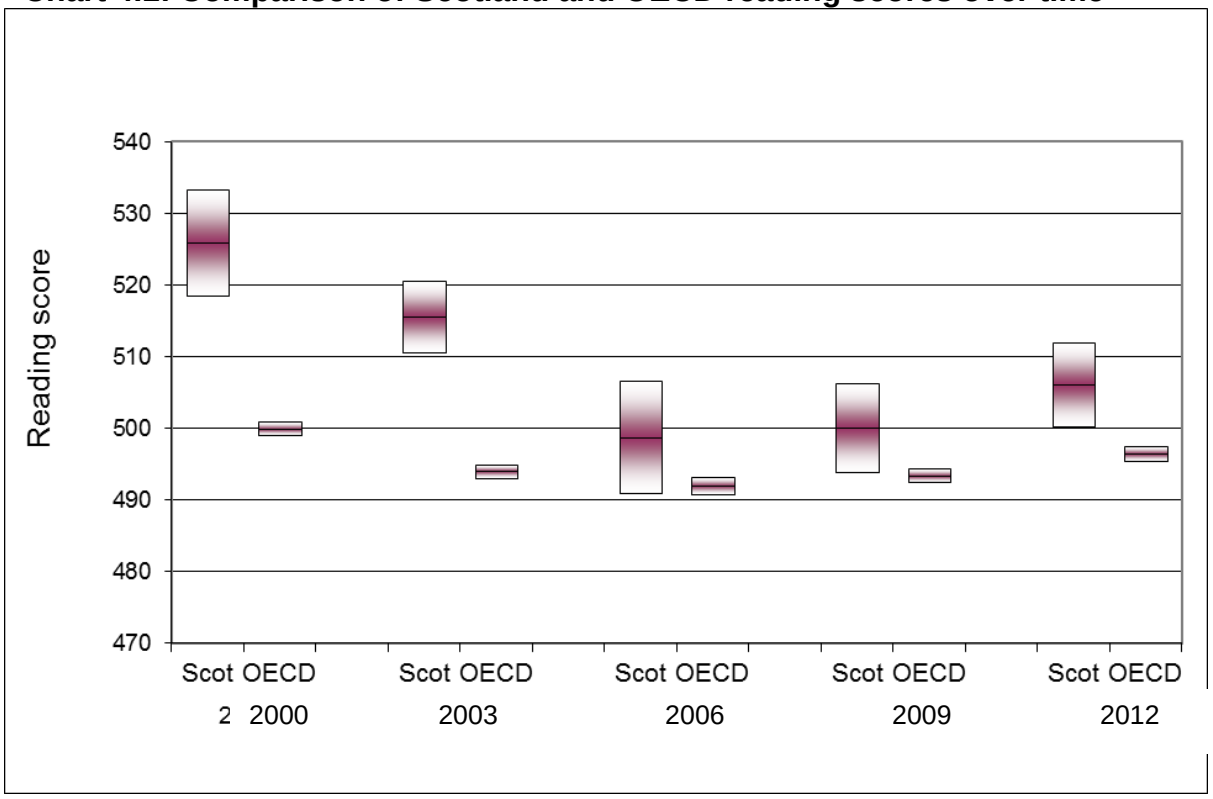
Average scores

4.1 Reading was assessed as the main domain in 2000 and 2009, with the 2003, 2006 and 2012 PISA cycles providing a briefer update.

4.2 Scotland's mean score in 2012 **(506)** was lower than in 2000 (526) but similar to the 2003 (516), 2006 (499) and 2009 (500) waves (Table A.7).

4.3 In 2012, the mean score for reading in Scotland was above the OECD average. This was also the case in 2009[8]. Chart 4.1 below shows Scotland's score compared to the OECD average over the five waves of PISA since 2000. The 95 per cent confidence intervals are included.

Chart 4.1: Comparison of Scotland and OECD reading scores over time



4.4 Of the 33 other OECD countries, and three UK administrations, seven were ranked above Scotland, 11 similar and 18 below. Of the UK administrations, England and Northern Ireland were similar to Scotland, with Wales below Scotland. Table 4.1 below shows which countries performed above, similar to and below Scotland in 2012. Table A.8a, located in the annex, shows each country's score.

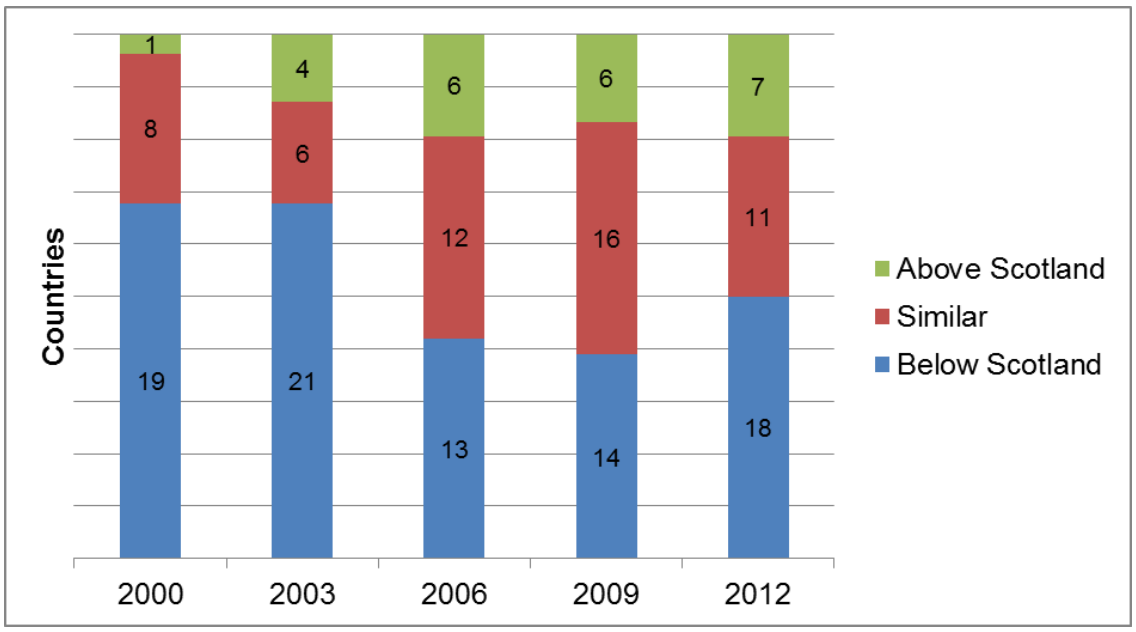
[8] However if the 2009 comparison was done on pre-2010 OECD member countries it would have shown Scotland as similar to the OECD average.

Table 4.1: OECD countries and UK administrations, higher than, similar to and lower than Scotland in reading

Higher score than Scotland	Similar score to Scotland	Lower score than Scotland
Canada	Australia	Austria
Estonia	Belgium	Chile
Finland	France	Czech Republic
Ireland	Germany	Denmark
Japan	Netherlands	Greece
Korea	New Zealand	Hungary
Poland	Norway	Iceland
	Switzerland	Israel
	United States	Italy
	England	Luxembourg
	Northern Ireland	Mexico
		Portugal
		Slovak Republic
		Slovenia
		Spain
		Sweden
		Turkey
		Wales
		OECD average

4.5 Compared to 2009, a greater number of countries performed significantly lower than Scotland, and the group of countries who were similar to Scotland shrunk. The numbers of countries placed higher, below or similar to Scotland in the five waves since 2000 is shown in the chart below.

Chart 4.2: Numbers of OECD countries and UK administrations- scoring above below or similar to Scotland in reading in PISA since 2000[9]



4.6 A number of notable changes have taken place since the 2009 survey. In particular, Poland moved from similar to above Scotland (as in maths and science) as their score improved by a greater number of points than Scotland's. New Zealand and Australia moved from above Scotland in 2009 to being similar in 2012, as Scotland's estimated mean score increased, whilst Australia and New Zealand's estimated mean scores decreased.

4.7 Among the participating non-OECD states, four were above Scotland: Chinese Taipei, Shanghai (China), Hong-Kong China and Singapore. Three countries were similar to Scotland and 24 were below Scotland. Shanghai (China) had the highest score out of all participants in PISA (570). (Table A.8b)

Distribution of scores

4.8 Scotland's spread of attainment, measured by the standard deviation (87) was below the OECD average (94). Three countries had a narrower distribution, 22 greater. Between 2009 and 2012, Scotland's spread of attainment is significantly smaller than the previous PISA cycle (2009 = 94).

High and low achievers

4.9 The proportion of students in Scotland below Level 2, the OECD's baseline of ability to participate effectively in society, was 12.5 per cent, lower than the OECD average of 18.0 per cent. This was also a significant reduction on

[9] The chart is not adjusted for constant OECD membership.

Scotland's 2009 figure of 16.3 per cent. At the other end of the distribution, the proportion of Scotland's students who can be described as higher achievers (Level 5 and above) was 7.9 per cent, similar to the OECD average of 8.4 per cent. Table A.9 shows each OECD country and UK administration's distribution of scores by proficiency level.

Gender

4.10 Unlike in maths, girls outperformed boys in reading. The average score for males was 493 and females 520, a gap of 27 points. These scores were significantly different to each other, however the gap was significantly smaller than the OECD average of 38 points.

Social background

4.11 The share of variation in test scores that was explained by the variation in students' background was around 11 per cent, this was similar to the OECD average, and similar to 2009 (14 per cent).

4.12 In 2012 the OECD calculate the impact of a one point improvement on the Index of Economic, Social & Cultural Status to have been around 35 points in the reading assessment for Scotland. This was similar to the OECD average of 37 points. Scotland's figure was a reduction on the estimated impact in the 2009 survey (44 points) suggesting a reduction in the gap between more and less disadvantaged pupils.

5 PERFORMANCE IN SCIENCE

Average scores

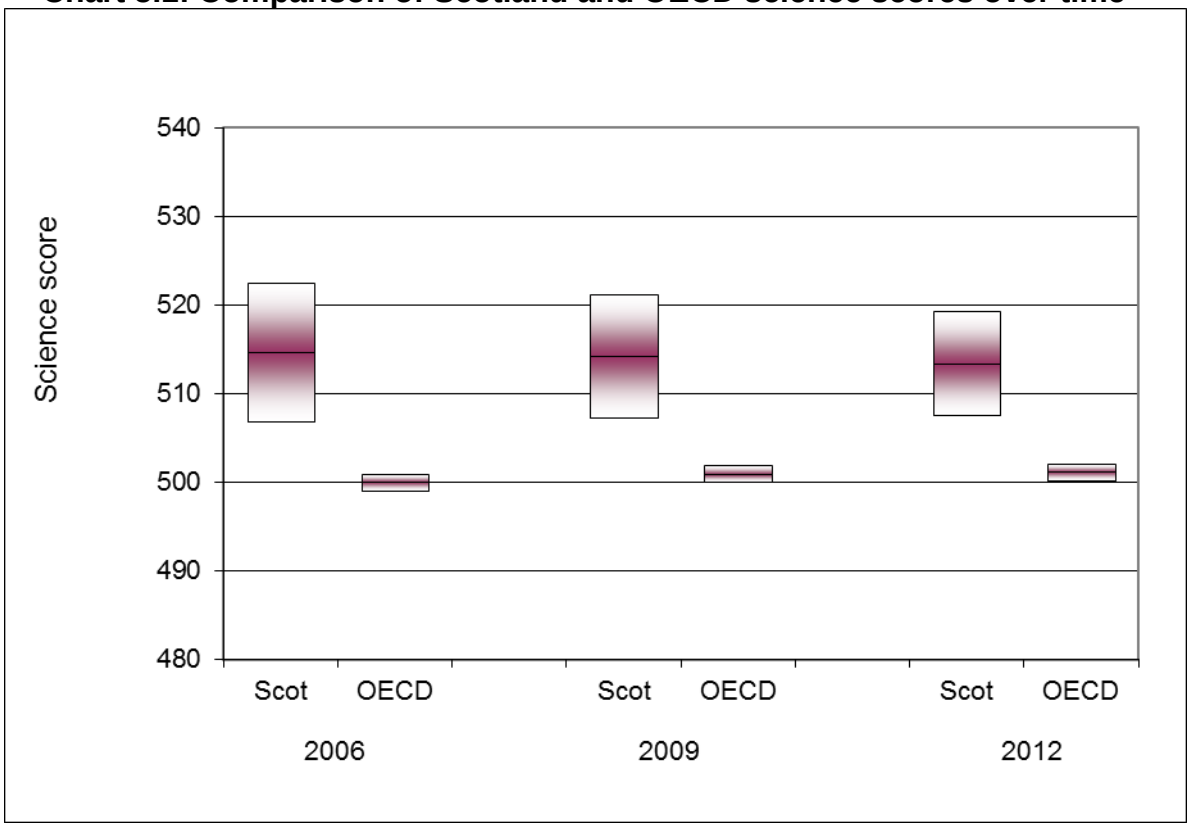
5.1 Science was assessed as a main domain in PISA in 2006, with the 2009 and 2012 PISA cycles providing a briefer update.

5.2 Scotland's mean score in the science assessment of **513** was similar to both the 2006 (515) and 2009 (514) figures (Table A.10).

5.3 In 2012, the mean score for science in Scotland was above the OECD average, as it was in both 2006 and 2009.

5.4 Chart 5.1 below shows Scotland's score compared to the OECD average over the three waves of assessment since 2006 with 95 per cent confidence intervals included.

Chart 5.1: Comparison of Scotland and OECD science scores over time



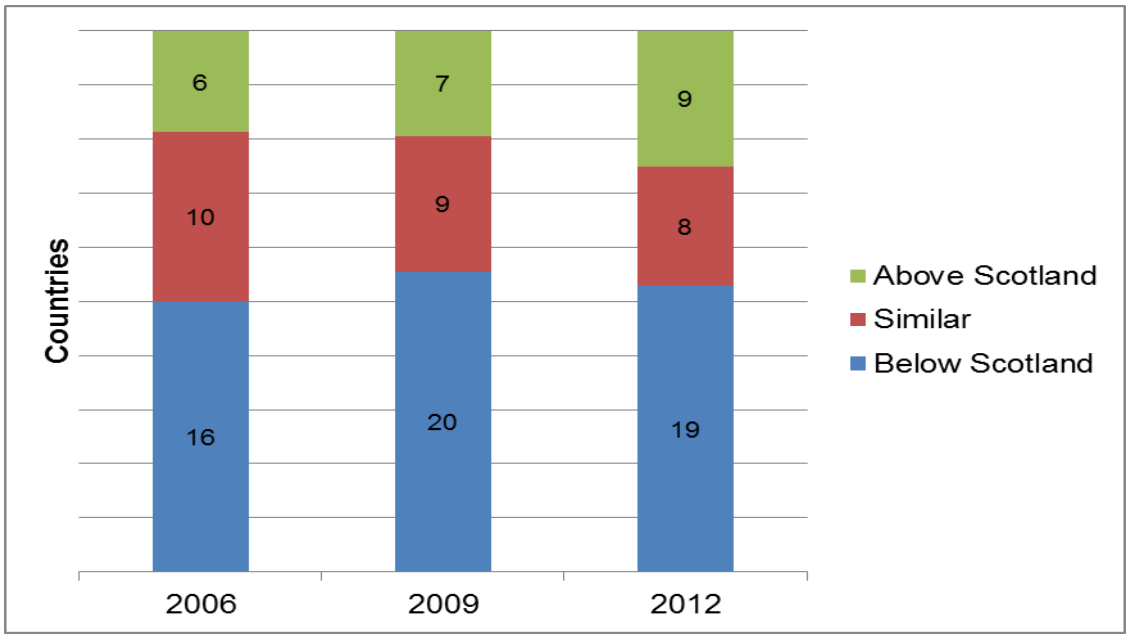
5.5 Of the 33 other OECD countries, and three UK administrations, nine were ranked above Scotland, eight similar and 19 below. Of the UK administrations, England and Northern Ireland were similar to Scotland and Wales below. Table 5.1 below shows which countries performed above, similar to and below Scotland in 2012. Table A.11a, located in the annex, shows each country's score.

Table 5.1: OECD countries and UK administrations, higher than, similar to and lower than Scotland in science

Higher score than Scotland	Similar score to Scotland	Lower score than Scotland
Australia	Austria	Belgium
Canada	Czech Republic	Chile
Estonia	Netherlands	Denmark
Finland	New Zealand	France
Germany	Slovenia	Greece
Ireland	Switzerland	Hungary
Japan	England	Iceland
Korea	Northern Ireland	Israel
Poland		Italy
		Luxembourg
		Mexico
		Norway
		Portugal
		Slovak Republic
		Spain
		Sweden
		Turkey
		United States
		Wales
		OECD average

5.6 The number of countries above and below Scotland has been broadly stable since 2006 (the furthest we can make allowable comparisons). The numbers of countries placed higher, below or similar to Scotland in the three waves since 2006 are shown in Chart 5.2 below.

Chart 5.2: Numbers of OECD countries and UK administrations scoring above or below Scotland in science in PISA since 2006[10]



5.7 A number of notable changes took place since the 2009 survey. In particular, Poland moved from similar to above Scotland (as in maths and reading) as its score estimated mean increased. New Zealand moved from above Scotland to being similar (as in maths and reading), as its estimated mean score decreased.

5.8 Among the participating non-OECD states, seven were above Scotland, including Shanghai (China), Hong Kong-China, Singapore and Vietnam; No states were similar to Scotland and 24 were below Scotland. Shanghai (China) and Hong-Kong China achieved the highest scores of all participating countries (Table A.11b).

Distribution of scores

5.9 Scotland's spread of attainment, measured by the standard deviation (89) was similar to the OECD average (93). Five countries had a narrower distribution, 14 greater. Between 2009 and 2012, Scotland's spread of attainment has decreased (2009 = 96).

High and low achievers

5.10 The proportion of Scotland's students below Level 2, the OECD's baseline of ability to participate effectively in society, was 12.1 per cent, statistically similar to the OECD average of 17.8 per cent. At the other end of the distribution, the proportion of Scotland's students who were higher achievers (Level 5 and above) was 8.8 per cent and similar to than the OECD average

[10] The chart is not adjusted for constant OECD membership.

of 8.4 per cent. Table A.12 shows each OECD country and UK administration's distribution of scores by proficiency level.

Gender

5.11 As in maths, boys outperformed girls in science. The average score for males was 517 and females 510, a gap of seven points which was not significantly different to the OECD gap of one point.

Social background

5.12 The share of variation in test scores that was explained by the variation in students' background was around 11 per cent, this was similar to the OECD average, but was less than the 2009 figure of 16 per cent.

5.13 For science, the OECD calculate the impact of a one point improvement on the Index of Economic, Social & Cultural Status to have been around 36 points. This was very similar to the OECD average (mean = 38 points). Scotland's figure was a reduction on the estimated impact in the 2009 survey (47 points) suggesting a reduction in the gap between disadvantaged and more affluent pupils.

6 SCHOOL AND STUDENT QUESTIONNAIRE RESPONSES

6.1 Students and headteachers are asked to fill in background questionnaires to gather contextual data to help explain the attainment scores.

6.2 Students are asked a range of questions on their social backgrounds, but also their attitudes to school, learning and mathematics. Similarly headteachers were asked how their school, and the teaching of mathematics, is organised.

6.3 Caution should be applied in comparing responses in other countries, as cultural expectations may differ between countries, and the criteria headteachers and pupils use to respond to questions may be different. However, a number of key findings are reported below, and we believe there is value in looking at how background factors vary within Scotland which will be part of our forthcoming work.

Students

Mathematics

6.4 Students were asked about their views on mathematics - its usefulness and their enjoyment of studying it.

6.5 Scottish students were significantly more likely to agree that "making an effort in mathematics is worth it because it will help in in the work I want to do later on" (35 per cent said "strongly agree" compared to 27 per cent across the OECD). Students were also more likely to "strongly agree" that learning mathematics would "improve my career prospects" (41 per cent compared to 29 per cent), "help me get a job" (30 per cent compared to 23 per cent) and that mathematics was important "for what I want to study later on" (31 per cent compared to 25 per cent).

6.6 In terms of enjoyment and interest in mathematics, Scottish students were slightly less likely to "strongly agree" they did mathematics because they enjoyed it (nine per cent compared to ten per cent across the OECD - although similar numbers across the OECD and Scotland "agree"). The pattern in terms of whether students were interested in the things they learn in mathematics was more mixed with fewer strongly agreeing (12 per cent strongly agreed compared to 14 per cent) but more agreeing (42 per cent compared to 39 per cent). However they were more likely to "agree" that they looked forward to mathematics lessons (35 per cent compared to 28 per cent) with similar numbers in both Scotland and OECD saying they "strongly agree".

Classroom behaviour in mathematics lessons

6.7 In terms of disruption during maths lessons, students in Scotland were more likely to say that "Students don't listen to what the teacher says" in "every

lesson" than the OECD average (12 per cent compared to 10 per cent across the OECD), but also more likely than their counterparts to say this was never the case (22 per cent compared to 20 per cent). They were also more likely to say that there is "noise and disorder" in every lesson (14 per cent compared to 11 per cent).

6.8 However, Scottish students were less likely to say that "students cannot work well" in "most" maths lessons than the OECD average (10 per cent compared to 15 per cent) and also less likely to say that "students don't start working for a long time after the lesson begins" in "most" lessons (13 per cent compared to 17 per cent).

Relations with teachers

6.9 Students were also asked how they got on with the teachers in their school.

6.10 Scottish students were less likely to "strongly agree" when asked if "students get along well with most teachers" (17 per cent compared to 21 per cent across the OECD) but more likely to "agree" (64 per cent compared to 60 per cent across the OECD). Scottish students were more likely to "agree" that "most teachers are interested in students' wellbeing" (64 per cent compared to 56 per cent), more likely to "strongly agree" that they would receive extra help from their teachers if they need it (31 per cent compared to 23 per cent) and more likely to "strongly agree "that "most of my teachers treat me fairly" (26 per cent compared to 23 per cent). Students in Scotland were similar to the OECD average when asked if they agreed that "most teachers really listen to what I have to say" (57 per cent in Scotland and 55 per cent across the OECD "agreed").

Headteachers

6.11 The headteacher survey received 108 responses from the 111 schools that were involved. Even with such a high response rate, a sample of this size needs to be interpreted with caution. However, we have outlined instances of where we can identify a significant difference with the OECD average. Results are reported according to the proportions of students represented by schools for which the headteacher responded.

Organisation of mathematics teaching

6.12 Headteachers were asked to report how they organised mathematics lessons in school. In general, pupils in Scotland were more likely to be in schools where maths lessons were organised on the basis of ability or difficulty of content than on average across the OECD.

6.13 Students in Scotland were more likely, than across the OECD, to be in schools where headteachers reported that they organised mathematics classes to "study similar content, but at different levels of difficulty" in "some"

classes (56 per cent compared to 39 per cent across the OECD). They were also less likely to be in schools where this was “not for any classes” (8 per cent compared to 32 per cent). In addition, they were also more likely to be in schools where classes were organised to “study different content or sets of mathematics topics that have different levels of difficulty” in “all” classes (35 per cent compared to 14 per cent) or “some” classes (52 per cent compared to 38 per cent).

6.14 Students were also more likely than the OECD average to be in schools where it was reported that they were grouped “by ability within their mathematics classes” in “all” classes (62 per cent compared to 16 per cent). Finally, they were less likely to be in schools where mathematics classes were organised to allow the teacher to use “pedagogy suitable for students with heterogeneous abilities (i.e. students are not grouped by ability)” in “all” (nine per cent compared to 43 per cent) and “some” classes (25 per cent compared to 35 per cent).

Teacher attitudes

6.15 Similar number of students were in Scottish schools where the headteacher either “strongly agreed” (27 per cent) or “agreed” (63 per cent) with the statement “the morale of teachers in this school is high”, compared to the OECD average (32 per cent “strongly agree” and 59 per cent “agree”). There are also high levels of agreement in Scotland that “Teachers work with enthusiasm” (42 per cent in Scotland “strongly agree” compared to 28 per cent in the OECD).

6.16 A similar picture is evident for the statement “Teachers take pride in this school”. In Scotland 61 per cent of students were in schools where headteachers strongly agreed with this statement compared to the OECD average of 39 per cent).

6.17 Finally, with respect to the statement “Teachers value academic achievement” more pupils in Scotland than the OECD average were in schools where the headteacher “strongly agreed” (66 per cent in Scotland, 49 per cent in the OECD).

ANNEX A - DETAILED RESULTS

Mathematics

Table A.1 Scotland's score in previous PISA surveys, together with comparison with 2012

	Mathematics		
	mean	**S.E.**	**comparison to 2012**
2000	*533*		n/a
2003	524	2.3	H
2006	506	3.6	S
2009	499	3.3	S
2012	498	2.6	

H: higher than 2012, S: similar to 2012, L: lower than 2012
Comparisons in mathematics are possible from 2003 (the first survey when mathematics was a full domain, and the scale was fully developed).

Table A.2a: Mean scores in mathematics, by gender, and comparison with Scotland: OECD and UK administrations

	Males		Females		overall			
	mean	s.e.	mean	s.e.	mean	s.e.	s.d.	s.e.
Significantly above Scotland								
Belgium	518	(2.8)	512	(2.6)	515	(2.1)	102	(1.4)
Canada	523	(2.1)	513	(2.1)	518	(1.8)	89	(0.8)
Estonia	523	(2.6)	518	(2.2)	521	(2.0)	81	(1.2)
Finland	517	(2.6)	520	(2.2)	519	(1.9)	85	(1.2)
Germany	520	(3.0)	507	(3.4)	514	(2.9)	96	(1.6)
Japan	545	(4.6)	527	(3.6)	536	(3.6)	94	(2.2)
Korea	562	(5.8)	544	(5.1)	554	(4.6)	99	(2.1)
Netherlands	528	(3.6)	518	(3.9)	523	(3.5)	92	(2.1)
Poland	520	(4.3)	516	(3.8)	518	(3.6)	90	(1.9)
Switzerland	537	(3.5)	524	(3.1)	531	(3.0)	94	(1.5)
Similar to Scotland								
Australia	510	(2.4)	498	(2.0)	504	(1.6)	96	(1.2)
Austria	517	(3.9)	494	(3.3)	506	(2.7)	92	(1.7)
Czech Republic	505	(3.7)	493	(3.6)	499	(2.9)	95	(1.6)
Denmark	507	(2.9)	493	(2.3)	500	(2.3)	82	(1.3)
England	502	(5.0)	489	(4.5)	495	(3.9)	96	(2.0)
France	499	(3.4)	491	(2.5)	495	(2.5)	97	(1.7)
Iceland	490	(2.3)	496	(2.3)	493	(1.7)	92	(1.3)
Ireland	509	(3.3)	494	(2.6)	501	(2.2)	85	(1.3)
New Zealand	507	(3.2)	492	(2.9)	500	(2.2)	100	(1.2)
OECD average	**499**	**(0.6)**	**489**	**(0.5)**	**494**	**(0.5)**	**92**	**(0.3)**
Scotland	**506**	**(3.0)**	**491**	**(3.2)**	**498**	**(2.6)**	**86**	**(1.6)**
Slovenia	503	(2.0)	499	(2.0)	501	(1.2)	92	(1.0)
United Kingdom	500	(4.2)	488	(3.8)	494	(3.3)	95	(1.7)
Significantly below Scotland								
Chile	436	(3.8)	411	(3.1)	423	(3.1)	81	(1.5)
Greece	457	(3.3)	449	(2.6)	453	(2.5)	88	(1.3)
Hungary	482	(3.7)	473	(3.6)	477	(3.2)	94	(2.4)
Israel	472	(7.8)	461	(3.5)	466	(4.7)	105	(1.8)
Italy	494	(2.4)	476	(2.2)	485	(2.0)	93	(1.1)
Luxembourg	502	(1.5)	477	(1.4)	490	(1.1)	95	(0.9)
Mexico	420	(1.6)	406	(1.4)	413	(1.4)	74	(0.7)
Northern Ireland	492	(5.0)	481	(5.4)	487	(3.1)	93	(2.0)
Norway	490	(2.8)	488	(3.4)	489	(2.7)	90	(1.3)
Portugal	493	(4.1)	481	(3.9)	487	(3.8)	94	(1.4)
Slovak Republic	486	(4.1)	477	(4.1)	482	(3.4)	101	(2.5)
Spain	492	(2.4)	476	(2.0)	484	(1.9)	88	(0.7)
Sweden	477	(3.0)	480	(2.4)	478	(2.3)	92	(1.3)
Turkey	452	(5.1)	444	(5.7)	448	(4.8)	91	(3.1)
United States	484	(3.8)	479	(3.9)	481	(3.6)	90	(1.3)
Wales	473	(2.6)	464	(2.9)	468	(2.2)	85	(1.3)

"s.e." = "standard error", "s.d." = standard deviation

Table A.2b: Mean scores in mathematics, by gender, and comparison with Scotland: non-OECD countries and economies

	Males		Females		Overall			
	mean	s.e.	mean	s.e.	mean	s.e.	s.d.	s.e.
Significantly above Scotland								
Chinese Taipei	563	(5.4)	557	(5.7)	560	(3.3)	116	(1.9)
Hong Kong-China	568	(4.6)	553	(3.9)	561	(3.2)	96	(1.9)
Liechtenstein	546	(6.0)	523	(5.8)	535	(4.0)	95	(3.7)
Macao-China	540	(1.4)	537	(1.3)	538	(1.0)	94	(0.9)
Shanghai (China)	616	(4.0)	610	(3.4)	613	(3.3)	101	(2.3)
Singapore	572	(1.9)	575	(1.8)	573	(1.3)	105	(0.9)
Vietnam	517	(5.6)	507	(4.7)	511	(4.8)	86	(2.7)
Significantly below Scotland								
Albania	394	(2.6)	395	(2.6)	394	(2.0)	91	(1.4)
Argentina	396	(4.2)	382	(3.4)	388	(3.5)	77	(1.7)
Brazil	401	(2.2)	383	(2.3)	391	(2.1)	78	(1.6)
Bulgaria	438	(4.7)	440	(4.2)	439	(4.0)	94	(2.2)
Colombia	390	(3.4)	364	(3.2)	376	(2.9)	74	(1.7)
Costa Rica	420	(3.6)	396	(3.1)	407	(3.0)	68	(1.8)
Croatia	477	(4.4)	465	(3.7)	471	(3.5)	88	(2.5)
Cyprus	440	(1.5)	440	(1.6)	440	(1.1)	93	(0.8)
Indonesia	377	(4.4)	373	(4.3)	375	(4.0)	71	(3.3)
Jordan	375	(5.4)	396	(3.1)	386	(3.1)	78	(2.7)
Kazakhstan	432	(3.4)	432	(3.3)	432	(3.0)	71	(1.8)
Latvia	489	(3.4)	493	(3.2)	491	(2.8)	82	(1.5)
Lithuania	479	(2.8)	479	(3.0)	479	(2.6)	89	(1.4)
Malaysia	416	(3.7)	424	(3.7)	421	(3.2)	81	(1.6)
Montenegro	410	(1.6)	410	(1.6)	410	(1.1)	83	(1.1)
Peru	378	(3.6)	359	(4.8)	368	(3.7)	84	(2.2)
Qatar	369	(1.1)	385	(0.9)	376	(0.8)	100	(0.7)
Romania	447	(4.3)	443	(4.0)	445	(3.8)	81	(2.2)
Russian Federation	481	(3.7)	483	(3.1)	482	(3.0)	86	(1.6)
Serbia	453	(4.1)	444	(3.7)	449	(3.4)	91	(2.2)
Thailand	419	(3.6)	433	(4.1)	427	(3.4)	82	(2.1)
Tunisia	396	(4.3)	381	(4.0)	388	(3.9)	78	(3.1)
United Arab Emirates	432	(3.8)	436	(3.0)	434	(2.4)	90	(1.2)
Uruguay	415	(3.5)	404	(2.9)	409	(2.8)	89	(1.7)
Scotland	**506**	**(3.0)**	**491**	**(3.2)**	**498**	**(2.6)**	**86**	**(1.6)**

Table A.3: Estimates of proportion at each proficiency level (per cent), mathematics: OECD and UK administrations

	Below Level 1	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
Australia	6.1	13.5	21.9	24.6	19.0	10.5	4.3
Austria	5.7	13.0	21.9	24.2	21.0	11.0	3.3
Belgium	7.0	11.9	18.4	22.6	20.7	13.4	6.1
Canada	3.6	10.2	21.0	26.4	22.4	12.1	4.3
Chile	22.0	29.5	25.3	15.4	6.2	1.5	0.1
Czech Republic	6.8	14.2	21.7	24.8	19.7	9.6	3.2
Denmark	4.4	12.5	24.4	29.0	19.8	8.3	1.7
Estonia	2.0	8.6	22.0	29.4	23.4	11.0	3.6
Finland	3.3	8.9	20.5	28.8	23.2	11.7	3.5
France	8.7	13.6	22.1	23.8	18.9	9.8	3.1
Germany	5.5	12.2	19.4	23.7	21.7	12.8	4.7
Greece	14.5	21.2	27.2	22.1	11.2	3.3	0.6
Hungary	9.9	18.2	25.3	23.0	14.4	7.1	2.1
Iceland	7.5	14.0	23.6	25.7	18.1	8.9	2.3
Ireland	4.8	12.1	23.9	28.2	20.3	8.5	2.2
Israel	15.9	17.6	21.6	21.0	14.6	7.2	2.2
Italy	8.5	16.1	24.1	24.6	16.7	7.8	2.2
Japan	3.2	7.9	16.9	24.7	23.7	16.0	7.6
Korea	2.7	6.4	14.7	21.4	23.9	18.8	12.1
Luxembourg	8.8	15.5	22.3	23.6	18.5	8.6	2.6
Mexico	22.8	31.9	27.8	13.1	3.7	0.6	0.0
Netherlands	3.8	11.0	17.9	24.2	23.8	14.9	4.4
New Zealand	7.5	15.1	21.6	22.7	18.1	10.5	4.5
Norway	7.2	15.1	24.3	25.7	18.3	7.3	2.1
Poland	3.3	11.1	22.1	25.5	21.3	11.7	5.0
Portugal	8.9	16.0	22.8	24.0	17.7	8.5	2.1
Slovak Republic	11.1	16.4	23.1	22.1	16.4	7.8	3.1
Slovenia	5.1	15.0	23.6	23.9	18.7	10.3	3.4
Spain	7.8	15.8	24.9	26.0	17.6	6.7	1.3
Sweden	9.5	17.5	24.7	23.9	16.3	6.5	1.6
Switzerland	3.6	8.9	17.8	24.5	23.9	14.6	6.8
Turkey	15.5	26.5	25.5	16.5	10.1	4.7	1.2
United States	8.0	17.9	26.3	23.3	15.8	6.6	2.2
United Kingdom	7.8	14.0	23.2	24.8	18.4	9.0	2.9
Scotland	**4.9**	**13.3**	**24.8**	**27.2**	**18.8**	**8.5**	**2.4**
England	8.0	13.7	22.8	24.5	18.7	9.3	3.1
Northern Ireland	8.6	15.5	23.8	24.3	17.5	8.1	2.2
Wales	9.6	19.4	27.5	25.1	13.1	4.3	1.0
OECD average	**8.0**	**15.0**	**22.5**	**23.7**	**18.2**	**9.3**	**3.3**

Table A.4 Mean scores in mathematical processes: OECD and UK administrations

	Formulating		Employing		Interpreting	
	mean	**s.e.**	**mean**	**s.e.**	**mean**	**s.e.**
Australia	498	1.9	500	1.7	514	1.7
Austria	499	3.2	510	2.5	509	3.3
Belgium	512	2.4	516	2.1	513	2.4
Canada	516	2.2	517	1.9	521	2.0
Chile	420	3.2	416	3.3	433	3.1
Czech Republic	495	3.4	504	2.9	494	3.0
Denmark	502	2.4	495	2.4	508	2.5
Estonia	517	2.3	524	2.1	513	2.1
Finland	519	2.4	516	1.8	528	2.2
France	483	2.8	496	2.3	511	2.5
Germany	511	3.4	516	2.8	517	3.2
Greece	448	2.3	449	2.7	467	3.1
Hungary	469	3.6	481	3.2	477	3.1
Iceland	500	1.7	490	1.6	492	1.9
Ireland	492	2.4	502	2.4	507	2.5
Israel	465	4.7	469	4.6	462	5.2
Italy	475	2.2	485	2.1	498	2.1
Japan	554	4.2	530	3.5	531	3.5
Korea	562	5.1	553	4.3	540	4.2
Luxembourg	482	1.0	493	0.9	495	1.1
Mexico	409	1.7	413	1.4	413	1.3
Netherlands	527	3.8	518	3.4	526	3.6
New Zealand	496	2.5	495	2.2	511	2.5
Norway	489	3.1	486	2.7	499	3.1
Poland	516	4.2	519	3.5	515	3.5
Portugal	479	4.3	489	3.7	490	4.0
Slovak Republic	480	4.1	485	3.4	473	3.3
Slovenia	492	1.5	505	1.2	498	1.4
Spain	477	2.2	481	2.0	495	2.2
Sweden	479	2.7	474	2.5	485	2.4
Switzerland	538	3.1	529	2.9	529	3.4
Turkey	449	5.2	448	5.0	446	4.6
United States	475	4.1	480	3.5	489	3.9
United Kingdom	489	3.7	492	3.1	501	3.5
Scotland	**490**	**3.3**	**496**	**2.8**	**510**	**2.7**
England	491	4.4	493	3.6	502	4.2
Northern Ireland	479	3.8	486	3.1	496	3.5
Wales	457	2.4	466	2.2	483	2.6
OECD average	**492**	**0.5**	**493**	**0.5**	**497**	**0.5**

Table A.5: Mean scores in mathematical content categories: OECD and UK administrations

	Change and relationship		Space and shape		Quantity		Uncertainty and data	
	mean	s.e.	mean	s.e.	mean	s.e.	mean	s.e.
Australia	509	1.7	497	1.8	500	1.9	508	1.5
Austria	506	3.4	501	3.1	510	2.9	499	2.7
Belgium	513	2.6	509	2.4	519	2.0	508	2.5
Canada	525	2.0	510	2.1	515	2.2	516	1.8
Chile	411	3.5	419	3.2	421	3.3	430	2.9
Czech Republic	499	3.5	499	3.4	505	3.0	488	2.8
Denmark	494	2.7	497	2.5	502	2.4	505	2.4
Estonia	530	2.3	513	2.5	525	2.2	510	2.0
Finland	520	2.6	507	2.1	527	1.9	519	2.4
France	497	2.7	489	2.7	496	2.6	492	2.7
Germany	516	3.8	507	3.2	517	3.1	509	3.0
Greece	446	3.2	436	2.6	455	3.0	460	2.6
Hungary	481	3.5	474	3.4	476	3.4	476	3.3
Iceland	487	1.9	489	1.5	496	1.9	496	1.8
Ireland	501	2.6	478	2.6	505	2.6	509	2.5
Israel	462	5.3	449	4.8	480	5.2	465	4.7
Italy	477	2.1	487	2.5	491	2.0	482	2.0
Japan	542	4.0	558	3.7	518	3.6	528	3.5
Korea	559	5.2	573	5.2	537	4.1	538	4.2
Luxembourg	488	1.0	486	1.0	495	1.0	483	1.0
Mexico	405	1.6	413	1.6	414	1.5	413	1.2
Netherlands	518	3.9	507	3.5	532	3.6	532	3.8
New Zealand	501	2.5	491	2.4	499	2.4	506	2.6
Norway	478	3.1	480	3.3	492	2.9	497	3.0
Poland	509	4.1	524	4.2	519	3.5	517	3.5
Portugal	486	4.1	491	4.2	481	4.0	486	3.8
Slovak Republic	474	4.0	490	4.1	486	3.5	472	3.6
Slovenia	499	1.1	503	1.4	504	1.2	496	1.2
Spain	482	2.0	477	2.0	491	2.3	487	2.3
Sweden	469	2.8	469	2.5	482	2.5	483	2.5
Switzerland	530	3.4	544	3.1	531	3.1	522	3.2
Turkey	448	5.0	443	5.5	442	5.0	447	4.6
United States	488	3.5	463	4.0	478	3.9	488	3.5
United Kingdom	496	3.4	475	3.5	494	3.8	502	3.0
Scotland	**497**	**3.1**	**482**	**3.1**	**501**	**3.0**	**504**	**2.6**
England	498	4.1	477	4.1	495	4.5	503	3.6
Northern Ireland	486	3.8	463	3.6	491	3.7	496	3.4
Wales	470	2.5	444	2.6	465	2.3	483	2.7
OECD average	**493**	**0.6**	**490**	**0.5**	**495**	**0.5**	**493**	**0.5**

Table A.6: Relationship between student performance in mathematics and the PISA index of economic, social and cultural status (ESCS): OECD and UK administrations

	Unadjusted mean score[1]	Mean score if students were on the OECD mean for background (ESCS =0) [2]	Strength of relationship between performance and ESCS[3]	Slope of socio-economic gradient[4]
Australia	504	496	12.3	42
Austria	506	503	15.8	43
Belgium	515	511	15.0	43
Canada	518	508	9.4	31
Chile	423	443	23.1	34
Czech Republic	499	503	16.2	51
Denmark	500	485	16.5	39
Estonia	521	518	8.6	29
Finland	519	508	9.4	33
France	495	500	22.5	57
Germany	514	511	16.9	43
Greece	453	456	15.5	34
Hungary	477	490	23.1	47
Iceland	493	470	7.7	31
Ireland	501	497	14.6	38
Israel	466	460	17.2	51
Italy	485	487	10.1	30
Japan	536	541	9.8	41
Korea	554	553	10.1	42
Luxembourg	490	488	18.3	37
Mexico	413	435	10.4	19
Netherlands	523	515	11.5	40
New Zealand	500	500	18.4	52
Norway	489	476	7.4	32
Poland	518	526	16.6	41
Portugal	487	506	19.6	35
Slovak Republic	482	492	24.6	54
Slovenia	501	499	15.6	42
Spain	484	492	15.8	34
Sweden	478	471	10.6	36
Switzerland	531	525	12.8	38
Turkey	448	494	14.5	32
United States	481	476	14.8	35
United Kingdom	494	486	12.5	41
Scotland	**498**	**495**	**12.9**	**37**
England	495	487	12.4	41
Northern Ireland	487	476	16.7	45
Wales	468	464	10.4	35
OECD average	**494**	**495**	**14.6**	**39**

Notes to Table A.6:

1: the headline PISA score.
2: the headline score adjusted for social background, by comparing the scores between countries for students on the ESCS mean (zero).
3: The amount of variation in score explained by social background.
4: The amount that the average score changes with social background – a lower score implies less change as background changes.

Reading

Table A.7 Scotland's score in previous PISA surveys, together with comparison with 2012

	Reading		
	mean	**S.E.**	**comparison to 2012**
2000	526	3.8	H
2003	516	2.5	S
2006	499	4.0	S
2009	500	3.2	S
2012	506	3.0	

H: higher than 2012, S: similar to 2012, L: lower than 2012
Comparisons in reading are possible from 2000 (the first survey when reading was a full domain and the scale was fully developed).

Table A.8a: Mean scores in reading, by gender, and comparison with Scotland: OECD and UK administrations

	Males		Females		Overall			
	mean	s.e.	mean	s.e.	mean	s.e.	s.d.	s.e.
Significantly above Scotland								
Canada	506	(2.3)	541	(2.1)	523	(1.9)	92	(0.9)
Estonia	494	(2.4)	538	(2.3)	516	(2.0)	80	(1.2)
Finland	494	(3.1)	556	(2.4)	524	(2.4)	95	(1.3)
Ireland	509	(3.5)	538	(3.0)	523	(2.6)	86	(1.7)
Japan	527	(4.7)	551	(3.6)	538	(3.7)	99	(2.3)
Korea	525	(5.0)	548	(4.5)	536	(3.9)	87	(2.0)
Poland	497	(3.7)	539	(3.1)	518	(3.1)	87	(1.6)
Similar to Scotland								
Australia	495	(2.3)	530	(2.0)	512	(1.6)	97	(1.0)
Belgium	493	(2.9)	525	(2.6)	509	(2.2)	103	(1.7)
France	483	(3.8)	527	(3.0)	505	(2.8)	109	(2.3)
Germany	486	(2.9)	530	(3.1)	508	(2.8)	91	(1.7)
Netherlands	498	(4.0)	525	(3.5)	511	(3.5)	93	(3.0)
New Zealand	495	(3.3)	530	(3.5)	512	(2.4)	106	(1.6)
Norway	481	(3.3)	528	(3.9)	504	(3.2)	100	(1.9)
Switzerland	491	(3.1)	527	(2.5)	509	(2.6)	90	(1.1)
England	487	(5.4)	512	(4.5)	500	(4.2)	98	(2.6)
Northern Ireland	484	(5.4)	512	(5.2)	498	(3.9)	95	(2.7)
Scotland	**493**	**(3.2)**	**520**	**(3.5)**	**506**	**(3.0)**	**87**	**(1.8)**
United Kingdom	487	(4.5)	512	(3.8)	499	(3.5)	97	(2.3)
United States	482	(4.1)	513	(3.8)	498	(3.7)	92	(1.6)
Significantly below Scotland								
Austria	471	(4.0)	508	(3.4)	490	(2.8)	92	(1.8)
Chile	430	(3.8)	452	(2.9)	441	(2.9)	78	(1.4)
Czech Republic	474	(3.3)	513	(3.4)	493	(2.9)	89	(1.9)
Denmark	481	(3.3)	512	(2.6)	496	(2.6)	86	(2.2)
Greece	452	(4.1)	502	(3.1)	477	(3.3)	99	(2.1)
Hungary	468	(3.9)	508	(3.3)	488	(3.2)	92	(1.9)
Iceland	457	(2.4)	508	(2.5)	483	(1.8)	98	(1.4)
Israel	463	(8.2)	507	(3.9)	486	(5.0)	114	(2.5)
Italy	471	(2.5)	510	(2.3)	490	(2.0)	97	(0.9)
Luxembourg	473	(1.9)	503	(1.8)	488	(1.5)	105	(1.0)
Mexico	411	(1.7)	435	(1.6)	424	(1.5)	80	(1.0)
OECD average	**478**	**(0.6)**	**515**	**(0.5)**	**496**	**(0.5)**	**94**	**(0.3)**
Portugal	468	(4.2)	508	(3.7)	488	(3.8)	94	(1.9)
Slovak Republic	444	(4.6)	483	(5.1)	463	(4.2)	104	(3.3)
Slovenia	454	(1.7)	510	(1.8)	481	(1.2)	92	(0.9)
Spain	474	(2.3)	503	(1.9)	488	(1.9)	92	(1.1)
Sweden	458	(4.0)	509	(2.8)	483	(3.0)	107	(1.8)
Turkey	453	(4.6)	499	(4.3)	475	(4.2)	86	(2.4)
Wales	466	(3.2)	493	(3.2)	480	(2.7)	90	(1.7)

Table A.8b: Mean scores in reading, by gender, and comparison with Scotland: non-OECD countries and economies

	Males		Females		Overall			
	mean	s.e.	mean	s.e.	mean	s.e.	s.d.	s.e.
Significantly above Scotland								
Chinese Taipei	507	(4.3)	539	(4.3)	523	(3.0)	91	(1.8)
Hong Kong-China	533	(3.8)	558	(3.3)	545	(2.8)	85	(1.8)
Shanghai (China)	557	(3.3)	581	(2.8)	570	(2.9)	80	(1.8)
Singapore	527	(1.9)	559	(1.9)	542	(1.4)	101	(1.2)
Similar to Scotland								
Liechtenstein	504	(6.2)	529	(5.8)	516	(4.1)	88	(4.2)
Macao-China	492	(1.4)	527	(1.1)	509	(0.9)	82	(0.7)
Vietnam	492	(5.0)	523	(4.0)	508	(4.4)	74	(2.6)
Significantly below Scotland								
Albania	387	(3.8)	401	(3.7)	394	(3.2)	116	(2.0)
Argentina	377	(4.5)	414	(3.6)	396	(3.7)	96	(2.3)
Brazil	394	(2.4)	425	(2.2)	410	(2.1)	85	(1.2)
Bulgaria	403	(6.3)	472	(5.6)	436	(6.0)	119	(2.8)
Colombia	394	(3.9)	412	(3.8)	403	(3.4)	84	(1.9)
Costa Rica	427	(3.9)	452	(3.5)	441	(3.5)	74	(1.6)
Croatia	461	(4.1)	509	(3.3)	485	(3.3)	86	(2.1)
Cyprus	418	(1.9)	481	(1.9)	449	(1.2)	111	(1.3)
Indonesia	382	(4.8)	410	(4.3)	396	(4.2)	75	(2.7)
Jordan	361	(5.5)	436	(3.1)	399	(3.6)	91	(2.5)
Kazakhstan	374	(3.4)	411	(2.6)	393	(2.7)	74	(1.4)
Latvia	462	(3.3)	516	(2.7)	489	(2.4)	85	(1.7)
Lithuania	450	(2.8)	505	(2.6)	477	(2.5)	86	(1.5)
Malaysia	377	(3.9)	418	(3.3)	398	(3.3)	84	(1.5)
Montenegro	391	(2.3)	453	(1.5)	422	(1.2)	92	(1.3)
Peru	373	(4.0)	395	(5.4)	384	(4.3)	94	(2.3)
Qatar	354	(1.1)	424	(1.2)	388	(0.8)	113	(0.8)
Romania	417	(4.5)	457	(4.2)	438	(4.0)	90	(2.0)
Russian Federation	455	(3.5)	495	(3.2)	475	(3.0)	91	(1.5)
Serbia	423	(3.9)	469	(3.8)	446	(3.4)	93	(2.0)
Thailand	410	(3.6)	465	(3.3)	441	(3.1)	78	(1.8)
Tunisia	388	(5.0)	418	(4.4)	404	(4.5)	88	(2.5)
United Arab Emirates	413	(3.9)	469	(3.2)	442	(2.5)	95	(1.1)
Uruguay	392	(3.9)	428	(3.2)	411	(3.2)	96	(2.0)
Scotland	**493**	**(3.2)**	**520**	**(3.5)**	**506**	**(3.0)**	**87**	**(1.8)**

Table A.9: Estimates of proportion at each proficiency level (per cent), reading: OECD and UK administrations

	Below Level 1b	Level 1b	Level 1a	Level 2	Level 3	Level 4	Level 5	Level 6
Australia	0.9	3.1	10.2	21.6	29.1	23.3	9.8	1.9
Austria	0.8	4.8	13.8	24.2	29.6	21.2	5.2	0.3
Belgium	1.6	4.1	10.5	20.2	27.3	24.0	10.7	1.6
Canada	0.5	2.4	8.0	19.4	31.0	25.8	10.8	2.1
Chile	1.0	8.1	23.9	35.1	24.3	6.9	0.6	0.0
Czech Republic	0.6	3.5	12.7	26.4	31.3	19.4	5.3	0.8
Denmark	0.8	3.1	10.7	25.8	33.6	20.5	5.1	0.4
Estonia	0.2	1.3	7.7	22.7	35.0	24.9	7.5	0.9
Finland	0.7	2.4	8.2	19.1	29.3	26.8	11.3	2.2
France	2.1	4.9	11.9	18.9	26.3	23.0	10.6	2.3
Germany	0.5	3.3	10.7	22.1	29.9	24.6	8.3	0.7
Greece	2.6	5.9	14.2	25.1	30.0	17.2	4.6	0.5
Hungary	0.7	5.2	13.8	24.3	29.9	20.4	5.3	0.4
Iceland	2.3	5.4	13.3	24.7	29.9	18.6	5.2	0.6
Ireland	0.3	1.9	7.5	19.6	33.4	26.0	10.1	1.3
Israel	3.8	6.9	12.9	20.8	25.3	20.6	8.1	1.5
Italy	1.6	5.2	12.7	23.7	29.7	20.5	6.1	0.6
Japan	0.6	2.4	6.7	16.6	26.7	28.4	14.6	3.9
Korea	0.4	1.7	5.5	16.4	30.8	31.0	12.6	1.6
Luxembourg	2.0	6.3	13.8	23.4	25.8	19.7	7.5	1.4
Mexico	2.6	11.0	27.5	34.5	19.6	4.5	0.4	0.0
Netherlands	0.9	2.8	10.3	21.0	29.2	26.1	9.0	0.8
New Zealand	1.3	4.0	11.0	20.8	26.3	22.7	10.9	3.0
Norway	1.7	3.7	10.8	21.9	29.4	22.3	8.5	1.7
Poland	0.3	2.1	8.1	21.4	32.0	26.0	8.6	1.4
Portugal	1.3	5.1	12.3	25.5	30.2	19.7	5.3	0.5
Slovak Republic	4.1	7.9	16.2	25.0	26.8	15.7	4.1	0.3
Slovenia	1.2	4.9	15.0	27.2	28.4	18.2	4.7	0.3
Spain	1.3	4.4	12.6	25.8	31.2	19.2	5.0	0.5
Sweden	2.9	6.0	13.9	23.5	27.3	18.6	6.7	1.2
Switzerland	0.5	2.9	10.3	21.9	31.5	23.8	8.2	1.0
Turkey	0.6	4.5	16.6	30.8	28.7	14.5	4.1	0.3
United States	0.8	3.6	12.3	24.9	30.5	20.1	6.9	1.0
United Kingdom	1.5	4.0	11.2	23.5	29.9	21.3	7.5	1.3
Scotland	**0.5**	**2.7**	**9.3**	**23.9**	**33.8**	**22.0**	**6.9**	**0.9**
England	1.6	4.0	11.1	23.1	29.5	21.5	7.8	1.3
Northern Ireland	1.1	4.1	11.5	24.4	29.8	20.8	7.1	1.2
Wales	1.0	4.9	14.7	28.5	29.8	16.3	4.2	0.5
OECD average	**1.3**	**4.4**	**12.3**	**23.5**	**29.1**	**21.0**	**7.3**	**1.1**

Science

Table A.10: Scotland's score in previous PISA surveys, together with comparison with 2012

	Science		
	mean	**S.E.**	**comparison to 2012**
2000	*522*		n/a
2003	*514*	2.7	n/a
2006	515	4.0	**S**
2009	514	3.5	**S**
2012	513	3.0	

H: higher than 2012, S: similar to 2012, L: lower than 2012
Comparisons in science are possible from 2006 (the first survey when science was a full domain and the scale was fully developed).

Table A.11a: Mean scores in science, by gender, and comparison with Scotland: OECD and UK administrations

	Males		Females		Overall			
	mean	s.e.	mean	s.e.	mean	s.e.	s.d.	s.e.
Significantly above Scotland								
Australia	524	(2.5)	519	(2.1)	521	(1.8)	100	(1.0)
Canada	527	(2.4)	524	(2.0)	525	(1.9)	91	(0.9)
Estonia	540	(2.5)	543	(2.3)	541	(1.9)	80	(1.1)
Finland	537	(3.0)	554	(2.3)	545	(2.2)	93	(1.2)
Germany	524	(3.1)	524	(3.5)	524	(3.0)	95	(2.0)
Ireland	524	(3.4)	520	(3.1)	522	(2.5)	91	(1.6)
Japan	552	(4.7)	541	(3.5)	547	(3.6)	96	(2.2)
Korea	539	(4.7)	536	(4.2)	538	(3.7)	82	(1.8)
Poland	524	(3.7)	527	(3.2)	526	(3.1)	86	(1.5)
Similar to Scotland								
Austria	510	(3.9)	501	(3.4)	506	(2.7)	92	(1.6)
Czech Republic	509	(3.7)	508	(3.5)	508	(3.0)	91	(2.1)
England	523	(5.4)	509	(4.3)	516	(4.0)	101	(2.2)
Netherlands	524	(3.7)	520	(3.9)	522	(3.5)	95	(2.2)
New Zealand	518	(3.2)	513	(3.3)	516	(2.1)	105	(1.4)
Northern Ireland	510	(6.3)	504	(5.8)	507	(3.9)	101	(2.7)
Scotland	**517**	**(3.3)**	**510**	**(3.6)**	**513**	**(3.0)**	**89**	**(2.0)**
Slovenia	510	(1.9)	519	(1.9)	514	(1.3)	91	(1.2)
Switzerland	518	(3.3)	512	(2.7)	515	(2.7)	91	(1.1)
United Kingdom	521	(4.5)	508	(3.7)	514	(3.4)	100	(1.8)
Significantly below Scotland								
Belgium	505	(2.9)	506	(2.6)	505	(2.1)	101	(1.4)
Chile	448	(3.7)	442	(2.9)	445	(2.9)	80	(1.5)
Denmark	504	(3.5)	493	(2.5)	498	(2.7)	93	(1.7)
France	498	(3.8)	500	(2.4)	499	(2.6)	100	(2.2)
Greece	460	(3.8)	473	(3.0)	467	(3.1)	88	(1.5)
Hungary	496	(3.4)	493	(3.3)	494	(2.9)	90	(1.9)
Iceland	477	(2.7)	480	(2.9)	478	(2.1)	99	(1.5)
Israel	470	(7.9)	470	(4.0)	470	(5.0)	108	(2.1)
Italy	495	(2.2)	492	(2.4)	494	(1.9)	93	(1.1)
Luxembourg	499	(1.7)	483	(1.7)	491	(1.3)	103	(1.0)
Mexico	418	(1.5)	412	(1.3)	415	(1.3)	71	(0.9)
Norway	493	(3.2)	496	(3.7)	495	(3.1)	100	(1.9)
OECD average	**502**	**(0.6)**	**500**	**(0.5)**	**501**	**(0.5)**	**93**	**(0.3)**
Portugal	488	(4.1)	490	(3.8)	489	(3.7)	89	(1.6)
Slovak Republic	475	(4.3)	467	(4.2)	471	(3.6)	101	(2.8)
Spain	500	(2.3)	493	(1.9)	496	(1.8)	86	(0.9)
Sweden	481	(3.9)	489	(2.8)	485	(3.0)	100	(1.5)
Turkey	458	(4.5)	469	(4.3)	463	(3.9)	80	(1.9)
United States	497	(4.1)	498	(4.0)	497	(3.8)	94	(1.5)
Wales	496	(3.4)	485	(3.5)	491	(3.0)	94	(1.6)

Table A.11b: Mean scores in science, by gender, and comparison with Scotland: non-OECD countries and economies

	Males		Females		Overall			
	mean	s.e.	mean	s.e.	mean	s.e.	s.d.	s.e.
Significantly above Scotland								
Chinese Taipei	524	(3.9)	523	(4.0)	523	(2.3)	83	(1.4)
Hong Kong-China	558	(3.6)	551	(3.1)	555	(2.6)	83	(1.8)
Liechtenstein	533	(5.8)	516	(5.7)	525	(3.5)	86	(4.1)
Macao-China	520	(1.3)	521	(1.2)	521	(0.8)	79	(0.7)
Shanghai (China)	583	(3.5)	578	(3.1)	580	(3.0)	82	(1.8)
Singapore	551	(2.1)	552	(1.9)	551	(1.5)	104	(1.2)
Vietnam	529	(5.0)	528	(4.1)	528	(4.3)	77	(2.3)
Significantly below Scotland								
Albania	394	(3.0)	401	(2.9)	397	(2.4)	99	(1.8)
Argentina	402	(4.5)	409	(4.0)	406	(3.9)	86	(2.2)
Brazil	406	(2.3)	404	(2.3)	405	(2.1)	79	(1.4)
Bulgaria	437	(5.6)	457	(4.6)	446	(4.8)	102	(2.5)
Colombia	408	(3.4)	390	(3.6)	399	(3.1)	76	(1.6)
Costa Rica	436	(3.5)	424	(3.2)	429	(2.9)	71	(1.6)
Croatia	490	(3.9)	493	(3.3)	491	(3.1)	85	(1.8)
Cyprus	431	(1.8)	444	(1.7)	438	(1.2)	97	(1.1)
Indonesia	380	(4.1)	383	(4.1)	382	(3.8)	68	(2.3)
Jordan	388	(5.4)	430	(2.9)	409	(3.1)	83	(2.0)
Kazakhstan	420	(3.4)	429	(3.2)	425	(3.0)	74	(1.5)
Latvia	495	(3.6)	510	(2.8)	502	(2.8)	79	(1.4)
Lithuania	488	(3.0)	503	(2.6)	496	(2.6)	86	(1.7)
Malaysia	414	(3.8)	425	(3.1)	420	(3.0)	79	(1.4)
Montenegro	402	(1.6)	419	(1.6)	410	(1.1)	84	(1.0)
Peru	376	(3.5)	370	(4.6)	373	(3.6)	78	(1.9)
Qatar	367	(1.2)	402	(1.1)	384	(0.7)	106	(0.7)
Romania	436	(3.7)	441	(3.5)	439	(3.3)	79	(2.0)
Russian Federation	484	(3.5)	489	(2.9)	486	(2.9)	85	(1.3)
Serbia	443	(4.0)	447	(3.8)	445	(3.4)	87	(1.9)
Thailand	433	(3.3)	452	(3.4)	444	(2.9)	76	(1.7)
Tunisia	399	(3.9)	398	(3.6)	398	(3.5)	79	(1.9)
United Arab Emirates	434	(4.1)	462	(3.7)	448	(2.8)	94	(1.1)
Uruguay	415	(3.4)	416	(3.1)	416	(2.8)	95	(1.7)
Scotland	**517**	**(3.3)**	**510**	**(3.6)**	**513**	**(3.0)**	**89**	**(2.0)**

Table A.12: Estimates of proportion at each proficiency level (per cent), science: OECD and UK administrations

	Below Level 1	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
Australia	3.4	10.2	21.5	28.5	22.8	10.9	2.6
Austria	3.6	12.2	24.3	30.1	21.9	7.0	0.8
Belgium	5.8	11.8	21.5	28.7	22.9	8.3	1.0
Canada	2.4	8.0	21.0	32.0	25.3	9.5	1.8
Chile	8.1	26.3	34.6	22.4	7.5	1.0	0.0
Czech Republic	3.3	10.5	24.7	31.7	22.2	6.7	0.9
Denmark	4.7	12.0	25.7	31.3	19.6	6.1	0.7
Estonia	0.5	4.5	19.0	34.5	28.7	11.1	1.7
Finland	1.8	5.9	16.8	29.6	28.8	13.9	3.2
France	6.1	12.6	22.9	29.2	21.3	6.9	1.0
Germany	2.9	9.3	20.5	28.9	26.2	10.6	1.6
Greece	7.4	18.1	31.0	28.8	12.2	2.3	0.2
Hungary	4.1	14.0	26.4	30.9	18.7	5.5	0.5
Iceland	8.0	16.0	27.5	27.2	16.2	4.6	0.6
Ireland	2.6	8.5	22.0	31.1	25.0	9.3	1.5
Israel	11.2	17.7	24.8	24.4	16.1	5.2	0.6
Italy	4.9	13.8	26.0	30.1	19.1	5.5	0.6
Japan	2.0	6.4	16.3	27.5	29.5	14.8	3.4
Korea	1.2	5.5	18.0	33.6	30.1	10.6	1.1
Luxembourg	7.2	15.1	24.2	26.2	19.2	7.0	1.2
Mexico	12.6	34.4	37.0	13.8	2.1	0.1	0.0
Netherlands	3.1	10.1	20.1	29.1	25.8	10.5	1.3
New Zealand	4.7	11.6	21.7	26.4	22.3	10.7	2.7
Norway	6.0	13.6	24.8	28.9	19.0	6.4	1.1
Poland	1.3	7.7	22.5	33.1	24.5	9.1	1.7
Portugal	4.7	14.3	27.3	31.4	17.8	4.2	0.3
Slovak Republic	9.2	17.6	27.0	26.2	15.0	4.3	0.6
Slovenia	2.4	10.4	24.5	30.0	23.0	8.4	1.2
Spain	3.7	12.0	27.3	32.8	19.4	4.5	0.3
Sweden	7.3	15.0	26.2	28.0	17.2	5.6	0.7
Switzerland	3.0	9.8	22.8	31.3	23.7	8.3	1.0
Turkey	4.4	21.9	35.4	25.1	11.3	1.8	0.0
United States	4.2	14.0	26.7	28.9	18.8	6.3	1.1
United Kingdom	4.3	10.7	22.4	28.4	23.0	9.3	1.8
Scotland	**2.7**	**9.4**	**24.9**	**32.4**	**21.8**	**7.5**	**1.3**
England	4.3	10.6	21.9	28.0	23.4	9.8	1.9
Northern Ireland	4.7	12.1	23.7	27.8	21.4	8.3	2.0
Wales	5.2	14.2	27.1	29.5	18.4	4.9	0.8
OECD average	**4.8**	**13.0**	**24.5**	**28.8**	**20.5**	**7.2**	**1.2**

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