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Report

Achievement of 15-Year-Olds in Wales: PISA 2012 National Report

OECD Programme for International Student Assessment

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Achievement of 15-Year-Olds in Wales: PISA 2012 National Report

OECD Programme for International Student Assessment

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Executive summary

Background

The Programme for International Student Assessment (PISA) is a survey of the educational achievement of 15-year-olds organised by the Organisation for Economic Co-operation and Development (OECD). In the UK, PISA 2012 was carried out on behalf of the respective governments by the National Foundation for Educational Research.

PISA assesses students' mathematics, science and reading skills. Mathematics was the main subject in PISA 2012 and so was assessed in greater depth compared with the other two areas. In addition pupils and schools complete questionnaires to provide information about pupil background and attitudes, and aspects of school management and school climate respectively.

Results for the United Kingdom as a whole are included in the international PISA report published by OECD with the results of the other 64 participating countries. With the UK, this included 34 OECD member countries and 27 members of the European Union. The results from PISA provide the Welsh Government with complementary information to that provided by national research.

Strict international quality standards are applied at all stages of the PISA survey to ensure equivalence in the translation and adaptation of instruments, sampling procedures and survey administration in all participating countries. In Wales, a total of 137 schools took part in PISA 2012 and pupils sat booklets in English or Welsh. The response rate for the UK was 89 per cent of sampled schools and 86 per cent of sampled pupils. This is a good response rate and fully met the PISA 2012 participation requirements.

Mathematics in Wales

Wales' performance in mathematics was significantly below the OECD average. The mean score of pupils in Wales decreased since PISA 2009, which it also did between PISA 2009 and 2006. However, this decrease is significant only when comparing performance between PISA 2012 and 2006.

In PISA 2012, there were 38 countries that significantly outperformed Wales in mathematics and two countries with a score that was not significantly different from that of Wales. Of the 38 countries with mean scores in mathematics that were significantly higher, the seven highest achieving countries were in East and South East Asia. There were 21 EU countries that significantly outperformed Wales and one EU country that performed similarly (Croatia). Twenty-four countries had mean scores which were significantly lower than Wales. This group contained only four EU countries.

Wales had a relatively narrow spread of performance. Only seven participating countries had a smaller difference between their highest and lowest attainers. There has been a small increase in the proportion of low achieving pupils and a decrease in the proportion of high achieving pupils. The percentage of pupils in the top two proficiency levels in Wales was less than half the OECD average. Boys performed significantly better than girls, as was the case in nearly two-thirds of participating countries.

As mathematics was the main subject in PISA 2012, it was assessed in greater depth than science and reading and, therefore, performance of pupils in different areas of mathematics can be compared. In Wales, pupils are relatively strong on the questions that focus on probability and statistics (*uncertainty and data*) or require them to *interpret, apply and evaluate* mathematical outcomes in order to solve problems. They are less strong on questions that focus on aspects of *space and shape* or that require them to *formulate* situations mathematically in order to solve a problem.

Science in Wales

Wales' performance in science was significantly below the OECD. The mean score of pupils in Wales decreased since PISA 2009, which it also did between PISA 2009 and 2006. However, this decrease is significant only when comparing performance between PISA 2012 and 2006.

In PISA 2012, there were 25 countries which performed at a level significantly higher than Wales, including 12 EU countries. In 12 countries, science attainment was not significantly different from that of Wales, while the remaining 27 countries performed significantly less well. Nine EU countries did not perform significantly differently from Wales and only five performed less well.

The difference between the score points of the lowest scoring pupils and the highest scoring pupils in Wales was similar to the OECD average. However, the proportion of pupils in Wales at the highest levels was lower than the OECD average.

There was no clear pattern of performance by gender across participating countries. In Wales, there was a significant gender difference of 11 points in favour of boys.

Reading in Wales

Wales' performance in reading in PISA 2012 was significantly below the OECD average and generally similar to performance in 2006 and 2009. Wales had a smaller difference between the score points of the lowest scoring pupils and the highest scoring pupils compared with the OECD average but the proportion of pupils at each level of achievement differed from the OECD averages in that Wales had lower proportions of pupils performing at the higher levels (Levels 5 and 6), and higher proportions at Level 1 and below.

Thirty-one countries had a mean score for reading significantly higher than that of Wales. In ten countries the difference in mean scores from that in Wales was not statistically significant. Twenty-three countries had mean scores which were significantly lower than Wales.

Of the 31 countries with higher mean scores (where the difference was statistically significant), 16 are EU members. Six EU countries did not perform significantly differently from Wales and only four performed less well.

Girls scored significantly higher than boys in all countries, although in Wales the gender difference, while statistically significant, was not as large as in the majority of other countries. In Wales, this difference was 27 score points between girls and boys compared with an OECD average of 38 score points.

Pupils and mathematics in Wales

Pupils in Wales reported moderate interest in learning mathematics, but recognised that it is useful. A very high proportion of pupils reported that their parents believe in the importance of mathematics. Pupils in Wales show greater motivation to learn mathematics than the OECD average and report a high sense of belonging and satisfaction with school, similar to the OECD average.

Pupils reported a high amount of control over their ability to succeed in mathematics and a high level of conscientiousness towards learning mathematics. Pupils in Wales generally reported a greater level of conscientiousness and a similar level of perseverance for mathematics tasks compared with the OECD average. Related to this, pupils in Wales reported that they were confident in their ability to perform mathematics tasks and have low anxiety about mathematics.

Pupils in Wales reported a higher level of support from their mathematics teachers than that found for the OECD on average and reported that a wide variety of tasks and strategies are used by their teachers in the mathematics lessons.

Pupils in Wales are better able to overcome disadvantage and achieve scores higher than predicted by their background when compared with some other OECD countries.

Schools in Wales

Headteachers in Wales reported that they have a high level of responsibility for most aspects of school management, as they did in 2009. Compared with the OECD average, headteachers in Wales play a greater role in most aspects of school management.

Headteachers in Wales also reported a higher frequency for most school leadership activities than their OECD counterparts, with over 80 per cent of headteachers in Wales saying they pay attention to disruptive behaviour in classrooms, compared with 56 per cent of headteachers saying so across the OECD on average.

Headteachers in Wales reported the biggest staffing issue was a shortage of mathematics teachers. This had increased since 2009, when eight per cent of headteachers said it hindered instruction to some extent or a lot, compared with 17 per cent in this survey. The greatest resource issue for headteachers is a shortage or inadequacy of school buildings and grounds.

Schools in Wales reported a more positive climate for learning and noted that learning was less hindered by problems, particularly disciplinary problems compared with their OECD counterparts. Pupils were, on the whole, very positive about the climate of their school, although they were least positive on the extent to which they felt their teachers were interested in or listened to them. They were more positive about their relationship with their teachers across all aspects compared with the average across OECD countries.

In schools in Wales assessments serve various purposes, with the most frequent use being to inform parents, compare the school’s performance locally or nationally, and monitor the school’s progress.

PISA in the United Kingdom

In mathematics, the mean scores for England and Scotland and England and Northern Ireland were similar. Scotland significantly outperformed Northern Ireland. The mean score of pupils in Wales was significantly lower than that in the other parts of the UK. In England, Scotland and Wales, boys significantly outperformed girls. In Northern Ireland, the difference between the performance of boys and girls was not significant. The spread of attainment was greatest in England and Northern Ireland and this was above the OECD average for both countries. Wales and Scotland had a similar narrower spread of attainment. Across the OECD on average, 15 per cent of the variance in mathematics scores can be explained by socio-economic background. Of the UK countries, only Northern Ireland had a variance greater than the OECD average (at 17 per cent), while Wales had the lowest percentage (10 per cent). This suggests that socio-economic background has the least impact on performance in mathematics in Wales, whereas it has the biggest impact in Northern Ireland.

In science, there were no significant differences between England, Scotland and Northern Ireland but the mean score in Wales was significantly lower. Boys significantly outperformed girls in England, Scotland and Wales. The spread of attainment was greatest in England and Northern Ireland. Wales and Scotland had a narrower spread of attainment. Scotland had the narrowest spread of attainment of UK countries.

In reading, the mean scores in England, Scotland and Northern Ireland were similar. The mean score of pupils in Wales was significantly lower than that of pupils in the other parts of the UK. The spread of attainment was greatest in England and Northern Ireland and this was above the OECD average for both countries. Wales and Scotland had a narrower spread of attainment compared with the OECD average, and Scotland had the narrowest spread of attainment of UK countries. Girls outperformed boys in all parts of the UK, as they did in every other country in the PISA survey, although the difference in performance of boys and girls was less in all parts of the UK than the OECD average.

Pupils in all parts of the UK showed moderate interest in mathematics. Pupils in England tended to look forward to their mathematics lessons most and pupils in Northern Ireland were most likely to worry that mathematics classes would be difficult.

There were some differences in staffing and resource shortages with headteachers in Northern Ireland reporting a greater shortage of resources than headteachers in other parts of the UK. Headteachers in Scotland reported the highest shortage of teachers of subjects other than mathematics, science or reading.

1 Introduction

1.1 What is PISA?

The Programme for International Student Assessment (PISA) is a survey of educational achievement organised by the Organisation for Economic Co-operation and Development (OECD). In England, Wales, Northern Ireland and Scotland, the PISA 2012 survey was carried out on behalf of the respective governments by the National Foundation for Educational Research (NFER). The PISA surveys provide Government with detailed comparative evidence on which to base educational policy.

The OECD has 34 member countries, of which the United Kingdom is one, and is an organisation dedicated to global development. As a measure of educational outcomes PISA complements the other educational indicators gathered by OECD members to make international comparisons. It assesses the knowledge, skills and readiness for adult life of pupils aged 15. Pupils are assessed on their competence to address real life challenges involving reading, mathematics and science. This aim differentiates PISA from other pupil assessments which measure their mastery of the school curriculum, as instead it measures their 'literacy' in these areas. In 2012, there was also an assessment of problem solving, in which England was the only part of the UK to participate. Results for problem solving will be reported separately in March 2014.

PISA is carried out on a three-year cycle. The first PISA study was in 2000 (supplemented in 2002) and was undertaken in 43 countries (32 in 2000 and another 11 in 2002). Since then, the number of participating countries has increased. In PISA 2012, 65 countries took part. Of these, 34 were members of OECD. Each round of PISA focuses on one of the three areas of literacy in which knowledge and skills are assessed: mathematics, science and reading. The main focus for PISA 2012 was mathematics, with science and reading as minor domains.

In addition to the PISA assessment, pupils completed a questionnaire. The Student Questionnaire provided information on pupils' economic and social backgrounds, study habits, and attitudes to mathematics and to mathematics activities in school. A School Questionnaire was also completed by headteachers in participating schools. This provided information on the school's size, intake, resources and organisation, as well as mathematics activities available in the school. The questionnaires provided contextual information to support a more detailed analysis of the findings.

Age, rather than year group, is used to define pupils eligible to participate in the survey. This has an advantage over year group definitions as the age at which pupils start school can make it difficult to determine comparable year groups and because countries have different policies about holding pupils back a year or pushing them forward depending on their performance at school. The pupils who took part were mainly in Year 11 in England and Wales, Year 12 in Northern Ireland and S3 or S4 in Scotland.

All pupils sat some mathematics questions and approximately 70 per cent of the pupils who took part were assessed in science and reading. Mathematics is therefore covered more fully than science and reading. The results reported for each domain are estimates for the whole population of 15-year-olds in Wales, based on the performance of pupils who were presented with test items

in each domain. These estimates take into account information about how pupils with specific characteristics performed. The characteristics cover a wide range of variables from the Student Questionnaires (see OECD (forthcoming)). Further details on the development of the survey, what PISA measures, PISA scales and proficiency levels, how the survey was administered and the PISA sample are included in Appendix A. Here some of the guidelines for survey procedures to ensure the quality of the data collected in every country are detailed.

1.2 Organisation of this report

There are 65 countries in PISA 2012, including the UK. The OECD international report includes outcomes for all 65 participating countries. In this national report, the scores for Wales are compared with the 64 other countries, excluding the UK.

Chapters 2, 4 and 5 describe PISA results for mathematics, science and reading. Chapter 3 discusses pupils' responses to the Student Questionnaire, in particular, responses on attitudes towards mathematics. Chapter 6 presents responses by headteachers to the School Questionnaire and also responses by pupils to questions in the Student Questionnaire where questions are related. Chapter 7 describes and discusses the PISA results in the four constituent parts of the United Kingdom. In each chapter, comparisons are made with the OECD average. This is the average of the 34 members of the OECD. This is more useful than a comparison with all participating countries as it enables comparison with similarly developed countries or emerging countries. Information about how to interpret differences in performance between participating countries is included in each chapter which discusses attainment data. Further details on the background to PISA 2012 are included in Appendix A.

The international tables and figures presented in the appendices of this report include the results for the United Kingdom since these are reported in all international tables. In most cases, tables and figures include results for England, Wales, Northern Ireland and Scotland since these figures are referred to in Chapter 7. Where comparisons with performance of the constituent parts of the UK are made with PISA 2009 and 2006, figures come from analysis carried out for the national reports for these surveys (Bradshaw *et. al.*, 2009; Bradshaw *et. al.*, 2006).

More detailed analyses of international results can be found in the OECD report on PISA 2012, which also includes results for the United Kingdom (OECD, 2013). The results from the separate parts of the UK are reported in an Annex to the international report.

2 Mathematics

Chapter outline

This chapter reports the attainment of pupils in Wales in mathematics and how performance varies on different aspects of mathematical literacy. It draws on findings outlined in the international report (OECD, 2013) and places outcomes for Wales in the context of those findings. Throughout the chapter, comparisons are made between the findings for PISA 2012 and those from PISA 2006 and 2009. It is important to note that, for PISA 2006 and 2009, mathematics was a minor domain and as such it is not possible to compare the subscale data obtained in the PISA 2012 cycle where mathematics was the main focus. It is also not possible to compare the findings from PISA 2012 with those from PISA 2003 (the last time that mathematics was the main focus) because in 2003 the UK did not meet the data requirements and therefore the OECD does not make comparisons before 2006.

Key findings

- Wales' performance in mathematics is significantly lower than the OECD average and is lower than the performance in the last two cycles of the survey (2006 and 2009). The difference in performance since 2009 is not significant, but there is a significant decline in performance since 2006.
- The number of countries outperforming Wales has increased to 38 in 2012.
- Pupil performance varied across the four mathematical content areas and three mathematical process areas, as was the case in other countries. In Wales, pupils are relatively strong on the questions that focus on probability and statistics (*uncertainty and data*) or require them to *interpret, apply and evaluate* mathematical outcomes in order to solve problems. They are less strong on questions that focus on aspects of *space and shape* or that require them to *formulate* situations mathematically in order to solve a problem.
- Since 2006 there has been a small increase in the proportion of low achieving pupils and a decrease in the proportion of high achieving pupils. The percentage of pupils in the top two proficiency levels in Wales is less than half the OECD average.
- The spread of performance in Wales is relatively narrow. Only seven participating countries have a smaller difference between their highest and lowest attainers. However, in 2012 this difference increased in Wales. It is likely that the main reason for this increase is that the score of pupils at the 5th percentile has decreased since 2006.
- Boys performed significantly better than girls in mathematics in PISA 2012, although Wales had one of the smallest gender differences and the gap has decreased since 2009.

2.1 Comparison countries

The international report includes outcomes for all 65 participating countries, including the UK as a whole (outcomes for the four nations of the UK are not reported separately in the international report). In this chapter, scores for Wales are compared with 64 other countries excluding the UK. Comparisons between Wales and the other three constituent parts of the UK are reported in

Chapter 7. While findings for all countries are reported in this chapter where relevant, most findings relate to a sub-group of countries. The countries forming the comparison group include OECD countries, EU countries and other countries with relatively high scores. Since countries with very low scores are not so relevant for comparison purposes, those with a mean score for mathematics of less than 430 have been omitted from the tables unless they are in the OECD or the EU. Hence, the comparison group for mathematics in this chapter comprises 50 countries (of which 26 are EU members and 33 OECD members).

Table 2.1 Countries compared with Wales

Australia	France*	*Lithuania**	*Shanghai-China*
Austria*	Germany*	Luxembourg*	*Singapore*
Belgium*	Greece*	*Macao-China*	Slovak Republic*
*Bulgaria**	*Hong Kong-China*	Mexico	Slovenia*
Canada	Hungary*	Netherlands*	Spain*
Chile	Iceland	New Zealand	Sweden*
Chinese Taipei	Israel	Norway	Switzerland
*Croatia**	Italy*	Poland*	Turkey
*Cyprus**	Japan	Portugal*	*United Arab Emirates*
Czech Republic*	*Kazakhstan*	Republic of Ireland*	United States
Denmark*	Korea	*Romania**	*Vietnam*
Estonia*	*Latvia**	*Russian Federation*	
Finland*	*Liechtenstein*	*Serbia*	

OECD countries (not italicised) *Countries not in OECD (italicised)* *EU countries

In addition to the countries listed above, tables and figures in Appendix B include the data for all four constituent parts of the United Kingdom.

Outcomes for the United Kingdom as a whole are presented in the international report (OECD, 2013) and in the appendices that accompany this chapter (Appendix B). Outcomes for Wales (and the other three constituent parts of the UK) are derived from the ‘sub-national’ level analysis carried out by the international consortium, as well as from additional analysis carried out by NFER using the international dataset. Comparisons between the four constituent parts of the UK are provided in Chapter 7.

Interpreting differences between countries

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

Sources of uncertainty

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

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

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

Interpreting rank order

Because of the areas of uncertainty described above, interpretations of very small differences between two sets of results are often meaningless. Were they to be measured again it could well be that the results would turn out the other way round. For this reason, this chapter focuses mainly on *statistically significant* differences between mean scores rather than the simple rank order of countries. Statistically significant differences are unlikely to have been caused by random fluctuations due to sampling or measurement error.

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

2.2 Scores in Wales

Mathematical literacy

…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 recognising the role that mathematics plays in the world and to make the well-founded judgements and decisions needed by constructive, engaged and reflective citizens. (OECD, 2013)

Wales' pupils achieved a mean score of 468 in mathematics in PISA 2012, which was significantly lower than the OECD mean of 494. (See the box above on interpreting differences between countries for an explanation of how statistical significance should be interpreted in this report.) Wales' performance in mathematics has declined since 2006; the mean score in 2012 is significantly lower than that in 2006 (484). Wales' mean score has been significantly lower than the OECD average for the last three cycles of PISA. Tables 2.2 to 2.4 show whether countries' mean scores have changed significantly since PISA 2009 (further data including mean scores for mathematics for the previous PISA cycles can be found in Appendix B21). Table 2.3 shows that Wales' performance is not significantly different from PISA 2009.

Internationally, the performance in mathematics in 38 of the other 64 participating countries was significantly higher than that in Wales (see Table 2.2). Since 2006, the number of countries with mean scores significantly higher than Wales has increased from 22, to 35 in 2009, to 38 in 2012. This increase is due in part to the high performance of countries participating for the first time, such as Shanghai-China and Singapore in 2009, and Vietnam in 2012, but is also due to improved performance in other countries. Notably, the Russian Federation achieved significantly higher mean scores compared with 2009 and as a result outperformed Wales in PISA 2012.

Two countries (Croatia and Israel) performed at a level that was not significantly different from that of Wales (shown in Table 2.3). In 2009 Croatia and Israel performed significantly less well than Wales. However, a significant increase in the mean score for mathematics has resulted in performance in 2012 that is not significantly different to Wales. The remaining 24 countries performed significantly less well than Wales (shown in Table 2.4). Further data can be found in Appendix B1 (mean scores and standard errors for Wales and the comparison group countries and significant differences between Wales and the comparison group countries).

Twenty-one of the countries that significantly outperformed Wales are EU members. Only one EU country, Croatia, did not perform significantly differently from Wales and a further four (Greece, Romania, Cyprus and Bulgaria) performed less well. Among OECD countries, 28 outperformed Wales, one performed similarly, and four performed less well. This indicates that the mathematics achievement of pupils in Wales is below that of pupils in many EU and OECD countries.

Table 2.2 Countries outperforming Wales in mathematics in 2012 (significant differences)

Country	Mean score		Country	Mean score	
Shanghai-China	613	^	Republic of Ireland*	501	^
Singapore	573	^	Slovenia*	501	
Hong Kong-China	561		Denmark*	500	
Chinese Taipei	560	^	New Zealand	500	v
Korea	554		Czech Republic*	499	
Macao-China	538	^	France*	495	
Japan	536		Iceland	493	v
Liechtenstein	535		*Latvia**	491	^
Switzerland	531		Luxembourg*	490	
Netherlands*	523		Norway	489	v
Estonia*	521	^	Portugal*	487	
Finland*	519	v	Italy*	485	
Canada	518	v	Spain*	484	
Poland*	518	^	*Russian Federation*	482	^
Belgium*	515		Slovak Republic*	482	v
Germany*	514		United States	481	
Vietnam	511		*Lithuania**	479	
Austria*	506		Sweden*	478	v
Australia	504	v	Hungary*	477	v

OECD countries (not italicised) *Countries not in OECD (italicised)* *EU countries

^ v Indicates a significant change since PISA 2009

Table 2.3 Countries not significantly different from Wales in mathematics

Country	Mean score	
*Croatia**	471	^
Wales	**468**	
Israel	466	^

OECD countries (not italicised) *Countries not in OECD (italicised)* *EU countries

^ v Indicates a significant change since PISA 2009

Table 2.4 Countries significantly below Wales in mathematics

Country	Mean score		Country	Mean score	
Greece*	453	∨	*United Arab Emirates*	434	∧
Serbia	449		*Kazakhstan*	432	∧
Turkey	448		Chile	423	
*Romania**	445	∧	Mexico	413	
*Cyprus**	440				
*Bulgaria**	439		*plus 14 other countries*		

OECD countries (not italicised) *Countries not in OECD (italicised)* *EU countries

∧ ∨ Indicates a significant change since PISA 2009

2.2.1 Mathematics content and process category scale scores

2.2.1.1 Mathematics content category scale scores

Mathematical literacy in PISA is assessed in relation to four content categories (*quantity*, *uncertainty and data*, *change and relationships*, and *space and shape*). Brief descriptions of each of these content categories are provided below (OECD, 2013). Figures 2.1 to 2.4 provide examples of released PISA 2012 mathematics items covering the four content categories (and the three mathematical process subscales: see section 2.2.2) (the mark schemes for these items can be found in Appendix B22). In addition to their overall performance, pupils' performance in mathematics was analysed separately by content category and by mathematical process (section 2.2.2). In some countries, pupils showed notably stronger or weaker performance in some of these areas, relative to their mean performance. If mean scores on some subscales are lower than on others, this could have implications for teaching and learning or might suggest that the balance of these areas in the curriculum should be evaluated. Appendices B5 to B11 show the mean scores for each comparison group country on each of the seven subscales, while Appendices B12 to B18 summarise the statistically significant differences for these scales.

Table 2.5 shows the difference between the overall mean mathematics scores and the mean scores for each of the content categories and mathematical processes for each of the countries that outperformed Wales. The size of the difference has been colour coded and the key for the table should be interpreted in the following way:

	The score is more than 20 score points lower than the overall country mean
	The score is between 11 and 20 score points lower than the overall country mean
	The score is between 5 and 10 score points lower than the overall country mean
	The score is between 5 and 10 score points higher than the overall country mean
	The score is between 11 and 20 score points higher than the overall country mean
	The score is more than 20 score points higher than the overall country mean

Table 2.5 Differences between scale scores in countries outperforming Wales in 2012

	Overall mathematics mean	Difference from overall mathematics mean						
		Mathematics content categories				Mathematical processes		
		quantity	*uncertainty and data*	*change and relationships*	*space and shape*	*formulate*	*employ*	*interpret*
Shanghai-China	613	-22	-21	11	36	12	0	-34
Singapore	573	-5	-14	7	6	8	1	-18
Hong Kong-China	561	4	-8	3	6	7	-3	-10
Chinese Taipei	560	-16	-11	1	32	19	-11	-11
Korea	554	-16	-16	5	19	8	-1	-14
Macao-China	538	-8	-13	4	20	7	-2	-9
Japan	536	-18	-8	6	21	18	-6	-5
Liechtenstein	535	3	-9	7	4	0	1	5
Switzerland	531	0	-9	-1	13	7	-2	-2
Netherlands*	523	9	9	-5	-16	4	-4	3
Estonia*	521	4	-10	9	-8	-3	4	-8
Finland*	519	8	0	2	-12	0	-3	9
Canada	518	-3	-2	7	-8	-2	-2	3
Poland*	518	1	-1	-8	7	-2	1	-3
Belgium*	515	4	-7	-1	-6	-2	1	-2
Germany*	514	4	-5	2	-6	-3	2	3
Vietnam	511	-2	8	-2	-4	-14	12	-15
Austria*	506	5	-7	1	-5	-6	4	3
Australia	504	-4	4	5	-8	-6	-4	10
Republic of Ireland*	501	4	7	0	-24	-9	1	5
Slovenia*	501	3	-5	-2	2	-9	4	-3

	Overall mathematics mean	Difference from overall mathematics mean						
		Mathematics content categories				Mathematical processes		
		quantity	*uncertainty and data*	*change and relationships*	*space and shape*	*formulate*	*employ*	*interpret*
Denmark*	500	2	5	-6	-3	2	-5	8
New Zealand	500	-1	6	1	-9	-4	-5	11
Czech Republic*	499	6	-11	0	0	-4	5	-5
France*	495	1	-3	2	-6	-12	1	16
Iceland	493	4	3	-6	-4	7	-3	0
*Latvia**	491	-3	-12	6	6	-3	5	-4
Luxembourg*	490	5	-7	-2	-3	-8	3	5
Norway	489	3	7	-12	-10	0	-3	9
Portugal*	487	-6	-1	-1	4	-8	2	3
Italy*	485	5	-3	-9	2	-10	0	13
Spain*	484	7	2	-3	-7	-8	-3	11
Russian Federation	482	-4	-19	9	14	-1	5	-11
Slovak Republic	482	5	-10	-7	8	-1	4	-8
United States	481	-3	7	7	-18	-6	-1	8
*Lithuania**	479	4	-5	0	-7	-1	3	-8
Sweden*	478	3	4	-9	-10	1	-4	7
Hungary*	477	-2	-1	4	-3	-8	4	0
Wales	**468**	**-4**	**14**	**1**	**-25**	**-11**	**-3**	**15**

OECD countries (not italicised) *Countries not in OECD (italicised)* *EU countries

Differences have been calculated using unrounded mean scores.

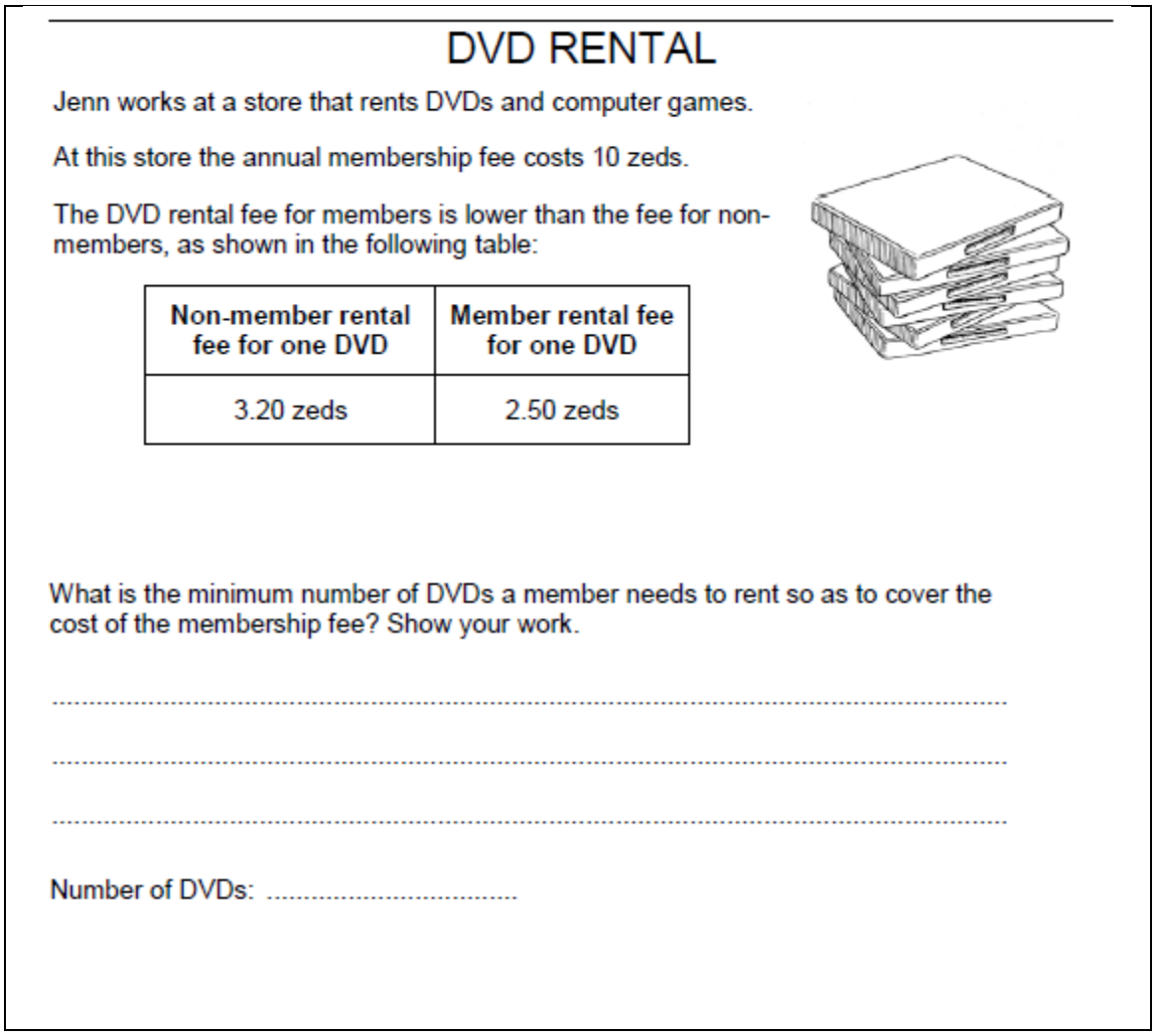
Quantity

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. 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 (OECD, 2013).

Figure 2.1 below is an example of a question from PISA 2012 that assesses the content area of *quantity*.

Wales' mean score on the *quantity* subscale was four points lower than the overall mean for mathematics. A number of the countries that outperformed Wales also had mean scores for this subscale that were similar to or slightly lower than the overall mean (for example: Switzerland, Canada, the United States and Australia). However, of the seven top performing countries four had mean scores for *quantity* that were more than ten points below the overall mean score for mathematics. For example, the mean score for *quantity* in Shanghai-China was 591; 22 points lower than the overall mean.

Figure 2.1 DVD Rental: a released *quantity* question from PISA 2012



DVD RENTAL

Jenn works at a store that rents DVDs and computer games.

At this store the annual membership fee costs 10 zeds.

The DVD rental fee for members is lower than the fee for non-members, as shown in the following table:

Non-member rental fee for one DVD	Member rental fee for one DVD
3.20 zeds	2.50 zeds

What is the minimum number of DVDs a member needs to rent so as to cover the cost of the membership fee? Show your work.

.....

.....

.....

Number of DVDs: .....

Uncertainty and data

Uncertainty and data covers 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 (OECD, 2013).

Figure 2.2 shows an example of a question from PISA 2012 that assesses the content area of *uncertainty and data*.

Wales' mean score for this content category was 14 points above the overall mean. A number of countries that outperformed Wales also had higher scores for *uncertainty and data* compared with the overall mean (for example: the Netherlands, the Republic of Ireland, Denmark, Norway and the United States). However the difference in mean scores in these countries was not as large as that seen in Wales. This suggests that pupils in Wales are relatively strong in answering questions related to statistics and probability (*uncertainty and data*) compared with pupils in a number of the high performing countries.

Change and relationships

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 (OECD, 2013).

Figure 2.3 shows an example of a question from PISA 2012 that assesses the content area of *change and relationships*.

In Wales, the mean score for *change and relationships* is very close to the overall mean score for mathematics (a difference of one score point). Amongst the countries that outperformed Wales there is variation in how pupils perform on this subscale compared with their overall performance for mathematics. For example, in Shanghai-China the mean score for *change and relationships* is 11 points higher than the overall mean, whereas in Norway the mean score is 12 points lower than the overall mean.

Figure 2.2 Penguins: a released *uncertainty and data* question from PISA 2012

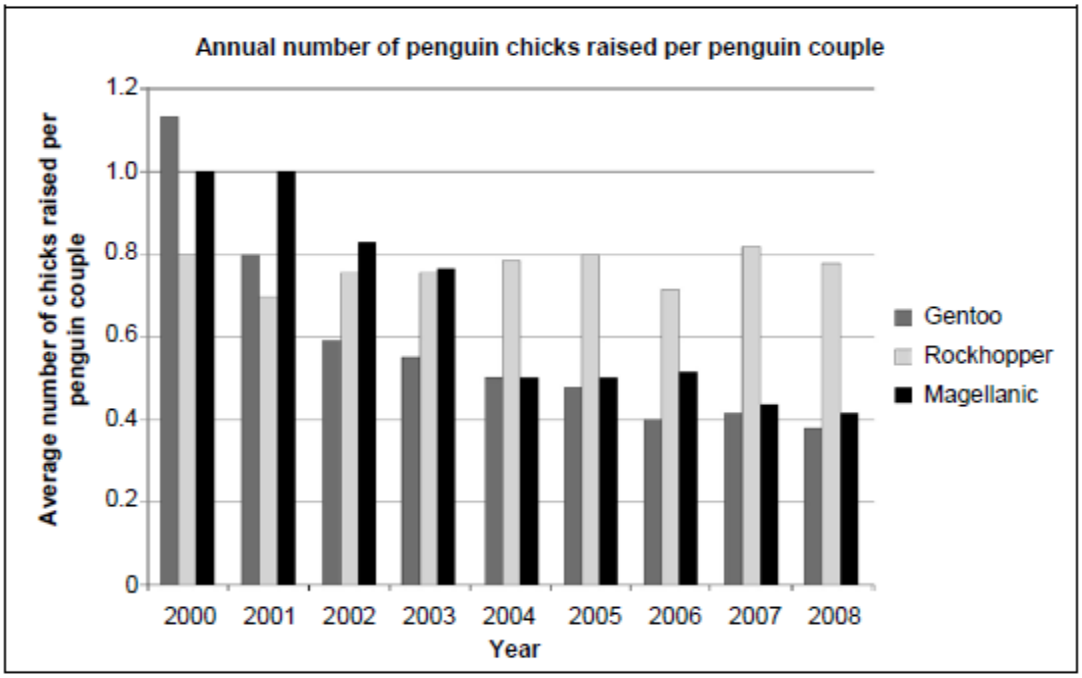
PENGUINS

The animal photographer Jean Baptiste went on a year-long expedition and took numerous photos of penguins and their chicks.

He was particularly interested in the growth in the size of different penguin colonies.

After he gets home from his trip, Jean Baptiste has a look on the Internet to see how many chicks a penguin couple raise on average.

He finds the following bar chart for the three penguin types Gentoo, Rockhopper and Magellanic.



Based on the chart above, are the following statements about these three penguin types true or false?

Circle "True" or "False" for each statement.

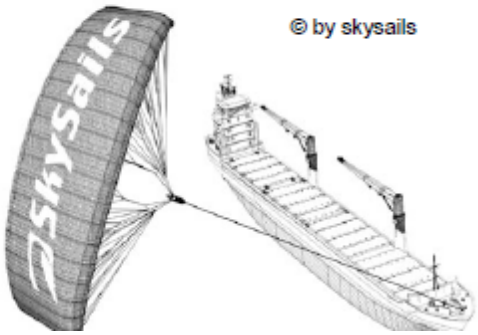
Statement	Is the statement true or false?
In 2000, the average number of chicks raised per penguin couple was larger than 0.6.	True / False
In 2006, on average, less than 80% of penguin couples raised a chick.	True / False
By about 2015 these three penguin types will be extinct.	True / False
The average number of Magellanic penguin chicks raised per penguin couple decreased between 2001 and 2004.	True / False

Figure 2.3 Sailing ships: a released *change and relationships* question from PISA 2012

SAILING SHIPS

Ninety-five percent of world trade is moved by sea, by roughly 50 000 tankers, bulk carriers and container ships. Most of these ships use diesel fuel.

Engineers are planning to develop wind power support for ships. Their proposal is to attach kite sails to ships and use the wind's power to help reduce diesel consumption and the fuel's impact on the environment.



© by skysails

Due to high diesel fuel costs of 0.42 zeds per litre, the owners of the ship *NewWave* are thinking about equipping their ship with a kite sail.

It is estimated that a kite sail like this has the potential to reduce the diesel consumption by about 20% overall.

Name: *NewWave*

Type: freighter

Length: 117 metres

Breadth: 18 metres

Load capacity: 12 000 tons

Maximum speed: 19 knots

Diesel consumption per year without a kite sail: approximately 3 500 000 litres

The cost of equipping the *NewWave* with a kite sail is 2 500 000 zeds.

After about how many years would the diesel fuel savings cover the cost of the kite sail? Give calculations to support your answer.

.....

.....

.....

.....

.....

.....

.....

Number of years:.....

Space and shape

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 (OECD, 2013).

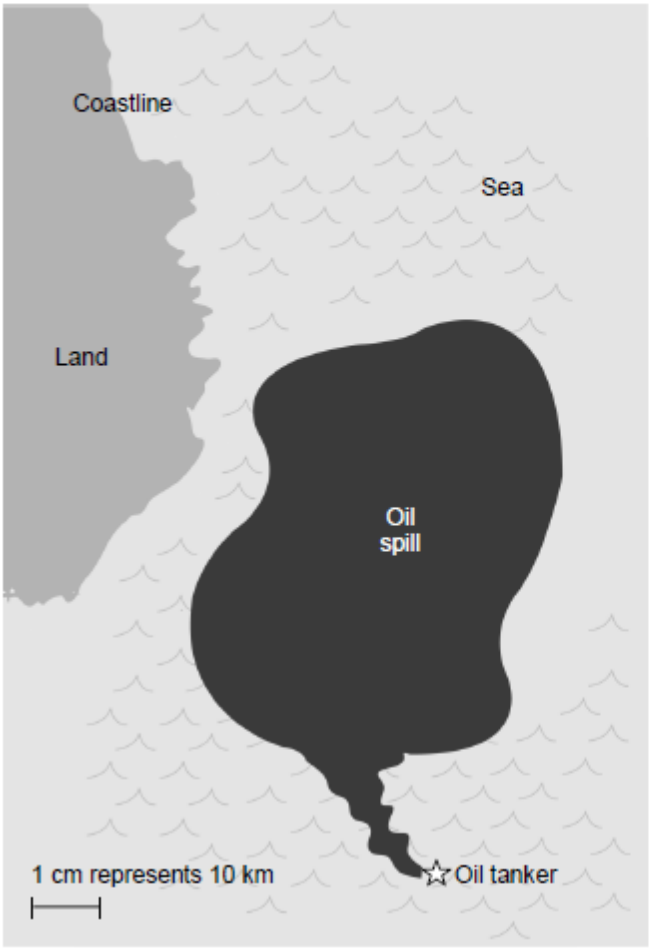
Figure 2.4 below is an example of a question from PISA 2012 that assesses the content area of *space and shape*.

Wales' mean score for this content category was considerably lower than the overall mean score for mathematics; a difference of 25 score points. The Republic of Ireland has a similar size of difference between the mean score for *space and shape* and the overall mean score. A number of the EU countries that outperform Wales (for example: the Netherlands, Finland and Sweden) also have a lower mean score compared with the overall mean, although in these countries the size of the difference is not as pronounced as in Wales. Wales does not compare well on this content category with the highest performing countries. The nine highest performing countries all had mean scores for *space and shape* that were higher than their overall scores for mathematics (for example, Shanghai-China and Chinese Taipei had a difference of over 30 score points).

Figure 2.4 Oil spill: a released *space and shape* question from PISA 2012

OIL SPILL

An oil tanker at sea struck a rock, making a hole in the oil storage tanks. The tanker was about 65 km from land. After a number of days the oil had spread, as shown on the map below.



Using the map scale, estimate the area of the oil spill in square kilometres (km^2).

Answer: ..... km^2

2.2.1.2 Mathematics process category scale scores

The PISA items are also classified according to the main mathematical process that a pupil uses to solve the problem they are presented with. There are three process categories:

- *formulating* situations mathematically
- *employing* mathematical concepts, facts, procedures and reasoning
- *interpreting, applying and evaluating* mathematical outcomes.

As shown in Table 2.5[1], Wales' highest mathematical process score was attained in the *interpret* subscale, with a mean of 483; 15 points higher than Wales' overall mean for mathematics. France had a similar size of difference between the mean score for *interpret* and the overall score. A number of other EU countries that outperform Wales (for example: Finland, Denmark, Spain and Italy) also have a higher mean score compared with the overall mean, although in some of these countries the the size of the difference is not as pronounced as it is in Wales. The mean scale score for the *employ* subscale was close to the overall mean (466). Amongst the countries that outperformed Wales, several had a mean score on this process scale that was similar to the overall mean for mathematics. In Wales the mean score for the *formulate* subscale was 11 points lower than the overall mean score (457). The Czech Republic and Italy had a similar size of diference between the mean score for *formulate* and the overall score. In contrast, the top seven performing countries had mean scores for this subscale that were higher than the overall mean, for example in Chinese Taipei the score for the *formulate* subscale was 19 points higher than the overall mean.

Summary

In Wales, pupil performance varied across the four mathematical content areas and the three mathematical process categories; variation was also seen in other countries. None of the countries which significantly outperformed Wales demonstrated consistent performance across the four content areas and the three mathematical processes (see Table 2.5 above). Of the four content categories, Wales achieved the highest mean score on the *uncertainty and data* scale (483), 14 score points higher than the overall mean for mathematics. The mean scale score for the *change and relationships* scale was closer to the overall mean (470) and the *quantity* scale score was 465, slightly lower than the overall mean. Wales' lowest score was attained on the *space and shape* scale (444); 25 score points lower than the overall mean. The difference between the mean score for *space and shape* and the overall mean, as observed in Wales, is also found in a number of EU countries that outperformed Wales (for example: the Republic of Ireland, the Netherlands and Finland). However, similar patterns were not observed in the highest performing countries. For example, Shanghai-China scored 36 score points higher than its overall mean on *space and shape* but over 20 score points lower on the *quantity* and *uncertainty and data* subscales. Chinese Taipei, Japan, Korea and Macao-China showed the same subscale trends as Shanghai-China, although to a less pronounced degree.

Comparing mean scores for the three mathematical processes, just over half of the countries that outperformed Wales had relatively high scores on the *interpret* subscale. However, a number of the high performing countries (for example: Shanghai-China, Singapore and Korea) had lower

[1] Differences have been calculated using unrounded mean scores.

mean scores for this process subscale compared with their scores on the other processes and their overall mean. These high performing countries had higher mean scores on the *formulate* subscale, Wales' weakest process area.

These findings suggest that, in Wales, pupils are relatively strong on the questions that focus on probability and statistics (*uncertainty and data*) and require them to *interpret, apply and evaluate* mathematical outcomes in order to solve problems, however, they are less strong on those focusing on aspects of *space and shape* and those requiring them to *formulate* situations mathematically in order to solve a problem. Comparisons between the four constituent parts of the UK are provided in Chapter 7.

2.3 Differences between highest and lowest attainers

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

2.3.1 Distribution of scores

The first way in which the spread of performance in each country can be examined is by looking at the distribution of scores. Appendix B2 shows the scores achieved by pupils at different percentiles. The 5th percentile is the score at which five per cent of pupils score lower, while the 95th percentile is the score at which five per cent score higher. The difference between the highest and lowest attainers at the 5th and 95th percentiles is a better measure of the spread of scores for comparing countries than using the lowest and highest scoring pupils. Such a comparison may be affected by a small number of pupils in a country with unusually high or low scores. Comparison of the 5th and the 95th percentiles gives a much better indication of the typical spread of attainment.

The score of pupils in Wales at the 5th percentile was 329 while the score of those at the 95th percentile was 610; a difference of 281 score points[2]. By comparison, the average difference across the OECD countries was 301 score points, indicating that Wales has a narrower distribution of scores. Only seven comparison countries had a smaller difference between the highest and lowest attainers, including Estonia (268 points) and Denmark (272 points). The Republic of Ireland had a very similar spread of attainment to that of Wales with a difference of 280 score points between the highest and lowest achievers.

[2] Differences have been calculated using unrounded mean scores.

2.3.2 Performance across PISA proficiency levels

Proficiency levels for mathematics overall

The second way of examining the spread of attainment is by looking at Wales' performance at each of the PISA proficiency levels. The PISA proficiency levels are devised by the PISA Consortium. As explained in Appendix A3, mathematics attainment is described in terms of six levels of achievement. These six performance levels are outlined in Figure 2.5 and Figure 2.6. Also shown in Figure 2.5 are the cumulative percentages at each level for the OECD average and for Wales. In all participating countries there were some pupils at or below the lowest level of achievement (Level 1) and in all countries at least some pupils achieved the highest level (Level 6). Full information on the proportion of pupils at each level in all comparison countries is provided in Appendices B19 and B20.

Figure 2.5 demonstrates that in Wales, 9.6 per cent of pupils scored below PISA Level 1. This was slightly more than the OECD average (8 per cent). Wales also had 29.0 per cent of pupils at Level 1 or below, compared with an OECD average of 23.0 per cent. Only ten of the comparison countries had a higher percentage of pupils at or below Level 1 than Wales.

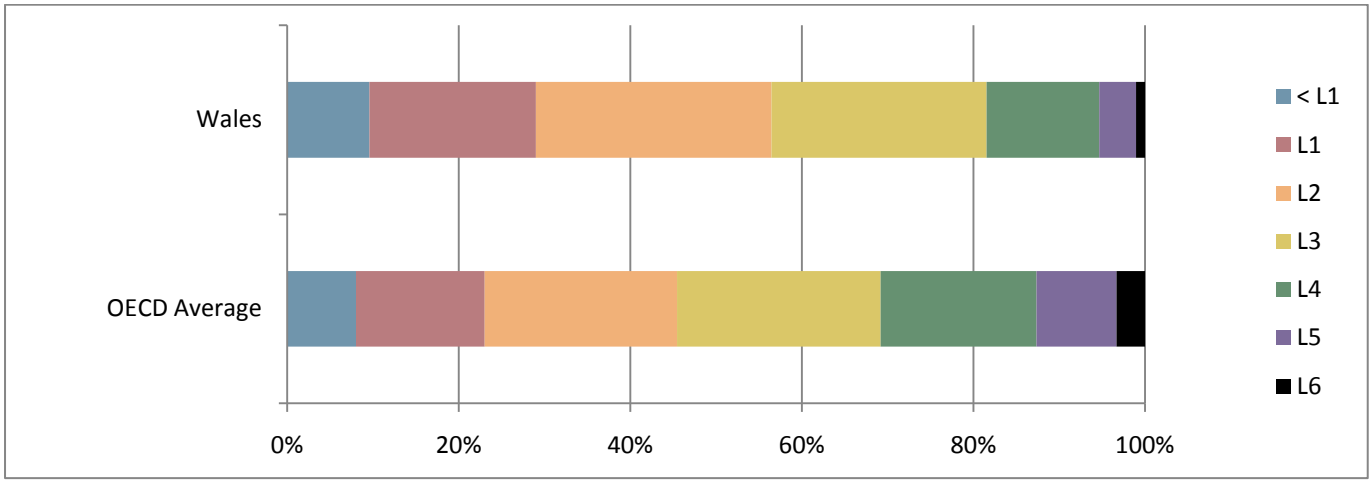
In terms of high achievers, only one per cent of Wales' pupils achieved PISA Level 6; a smaller percentage than the OECD average (3.3 per cent). Combining the two top levels (Levels 5 and 6), Wales is well below the OECD average (5.3 per cent compared with an OECD average of 12.6 per cent). Only nine comparison countries have a smaller percentage of pupils in these top two levels than Wales.

Figure 2.5 PISA mathematics proficiency levels

Level	% at this level		What students can typically do at each level
	OECD	Wales	
6	3.3% perform tasks at Level 6	1.0% perform tasks at Level 6	Students at Level 6 of the PISA mathematics assessment are able to successfully complete the most difficult PISA items. At Level 6, students can conceptualise, generalise and use 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 move flexibly 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 addressing 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 and arguments, and can explain why they were applied to the original situation.

Level	% at this level		What students can typically do at each level
	OECD	Wales	
5	12.6% perform tasks at least at Level 5	5.3% perform tasks at least at Level 5	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 insights pertaining to these situations. They begin to reflect on their work and can formulate and communicate their interpretations and reasoning.
4	30.8% perform tasks at least at Level 4	18.4% perform tasks at least at Level 4	At Level 4, students can work effectively with explicit models on complex, concrete situations that may involve constraints or call for making assumptions. They can select and integrate different representations, including symbolic representations, linking them directly to aspects of real-world situations. Students at this level can use 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, reasoning and actions.
3	54.5% perform tasks at least at Level 3	43.5% perform tasks at least at Level 3	At Level 3, students can execute clearly described procedures, including those that require sequential decisions. Their interpretations are sufficiently sound to be the basis 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	77.0% perform tasks at least at Level 2	71.0% perform tasks at least at Level 2	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	92.0% perform tasks at least at Level 1	90.4% perform tasks at least at Level 1	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 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.

Figure 2.6 Percentage of pupils achieveing each PISA level in the 2012 mathematics assessment



Proficiency levels for mathematics content areas and process categories

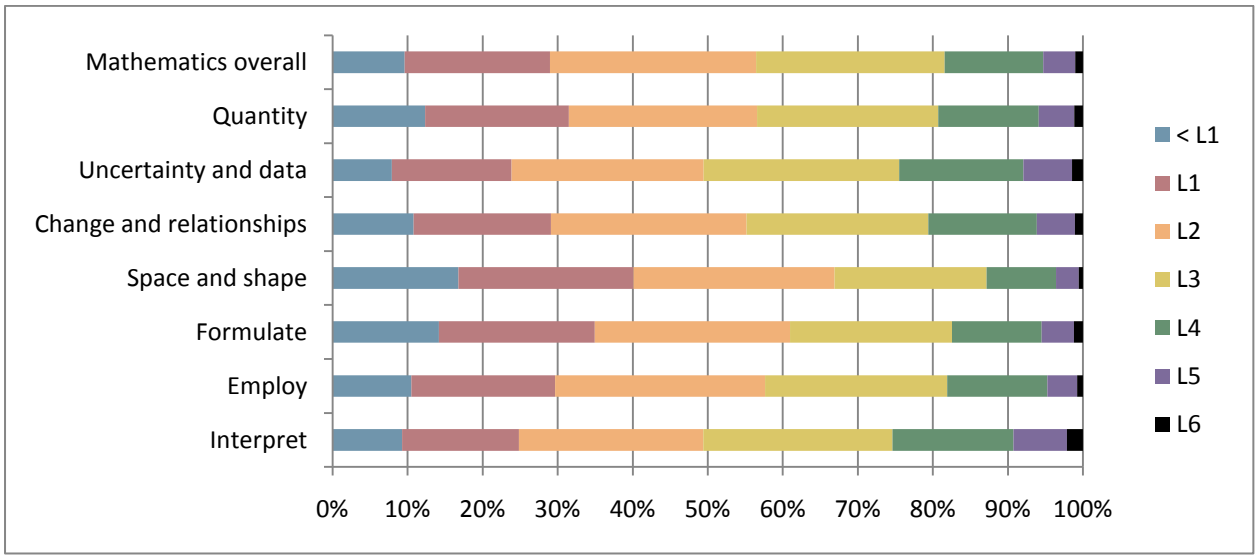
Findings presented earlier show that there was some inconsistency in the performance of pupils in Wales across the mathematical content subscales and the mathematical process subscales. We might expect to see a similar pattern of achievement for each subscale at each proficiency level. Table 2.6 and Figure 2.7 show the percentage of pupils in Wales at each level for each mathematics subscale.

The proficiency distribution reflects that seen for mathematics overall in Wales, that is, that there are slightly higher numbers of pupils at the higher proficiency levels in the *uncertainty and data, change and relationships* and *interpret* subscales. In the *uncertainty and data* subscale, 8.0 per cent of of pupils were at Levels 5 and 6, in the *change and relationships* subscale this figure was 6.2 per cent and in the *interpret* subscale this figure was 9.3 per cent, compared with 5.3 per cent for mathematics overall.

Table 2.6 Percentage of pupils at each level in Wales for each mathematics subscale

Scale	Level 6	Level 5	Level 4	Level 3	Level 2	Level 1	Below Level 1
Mathematics overall	1.0	4.3	13.1	25.1	27.5	19.4	9.6
Quantity	1.2	4.7	13.4	24.1	25.1	19.2	12.3
Uncertainty and data	1.5	6.5	16.5	26.1	25.6	16.0	7.9
Change and relationships	1.1	5.1	14.5	24.3	26.1	18.3	10.8
Space and shape	0.6	3.0	9.2	20.3	26.8	23.3	16.8
Formulate	1.2	4.3	12.0	21.6	26.0	20.8	14.2
Employ	0.8	4.0	13.3	24.3	28.0	19.2	10.5
Interpret	2.2	7.1	16.1	25.2	24.6	15.6	9.3

Figure 2.7 Percentage of pupils at each level in Wales for each mathematics subscale



2.3.3 Comparison with PISA 2006 and 2009

This section compares the distribution of scores in PISA 2012 with those from PISA 2006 and 2009. It is important to note that, for PISA 2006 and 2009, mathematics was a minor domain and as such it is not possible to compare the subscale data obtained in this PISA cycle where mathematics was the main focus.

The proportion of low achieving pupils (pupils achieving Level 1 or below) in Wales has increased since 2006 (22.1 per cent in 2006, 26.2 per cent in 2009 and 29.0 per cent in 2012). For the top two levels combined, the proportion of pupils has decreased since 2006, from 7.2 per cent to 5.3 per cent in 2012. Whereas the OECD average for high-achieving pupils has remained virtually unchanged since 2009. The difference in scores between the lowest and highest percentiles for OECD countries has increased slightly to 301 points in 2012 from 300 points in 2006 and 2009. In Wales, the difference between highest and lowest attainers was very similar in 2006 and 2009. However, in 2012 this difference increased to 281; ten points higher than in 2009. The main reason for this larger difference is that the score of pupils at the lowest percentile has decreased since 2006 (351 in 2006, 336 in 2009 and 329 in 2012). The score achieved by the highest percentile of pupils decreased between 2006 and 2009 but increased slightly in 2012 (621 in 2006, 607 in 2009 and 610 in 2012). This indicates that, in Wales, there is a widening gap between high and low achievers.

2.4 Differences between boys and girls

Of the 64 other participating countries in PISA 2012, 41 had a statistically significant difference in performance in mathematics by gender. In 36 countries this favoured boys and in five (Jordan, Qatar, Thailand, Malaysia and Iceland) it favoured girls (see Appendix B2).

In Wales, there was a significant difference favouring boys. This difference of nine score points between girls and boys was slightly lower than the OECD average of 11 score points. However, Wales had one of the smallest gender differences favouring boys, with 26 comparison countries having larger differences. Among OECD countries, Luxembourg and Chile had the largest difference (25 score points) and among the non-OECD comparison countries the largest difference was in Liechtenstein (23 score points).

The gender difference in Wales was fairly evenly distributed across the subscales for mathematics; there was a significant gender difference on each subscale. The largest gender difference, 13 score points, was found on the *change and relationships* content subscale. There were slightly smaller differences between boys and girls for the other six (content and process) subscales, with the smallest gender difference found on the *uncertainty and data* (content) and *employ* (process) subscales (nine score points).

Among comparison countries there was considerable variation in the pattern of gender differences across the mathematics subscales. In 17 comparison countries, as in Wales, there were significant gender differences on all the subscales, whereas in a number of countries there were significant differences on only one or two of the subscales (for example: the United States, Sweden, Singapore and Israel). In 19 of the comparison countries the largest difference between boys and girls was on the *formulate* subscale. This was also observed in the OECD average, although in Wales, as noted above, this was not the subscale with the largest gender difference. In terms of the other subscales there were no clear patterns in terms of gender differences.

This gender difference does not reflect what is found in other measurements of mathematics attainment in Wales. At Key Stage 4, attainment in the GCSE mathematics qualification (taken by 39,542 pupils in 2013) shows very little gender difference, with 12.7 per cent of boys and 11.3 per cent of girls achieving an A* or A grade (www.jcq.org.uk).

2.4.1 Comparison with PISA 2006 and 2009

This section compares the gender differences found in PISA 2012 with those from PISA 2006 and 2009. However, as mathematics was a minor domain in 2006 and 2009, it is not possible to compare the subscale data obtained in this PISA cycle where mathematics was the main focus.

In 2012, as in 2009 and 2006, boys scored significantly higher than girls. It appears, however, that the gender gap in Wales has decreased between the 2009 and 2012 PISA cycles, from 20 points difference in 2009 to a nine point difference in 2012. This narrowing of the gender gap brings the results for PISA more in line with other assessments, for example GCSE, where there is no significant gender difference in performance. In contrast, the OECD average for gender difference

(favouring boys) remained relatively stable over the last three cycles of PISA (11 points in 2006, 12 points in 2009 and 11 points in 2012).

2.5 Summary

Wales' performance in mathematics is significantly lower than the OECD average and lower than its performance in the last two cycles of the survey (2006 and 2009). The number of countries outperforming Wales has increased; from 22 in 2006, to 35 in 2009, to 38 in 2012. This increase is not only the result of the higher performance of new countries entering the survey (e.g. Shanghai-China, Singapore and Vietnam), but also because of the relative performance in countries that have participated in the last three cycles of PISA.

In terms of the PISA proficiency levels, 71 per cent of pupils in Wales achieved Level 2 or above. This is lower than the OECD average. Wales also has a low percentage of pupils (5.3 per cent) in the top two proficiency levels; this is less than half the OECD average of 12.6 per cent. Only nine comparison countries had a lower percentage of high achieving pupils. In 2012, there was also a small increase in the proportion of low achieving pupils in Wales and a decrease in the proportion of high achieving pupils.

The spread of performance in Wales is narrower than the OECD average; only a small number of comparison countries had narrower score distributions. The difference between the score of pupils at the 5th percentile and the score of pupils at the 95th percentile was 281 score points (the OECD average was 301 score points). Only seven countries had a smaller difference between their highest and lowest attainers.

In terms of gender differences, boys performed significantly better than girls (nine points difference). This was the case in nearly two-thirds of the participating countries. Wales had one of the smallest gender differences and the gap has decreased since 2009. This narrowing gap brings the results for PISA in line with other assessments, for example GCSE, where there is no significant gender difference in performance. There does not appear to be a clear relationship between a country's mean score and the existence of a high or low gender difference in performance. For example, whilst Liechtenstein and Chile had two of the biggest gender differences (23 and 25 score points respectively), Liechtenstein outperformed Wales whereas Chile performed significantly less well than Wales.

3 Pupils and mathematics

Chapter outline

This chapter reports on pupils' attitudes to school and learning, their drive and motivation for mathematics-related tasks, and their self-beliefs and participation in mathematics. In addition, aspects of mathematics lessons are discussed. The chapter begins by looking at the link between mathematics scores and pupils' backgrounds.

Key findings

- On average, pupils in Wales have a socio-economic status that is higher than the OECD average.
- Socio-economic status is associated with attainment in mathematics in Wales and across the OECD, with lower status related to lower mean scores.
- For Wales, ten per cent of the variance in mathematics scores can be explained by socio-economic background, which is lower than the OECD average of 15 per cent.
- Pupils in Wales report a high sense of belonging and satisfaction with school, similar to the OECD average.
- Pupils in Wales, similar to the OECD average, regard school as useful and worthwhile.
- With regard to mathematics in particular, pupils report only moderate interest in learning mathematics, but recognise that it is useful.
- Pupils in Wales show greater motivation to learn mathematics than the OECD average.
- Pupils report a high amount of control over their ability to succeed in mathematics and a high level of conscientiousness towards learning mathematics. Pupils in Wales generally report a greater level of conscientiousness for mathematics tasks than the OECD average.
- Pupils in Wales report that they are confident in their ability to perform mathematics tasks and have low anxiety about mathematics.
- Pupils in Wales report a higher level of support from their mathematics teachers than that found for the OECD on average.
- Pupils in Wales report that a wide variety of tasks and strategies are used by their teachers in mathematics lessons.

3.1 How do mathematics scores link with pupils' backgrounds?

This section reports on interactions between socio-economic background and mathematics scores. Socio-economic background in PISA is reported as the ESCS Index (economic, social and cultural status). This is based on pupils' responses to questions about their parents' backgrounds and education and possessions in their homes. The index is set to a mean of zero across OECD countries, with a standard deviation of one.

Wales' mean score on the ESCS Index was 0.19 indicating that, on average, pupils in the PISA sample in Wales have a higher socio-economic status than the average across OECD countries. In general there was a gap in achievement in OECD countries between those who are highest and those who are lowest on the ESCS Index, and this was also the case in Wales. As shown in Table

3.1, those in the bottom quarter of the ESCS Index have a mathematics score of 436, those in the second quarter 461, in the third quarter 473 and in the top quarter 512. This compares with the overall mean score for Wales of 468. The difference between the top and bottom quarters is 76 points, which represents almost two years of schooling. Appendix E shows the Index for comparator countries.

Table 3.1 Socio-economic background and mathematics performance in Wales and the OECD

	PISA index of economic, social and cultural status (ESCS)		Mean scores on the mathematics scale, by national quarters of the ESCS index				Score point difference in mathematics associated with one unit increase in the ESCS	Percentage of explained variance in mathematics performance
	Mean index for all students	Mathematics overall mean score	Bottom quarter	Second quarter	Third quarter	Top quarter		
Wales	0.19	468	436	461	473	512	35	10.4
OECD average	0	494	452	482	506	542	39	14.6

The change in score for each unit of the ESCS Index in Wales is 35 points on the PISA mathematics scale. This means that, for a change of one standard deviation on the ESCS Index, there will be a predicted difference in score of 35 points. This is lower than the OECD average of 39 points and suggests that socio-economic background has a smaller effect in Wales than on average in OECD countries. Only 11 OECD countries had a smaller change in score than Wales (when looking at values not rounded to the nearest whole number).

However, to gain a true picture of interactions between mathematics score and the ESCS Index, it is also necessary to look at the amount of variance in scores which can be explained by socio-economic background. This shows the extent to which the scores of pupils in each country are predicted by socio-economic background. In the case of Wales, ten per cent of the variance in scores can be explained by socio-economic background. The OECD average is 15 per cent. In the United States, where the change in score per unit of the ESCS was the same as that in Wales, the amount of variance explained was 15 per cent. This means that disadvantaged pupils in Wales have more chance of performing as well as their more advantaged peers than their counterparts in the United States. Among OECD countries there are only eight countries where the amount of explained variance was lower than that for Wales (when looking at values not rounded to the nearest whole number). This suggests that the education system in Wales is amongst those which are successful at overcoming the effects of socio-economic background. The country in which the most disadvantaged pupils have the best chance of succeeding in spite of their background is Macao-China, where the change in the mathematics score per unit is 17 and the amount of variance explained is three per cent.

The performance gap between the most advantaged and disadvantaged pupils is relatively low in Wales, compared with other OECD countries, and pupils in Wales are relatively well able to overcome the disadvantages of their background.

3.2 Pupils' attitudes to school and learning

Pupils in Wales, and across the OECD on average, reported a high sense of belonging and satisfaction with school, as shown in Table 3.2. Pupils might be expected to be able to achieve more if they feel comfortable in their learning environment. The proportions of responses were very similar for Wales and the OECD average, with the exception of the statement "Things are ideal in my school"; 73 per cent of pupils in Wales agreed or strongly agreed with this compared with 61 per cent for the OECD average.

Table 3.2 Pupils' sense of belonging

Thinking about your school, to what extent do you agree with the following statements?		
	Wales	OECD average
	agree/strongly agree	
I make friends easily at school.	88%	87%
I feel like I belong at school.	78%	81%
Other students seem to like me.	92%	89%
I feel happy at school.	84%	80%
Things are ideal in my school.	73%	61%
I am satisfied with my school.	84%	78%
	disagree/strongly disagree	
I feel like an outsider (or left out of things) at school.	89%	89%
I feel awkward and out of place in my school.	87%	88%
I feel lonely at school.	93%	91%

Pupils were asked two further questions about their attitudes towards school: one focused on learning outcomes (reported in Table 3.3), the other on learning activities (reported in Table 3.4). Attitudes are believed to be important because they can predict pupils' intentions, which can then predict behaviours. However, the international PISA report (Volume 3, Chapter 2, OECD, 2013) found that pupils' attitudes towards school were not highly associated with mathematics performance. Pupils in Wales, and on average across the OECD, reported that they regarded school as useful, with the overwhelming majority of pupils in Wales agreeing or strongly agreeing that "Trying hard at school is important" (98 per cent; higher than the OECD average of 93 per cent). In addition, 92 per cent of pupils in Wales disagreed or strongly disagreed with the statement "School has been a waste of time" (slightly higher than the OECD average of 88 per cent).

Table 3.3 Pupils' attitudes towards school: learning outcomes

Thinking about what you have learned at school, to what extent do you agree with the following statements?		
	Wales	OECD average
	disagree/strongly disagree	
School has done little to prepare me for adult life when I leave school.	67%	71%
School has been a waste of time.	92%	88%
	agree/strongly agree	
School has helped give me confidence to make decisions.	83%	77%
School has taught me things which could be useful in a job.	87%	87%

Table 3.4 Pupils' attitudes towards school: learning activities

Thinking about your school, to what extent do you agree with the following statements?		
	agree/strongly agree	
	Wales	OECD average
Trying hard at school will help me get a good job.	97%	91%
Trying hard at school will help me get into a good university.	97%	94%
I enjoy receiving good marks.	98%	95%
Trying hard at school is important.	98%	93%

3.3 Pupils' attitudes to learning mathematics

Pupils' attitudes towards mathematics in particular were investigated in a series of questions looking at motivation, beliefs about success and conscientiousness.

Motivation to learn mathematics was measured on two scales in the Student Questionnaire, looking at *intrinsic motivation* to learn mathematics (based on a pupil's interest and enjoyment) and *instrumental motivation* (where learning mathematics is seen as a useful activity).

Table 3.5 shows the percentages of pupils in Wales, and on average across OECD countries, who agreed or strongly agreed with the statements presented as part of this question. Pupils did not report a particularly high level of intrinsic motivation to learn mathematics and there is little difference between the proportions of pupils in Wales and the OECD average, apart from a greater proportion of pupils in Wales reporting that they look forward to their mathematics lessons (47 per cent compared with the OECD average of 36 per cent).

While pupils are, on average, not particularly interested in learning mathematics, they show a greater level of instrumental motivation to learn mathematics, apparently recognising that it is useful. For pupils in Wales and across the OECD on average there was stronger agreement with the statements relating to instrumental motivation than intrinsic motivation. In addition, pupils in Wales showed greater instrumental motivation to learn mathematics than pupils across the OECD on average. For example, 93 per cent of pupils in Wales said that learning mathematics is worthwhile because it will improve career chances, compared with the OECD average of 78 per cent.

Table 3.5 Pupils' motivation to learn mathematics

Thinking about your views on mathematics, to what extent do you agree with the following statements?		
	agree/strongly agree	
	Wales	OECD average
Intrinsic motivation to learn mathematics		
I enjoy reading about mathematics.	30%	31%
I look forward to my mathematics lessons.	47%	36%
I do mathematics because I enjoy it.	39%	38%
I am interested in the things I learn in mathematics.	53%	53%
Instrumental motivation to learn mathematics		
Making an effort in mathematics is worth it because it will help me in the work that I want to do later on.	92%	75%
Learning mathematics is worthwhile for me because it will improve my career chances.	93%	78%
Mathematics is an important subject for me because I need it for what I want to study later on.	76%	66%
I will learn many things in mathematics that will help me get a job.	85%	70%

A large proportion of pupils reported that learning mathematics was worthwhile because it was important. They also reported feeling high levels of control over their ability to succeed in mathematics. As shown in Table 3.6, pupils in Wales reported a high degree of perceived control of success in mathematics, similar to the OECD average. Almost all pupils said that with sufficient effort they could succeed in mathematics (96 per cent for Wales, slightly higher than the OECD average of 92 per cent). The international PISA report (Volume 3, Chapter 3, OECD, 2013) found that pupils from all participating countries who strongly agreed that they can succeed in mathematics if they put in enough effort performed better on the PISA mathematics assessment by 32 score points than those pupils who did not feel such a strong belief in their ability to succeed in mathematics. This link between perceived control of success in mathematics and performance on the PISA mathematics assessment was also found to be the case for the mathematics performance of pupils in Wales.

Table 3.6 Pupils' perceived control of success in mathematics

Thinking about your mathematics lessons, to what extent do you agree with the following statements?		
	agree/strongly agree	
	Wales	OECD average
If I put in enough effort I can succeed in mathematics.	96%	92%
Whether or not I do well in mathematics is completely up to me.	84%	83%
If I wanted to, I could do well in mathematics.	86%	83%
	disagree/strongly disagree	
Family demands or other problems prevent me from putting a lot of time into my mathematics work.	72%	73%
If I had different teachers, I would try harder in mathematics.	72%	64%
I do badly in mathematics whether or not I study for my exams.	73%	73%

One question asked pupils to imagine that they had recently been doing badly on mathematics tests, and to say whether they were likely to blame this on any of a series of factors. As reported above, pupils felt a high level of control over their ability to succeed in mathematics and, as shown in Table 3.7, pupils in Wales were generally less likely to attribute blame for failing to succeed than pupils across the OECD on average. While there was little difference in the proportions agreeing with the statement which placed the blame on themselves, "I'm not very good at solving mathematics problems" (53 per cent in Wales and 58 per cent for the OECD average), pupils in Wales were less likely to attribute the failing to external factors such as hard course materials (58 per cent compared with the OECD average of 71 per cent).

Table 3.7 Pupils' self-responsibility for failing in mathematics

Imagine you are a student in the following situation: *Each week, your mathematics teacher gives a short test. Recently you have done badly on these tests. Today you are trying to figure out why.* **How likely are you to have these thoughts or feelings in this situation?**		
	agree/strongly agree	
	Wales	OECD average
I'm not very good at solving mathematics problems.	53%	58%
My teacher did not explain the concepts well this week.	39%	48%
This week I made bad guesses on the test.	41%	46%
Sometimes the course material is too hard.	58%	71%
The teacher did not get students interested in the material.	41%	53%
Sometimes I am just unlucky.	43%	49%

Pupils reported a high level of conscientiousness towards mathematics-related tasks. Pupils in Wales generally reported a greater level of conscientiousness towards mathematics-related tasks than pupils across the OECD on average. In particular, pupils in Wales were more likely to report

putting effort into their work for mathematics homework and for mathematics tests. As shown in Table 3.8, 73 per cent of pupils in Wales agreed or strongly agreed that “I work hard on my mathematics homework” compared with 56 per cent for the OECD average, and 70 per cent agreed or strongly agreed that “I study hard for mathematics tests” compared with 52 per cent for the OECD average.

Table 3.8 Pupils’ conscientiousness towards mathematics-related tasks

Thinking about the mathematics you do for school, to what extent do you agree with the following statements?		
	agree/strongly agree	
	Wales	OECD average
I finish my homework in time for mathematics lessons.	80%	68%
I work hard on my mathematics homework.	73%	56%
I am prepared for my mathematics exams.	74%	67%
I study hard for mathematics tests.	70%	52%
I keep studying until I understand mathematics material.	67%	60%
I pay attention in mathematics lessons.	90%	77%
I listen in mathematics lessons.	92%	83%
I avoid distractions when I am studying mathematics.	56%	58%
I keep my mathematics work well organised.	70%	59%

A related question, relating to perseverance with tasks, showed a slightly less positive picture of pupils’ attitudes. As shown in Table 3.9, pupils were asked how well a set of statements (this time not specifically related to mathematics) described themselves. Pupils reported a lower level of commitment to achieving tasks in this question than the previous one (see Table 3.8) and pupils in Wales reported a similar level of perseverance to the OECD average. The international PISA report (Volume 3, Chapter 3, OECD, 2013) found that, in most countries and economies including Wales, the association between pupils’ perseverance and mathematics performance was relatively strong.

Table 3.9 Pupils’ perseverance

How well does each of the following statements describe you?		
	very much or mostly like me	
	Wales	OECD average
When confronted with a problem, I give up easily.	53%	56%
I put off difficult problems.	42%	37%
I remain interested in the tasks that I start.	49%	49%
I continue working on tasks until everything is perfect.	46%	44%
When confronted with a problem, I do more than what is expected of me.	35%	34%

In addition to investigating pupils' conscientiousness and perseverance, the Student Questionnaire asked pupils about their willingness to tackle problems. This openness to problem solving is considered an important characteristic to have alongside proficiency in academic subjects. Generally, pupils showed a moderate amount of openness to problem solving, with half or more agreeing or strongly agreeing with four of the five statements, as shown in Table 3.10. The statement, "I like to solve complex problems" was the one with which the lowest proportion of pupils agreed, both in Wales and across the OECD.

The proportions of pupils agreeing or strongly agreeing with statements about their openness to problem solving in Wales were similar to the OECD averages. The largest differences were for the two statements "I am quick to understand things" and "I can easily link facts together". Just over half of pupils in Wales agreed or strongly agreed with each of these statements (51 per cent) compared with 57 per cent for the OECD average. The international PISA report (Volume 3, Chapter 3, OECD, 2013) found that, in most countries and economies, there is a strong association between pupils' openness to problem solving (as measured by this group of statements) and mathematics performance and, for Wales compared with other countries, the association is one of the strongest.

Table 3.10 Pupils' openness to problem solving

How well does each of the following statements describe you?		
	agree/strongly agree	
	Wales	OECD average
I can handle a lot of information.	50%	53%
I am quick to understand things.	51%	57%
I seek explanations for things.	57%	61%
I can easily link facts together.	51%	57%
I like to solve complex problems.	32%	33%

Pupils' attitudes to mathematics were further explored by questions looking at the influence of friends and parents, self-confidence in tackling mathematics, anxiety about mathematics and mathematics activities done at home and school.

The influence of parents and friends on pupils' attitudes towards mathematics is expected to impact on their behaviour, where positive attitudes and behaviours will be more likely to result from a social environment which promotes mathematics and the study of mathematics. Table 3.11 shows that high proportions of pupils reported that their parents believe in the importance of mathematics and that 56 per cent of pupils believe their parents like mathematics. Compared with the OECD average, a greater proportion of pupils in Wales agreed that "My parents believe that mathematics is important for my career" (90 per cent compared with 80 per cent).

Another difference between Wales and the OECD is apparent for the proportions of pupils reporting that their friends do well and work hard at mathematics, with 84 per cent of pupils in Wales saying that most of their friends do well (compared with the OECD average of 60 per cent), and 74 per cent saying that most of their friends work hard at mathematics (the OECD average is 51 per cent). The proportion of pupils reporting that their friends enjoy taking mathematics tests is

similarly low for Wales and the OECD on average (12 and 13 per cent respectively). This may be influenced by the fact that pupils answered this question in the Student Questionnaire just after finishing the PISA assessment.

Table 3.11 Pupils' subjective norms in mathematics

Thinking about how people important to you view mathematics, how strongly do you agree with the following statements?		
	agree/strongly agree	
	Wales	OECD average
Most of my friends do well in mathematics.	84%	60%
Most of my friends work hard at mathematics.	74%	51%
Most of my friends enjoy taking mathematics tests.	12%	13%
My parents believe it's important for me to study mathematics.	97%	90%
My parents believe that mathematics is important for my career.	90%	80%
My parents like mathematics.	56%	58%

A question asking pupils how confident they felt about having to do specific mathematical tasks was intended to measure pupils' self-efficacy in mathematics. It is believed that pupils who are not confident of their ability are at risk of underperforming, if their lack of confidence does not reflect a lack of ability. Generally pupils showed a high level of confidence in their ability to perform the tasks, as shown in Table 3.12. For two of the tasks, the proportions of pupils in Wales saying they were confident or very confident were slightly higher than the OECD averages, and for six tasks the proportions were slightly lower. The largest difference was seen for the task "Finding the actual distance between two places on a map with a 1:10,000 scale"; 43 per cent of pupils in Wales said they were confident or very confident about this, compared with the OECD average of 56 per cent.

Table 3.12 Pupils' self-efficacy in mathematics

How confident do you feel about having to do the following mathematics tasks?		
	confident/very confident	
	Wales	OECD average
Using a train timetable to work out how long it would take to get from one place to another.	82%	81%
Calculating how much cheaper a TV would be after a 30% discount.	76%	80%
Calculating how many square metres of tiles you need to cover a floor.	64%	68%
Understanding graphs presented in newspapers.	86%	80%
Solving an equation like $3x + 5 = 17$.	82%	85%
Finding the actual distance between two places on a map with a 1:10,000 scale.	43%	56%
Solving an equation like $2(x + 3) = (x + 3)(x - 3)$.	65%	73%
Calculating the petrol consumption rate of a car.	49%	56%

In addition to reporting that they were generally confident in their ability to perform mathematics tasks, pupils also showed fairly positive mathematics self-concepts and low anxiety about mathematics. As shown in Table 3.13, pupils in Wales reported greater belief in their abilities in mathematics than was the case for the OECD on average for three of the five statements. In particular, 69 per cent of pupils in Wales reported that they get good marks in mathematics compared with 59 per cent for the OECD average. A greater proportion also reported that they understand even the most difficult mathematics classwork (47 per cent in Wales compared with 37 per cent on average across the OECD).

Pupils in Wales reported a similar level of anxiety about learning mathematics as was seen across the OECD on average. However, for three of the five statements related to anxiety about learning mathematics, pupils in Wales showed less anxiety. A lower proportion than the OECD average reported that they often worry that mathematics lessons will be difficult (50 per cent compared with 59 per cent for the OECD) or that they feel helpless when doing a mathematics problem (20 per cent compared with 30 per cent for the OECD).

Table 3.13 Pupils' self-concept in mathematics alongside pupils' mathematics anxiety

Thinking about studying mathematics, to what extent do you agree with the following statements?		
	agree/strongly agree	
Self-concept in mathematics	Wales	OECD average
I am just not good at mathematics. *(figures for disagree/strongly disagree)*	62%	57%
I get good marks in mathematics.	69%	59%
I learn mathematics quickly.	52%	52%
I have always believed that mathematics is one of my best subjects.	36%	38%
In my mathematics class, I understand even the most difficult work.	47%	37%
Mathematics anxiety		
I often worry that it will be difficult for me in mathematics classes.	50%	59%
I get very tense when I have to do mathematics homework.	33%	33%
I get very nervous doing mathematics problems.	30%	31%
I feel helpless when doing a mathematics problem.	20%	30%
I worry that I will get poor marks in mathematics.	61%	61%

When asked about mathematics behaviour at school and outside of school, pupils generally reported that they did not perform tasks relating to mathematics very often. The most common behaviour was helping friends with mathematics, which 28 per cent of pupils in Wales did often, almost always or always (compared with 25 per cent for the OECD average). As shown in Table 3.14, there was little difference between the proportions of pupils in Wales and on average across the OECD who reported that they frequently did mathematics-related tasks.

Table 3.14 Pupils' mathematics behaviours

How often do you do the following at school and outside of school?		
	often, almost always or always	
	Wales	OECD average
I talk about mathematics problems with my friends.	16%	18%
I help my friends with mathematics.	28%	25%
I do mathematics as an extra-curricular activity.	12%	15%
I take part in mathematics competitions.	4%	7%
I do mathematics more than 2 hours a day outside of school.	6%	9%
I play chess.	8%	12%
I program computers.	10%	15%
I participate in a mathematics club.	4%	4%

3.4 Pupils' experience of learning mathematics

In the Student Questionnaire, pupils were asked about how supportive their mathematics teachers were in lessons. Table 3.15 shows that a large proportion of pupils said that teachers were supportive in most or all lessons. The proportions of pupils in Wales were greater than the OECD average for all statements. The largest difference was for the statement "The teacher helps students with their learning", which 88 per cent of pupils in Wales said happened in most or all lessons, compared with 72 per cent of pupils across the OECD on average. The lowest proportion in Wales was for "The teacher gives students an opportunity to express opinions" which two-thirds of pupils said happened in most or all lessons (similar to the OECD average).

Table 3.15 Teacher support in mathematics classes

How often do these things happen in your mathematics lessons?		
	most/all lessons	
	Wales	OECD average
The teacher shows an interest in every student's learning.	72%	63%
The teacher gives extra help when students need it.	84%	72%
The teacher helps students with their learning.	88%	72%
The teacher continues teaching until the students understand.	78%	66%
The teacher gives students an opportunity to express opinions.	67%	66%

Pupils were also were asked how often teachers ask pupils to tackle mathematics problems in their lessons. Responses are reported in Table 3.16. These statements have been described as reflecting different types of 'cognitive activation' which pupils are asked to use. For all of the approaches mentioned in the question, greater proportions of pupils in Wales, compared with the OECD average, reported that they occurred often, almost always or always in their mathematics lessons. The largest difference was for the statement "The teacher helps us to learn from mistakes

we have made", which three-quarters of pupils in Wales (75 per cent) said happened frequently, compared with just under three-fifths of pupils across the OECD on average (59 per cent). A similar difference was found for the statement "The teacher gives us problems that require us to think for an extended time". The approach which the lowest proportion of pupils in Wales reported as common practice was "The teacher asks us to decide on our own procedures for solving complex problems"; fewer than half of pupils (45 per cent) said this happened often, almost always or always (the OECD average was 41 per cent).

Table 3.16 Pupils' cognitive activation in mathematics lessons

Thinking about the mathematics teacher who taught your last mathematics lesson, how often does he or she do each of the following?		
	often, almost always or always	
	Wales	OECD average
The teacher asks questions that make us reflect on the problem.	65%	59%
The teacher gives us problems that require us to think for an extended time.	67%	52%
The teacher asks us to decide on our own procedures for solving complex problems.	45%	41%
The teacher presents problems which have no immediately obvious method for finding the answer.	56%	46%
The teacher presents problems in different contexts so that students know whether they have understood the concepts.	65%	58%
The teacher helps us to learn from mistakes we have made.	75%	59%
The teacher asks us to explain how we have solved a problem.	76%	69%
The teacher presents problems that require students to apply what they have learned to new contexts.	67%	61%
The teacher gives us problems that can be solved in several different ways.	65%	59%

A similar question asked pupils about the instructional strategies used by their mathematics teachers. These strategies represent the three categories of 'structuring', 'student orientation' and 'enhanced activities'. As shown in Table 3.17, there are considerable differences between the proportions of pupils reporting that the various strategies are used in most or all lessons, something which might be expected due to the nature of the work appropriate to each strategy. For instance, 86 per cent of pupils in Wales reported that "The teacher tells us what we have to learn" in most or all lessons; this is something that would be expected to feature in most lessons, unlike pupils helping to plan classroom activities or topics (reported by nine per cent of pupils), which might be expected to happen infrequently.

Comparing the findings for Wales with the OECD, the majority of instructional strategies are reported as more common in Wales than across the OECD. In particular, two statements relating to feedback on performance in mathematics were reported as more common in Wales than on average across the OECD . These were (with percentages in Wales and the OECD average, respectively): "The teacher tells me what I need to do to become better in mathematics" (58 per cent, 46 per cent); and "The teacher gives me feedback on my strengths and weaknesses in

mathematics" (35 per cent, 26 per cent). The lowest proportion for Wales was for the statement "The teacher asks us to help plan classroom activities or topics" which only nine per cent of pupils said happened in most or all lessons. This statement showed the biggest negative difference with the OECD average, which was eight per cent higher at 17 per cent.

Table 3.17 Teaching practices in mathematics: instructional strategies

How often do these things happen in your mathematics lessons?		
	most or all lessons	
	Wales	OECD average
The teacher sets clear goals for our learning.	69%	68%
The teacher asks me or my classmates to present our thinking or reasoning at some length.	54%	55%
The teacher gives different work to classmates who have difficulties learning and/or to those who can advance faster.	22%	29%
The teacher sets projects that require at least one week to complete.	23%	16%
The teacher tells me about how well I am doing in my mathematics class.	39%	31%
The teacher asks questions to check whether we have understood what was taught.	78%	70%
The teacher puts us in small groups to come up with joint solutions to a problem or task.	16%	22%
At the beginning of a lesson, the teacher presents a short summary of the previous lesson.	44%	40%
The teacher asks us to help plan classroom activities or topics.	9%	17%
The teacher gives me feedback on my strengths and weaknesses in mathematics.	35%	26%
The teacher tells us what is expected of us when we get a test or assignment.	66%	60%
The teacher tells us what we have to learn.	86%	79%
The teacher tells me what I need to do to become better in mathematics.	58%	46%

3.5 Summary

Pupils in Wales reported a high sense of belonging and satisfaction with school and an understanding that it was useful, showing a similar level of satisfaction as pupils across the OECD on average. Pupils in Wales showed a slightly higher level of interest and enjoyment in learning mathematics than the OECD average. For both groups, the motivation to learn mathematics was less to do with enjoyment and more to do with regarding mathematics as a useful activity. Pupils in Wales also reported feeling high levels of control over their ability to succeed in mathematics.

Pupils reported a high level of conscientiousness towards mathematics-related tasks, generally greater than the OECD average. The majority of pupils in Wales saying that they worked hard and sensibly in order to learn mathematics.

Pupils in Wales reported that their parents believe in the importance of mathematics, possibly reflecting home environments which encourage the study of mathematics. This was slightly higher

than the OECD averge. Generally, pupils in Wales showed a high level of confidence in their ability to perform mathematical tasks, and low levels of anxiety about learning mathematics.

Pupils in Wales reported that their teachers asked them to approach mathematics learning in a wide variety of ways. They were more likely than pupils across the OECD on average to report that their mathematics teachers were helpful and supportive.

In Wales, socio-economic background had a relatively low connection with mathematics scores compared with other OECD countries. Many pupils in Wales are able to overcome disadvantage and achieve scores higher than predicted by their background. In other OECD countries on average, it is more difficult than in Wales for disadvantaged pupils to reach high levels of attainment.

4 Science

Chapter outline

This chapter explores attainment in science. It draws on findings outlined in the international report (OECD, 2013) and places outcomes for Wales in the context of those findings.

Key findings

- Wales performed significantly below the OECD average in science and 25 countries significantly outperformed Wales.
- The achievement of pupils in Wales has declined in both PISA surveys since 2006 and the difference in performance in PISA 2012 is significantly below that of 2006. Wales has shown particular decline in the scores of the highest achievers since 2006. There are six comparator countries that have also significantly declined since 2006.
- The difference between score points of the lowest scoring pupils and highest scoring pupils in Wales was similar to the OECD average, however the proportion of pupils in Wales at the highest levels was lower than the OECD average.

4.1 Comparison countries

As with mathematics, the comparator countries reported here include OECD countries, EU countries and other countries with relatively high scores. Since countries with very low scores are not so relevant for comparison purposes, those with a mean score for science of less than 430 (14 countries) have been omitted from tables unless they are in the OECD or EU. This results in a comparison group of 50 countries, as shown in Table 4.1.

Table 4.1 Countries compared with Wales

Australia	France*	Luxembourg*	*Singapore*
Austria*	Germany*	*Macao-China*	Slovak Republic*
Belgium*	Greece*	Mexico	Slovenia*
*Bulgaria**	*Hong Kong-China*	Netherlands*	Spain*
Canada	Hungary*	New Zealand	Sweden*
Chile	Iceland	Norway	Switzerland
Chinese Taipei	Israel	Poland*	*Thailand*
*Croatia**	Italy*	Portugal*	Turkey
*Cyprus**	Japan	Republic of Ireland*	*United Arab Emirates*
Czech Republic*	Korea	*Romania**	United States
Denmark*	*Latvia**	*Russian Federation*	*Vietnam*
Estonia*	*Liechtenstein*	*Serbia*	
Finland*	*Lithuania**	*Shanghai-China*	

OECD countries (not italicised) *Countries not in OECD (italicised)* *EU countries

In addition to the countries listed above, tables and figures in Appendix C include the data for all four constituent parts of the United Kingdom.

Outcomes for the United Kingdom as a whole are presented in the international report (OECD, 2013) and in the appendices that accompany this chapter (Appendix C). Outcomes for Wales (and the other three constituent parts of the UK) are derived from the 'sub-national' level analysis carried out by the international consortium, as well as from additional analysis carried out by NFER using the international dataset. Comparisons between the four constituent parts of the UK are provided in Chapter 7.

Interpreting differences between countries

As for mathematics, it is important to know what can reasonably be concluded from the PISA data and which interpretations would be going beyond what can be reliably supported by the results. This section outlines some points that need to be kept in mind while reading this chapter.

Sources of uncertainty

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

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

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

Interpreting rank order

Because of the areas of uncertainty described above, interpretations of very small differences between two sets of results are often meaningless. Were they to be measured again it could well be that the results would turn out the other way round. For this reason, this chapter focuses mainly on *statistically significant* differences between mean scores rather than the simple rank order of countries. Statistically significant differences are unlikely to have been caused by random fluctuations due to sampling or measurement error.

Where statistically significant differences between countries are found, these may be the result of a great number of factors. The data for some of these factors were not collected in the PISA survey. Therefore, the PISA survey is only able to explain the reasons for differences between countries to a limited extent. For example, differences in school systems and educational

experiences in different countries could play a part, but so could a wide range of different out-of-school experiences. It is important to bear this in mind while reading this report.

4.2 Scores in Wales

Pupils in Wales achieved a mean score of 491 for science, significantly below the OECD average of 501.

Internationally, 25 countries performed at a level significantly higher than Wales. In 12 countries, science attainment was not significantly different from that of Wales, while the remaining 27 out of a total of 64 countries performed significantly less well. Table 4.2 below shows the countries which significantly outperformed Wales. Table 4.3 shows the countries whose performance was not significantly different from that of Wales, while Table 4.4 shows the comparison countries which were significantly lower. (See the box above on interpreting differences between countries for an explanation of how statistical significance should be interpreted in this report.)

Of the 25 countries with mean scores significantly above Wales, 12 are EU members. Nine EU countries did not perform significantly differently from Wales and only five performed less well. Among OECD countries, 17 outperformed Wales, whilst nine performed similarly and seven performed less well. In addition, of the 25 countries with mean scores in science that are significantly higher than Wales', three are English speaking (Republic of Ireland, Australia and New Zealand) and one, like Wales, has a substantial number of English speakers (Canada). Two other countries (Hong Kong-China and Singapore) have strong historical links with the education system of the UK. The United States performs similarly to Wales.

Wales' mean score in science has significantly declined since 2006, as has the the OECD average (by 3 score points). In 2006, Wales' mean score was 505 and not significantly different from the OECD average. In 2009, Wales' mean score was 496 and not significantly different from the OECD average. In 2012, Wales' mean score fell again to 491 and was significantly below the OECD average score. Therefore, Wales has shown a decline in mean score in both PISA cycles since 2006, but this difference is significant only when comparing scores between PISA 2012 and 2006. Since 2006, the number of countries with mean scores significantly above Wales has increased from 12 to 25. Although this is partly due to new high performing participant countries in the survey, such as Shanghai-China and Singapore in PISA 2009 and Vietnam in PISA 2012, it is mainly due to a decline in performance in Wales whilst the scores of other countries have remained stable or have shown improvement. Six comparator countries have shown a significant decline since 2006: these are Sweden, Finland, the Slovak Republic, New Zealand, Iceland and Canada (see Appendix C6 for further details).

More information can be found in Appendix C1, which summarises significant differences in attainment between Wales and the comparison group countries, while Appendix C2 gives mean scores with standard errors for these countries. Appendix C6 shows how the performance of participating countries has changed since 2006.

Table 4.2 Countries outperforming Wales in science (significant differences)

Country	Mean score		Country	Mean score	
Shanghai-China	580		Netherlands*	522	
Hong Kong-China	555		Republic of Ireland*	522	^
Singapore	551	^	Australia	521	
Japan	547		*Macao-China*	521	^
Finland*	545	v	New Zealand	516	v
Estonia*	541	^	Switzerland	515	
Korea	538		Slovenia*	514	
Vietnam	528		Czech Republic*	508	
Poland*	526	^	Austria*	506	
Canada	525		Belgium*	505	
Liechtenstein	525		*Latvia**	502	
Germany*	524		France*	499	
Chinese Taipei	523				

OECD countries (not italicised) *Countries not in OECD (italicised)* *EU countries ^ v Indicates a significant change since PISA 2009

Table 4.3 Countries not significantly different from Wales in science

Country	Mean score		Country	Mean score	
Denmark*	498		*Croatia**	491	
United States	497		Luxembourg*	491	^
Spain*	496	^	**Wales**	**491**	
*Lithuania**	496		Portugal*	489	
Norway	495		*Russian Federation*	486	
Hungary*	494		Sweden*	485	v
Italy*	494				

OECD countries (not italicised) *Countries not in OECD (italicised)* *EU countries ^ v Indicates a significant change since PISA 2009

Table 4.4 Countries significantly below Wales in science

Country	Mean score	Country	Mean score
Iceland	478 ∨	Chile	445
Slovak Republic*	471 ∨	*Serbia*	445
Israel	470 ∧	*Thailand*	444 ∧
Greece*	467	*Romania**	439 ∧
Turkey	463	*Cyprus**	438
United Arab Emirates	448	Mexico	415
*Bulgaria**	446	*plus 14 other countries*	

OECD countries (not italicised) *Countries not in OECD (italicised)* *EU countries ∧ ∨ Indicates a significant change since PISA 2009

4.3 Differences between highest and lowest attainers

It is important for teaching and learning purposes to know the spread of attainment between the highest and lowest scoring pupils. Countries with similar mean scores may have differences in the numbers of high or low attainers. A country with a wide spread of attainment may have a long tail of underachievement as well as pupils who are achieving at the highest levels. A country with a lower spread may have fewer very high achievers but may also have fewer underachievers, indicating greater social equality.

The first way in which the spread of performance in each country can be examined is by looking at the distribution of scores. Appendix C2 shows the average science score of pupils at each percentile and the size of the difference between the highest and lowest attainers (at the 5th and 95th percentiles) in each country. The 5th percentile is the score at which five per cent of pupils score lower, while the 95th percentile is the score at which five per cent score higher. This is a better measure for comparing countries than using the lowest and highest attaining pupils as such a comparison may be affected by a small number of pupils in a country with unusually high or low scores.

The score of pupils in Wales at the 5th percentile was 334 while the score of those at the 95th percentile was 639, a difference of 305 score points. This was similar to the OECD average difference of 304 score points. Twenty-three countries had a wider distribution than Wales; all but three were comparison group countries.

The second way of examining the spread of attainment is by looking at Wales' performance at each of the PISA proficiency levels. The PISA proficiency levels are devised by the PISA Consortium and are not linked to National Curriculum levels in Wales. PISA science attainment is described in terms of six levels of achievement. (See Appendix C3 for a full description of typical performance at each of these six levels.) In all participating countries there were some pupils at or below the lowest level of achievement (Level 1), while in most countries at least some pupils achieved the highest level (Level 6). See Appendices C4 and C5 for details.

In Wales, 5.2 per cent of pupils scored below PISA Level 1 in science. This was similar to the OECD average of 4.8 per cent. At Level 1 or below, the OECD average was 17.8 per cent compared with 19.3 per cent in Wales. The proportion of pupils at the highest level in Wales is 0.8 per cent, compared with an OECD average of 1.2 per cent. When the top two levels are combined (Level 5 and Level 6), a percentage of 5.6 for Wales is below the OECD average of 8.4 per cent. Wales therefore has fewer high achievers and slightly more low achievers compared with the OECD average.

The difference between scores in science at the 5th and the 95th percentile has stayed consistent for the OECD average in 2012, 2009 and 2006. In Wales, there has been a narrowing of the gap between the 5th and 95th percentile – from 334 in 2006 to 318 in 2009 and 305 in 2012. The scores at the 5th and 95th percentile show that this narrowing gap is due to a decrease in score of the high performers (from 673 in 2006 to 639 in 2012), whilst the scores of low performers have remained stable. Consistent with these results, the proportions of pupils with scores in the highest levels (Levels 5 and 6) have fallen in Wales, while the OECD average proportions have remained very similar since 2006.

4.4 Differences between boys and girls

Of the 64 other countries participating in PISA 2012, 27 had a statistically significant difference in gender performance on the science scale; 17 favouring girls and ten favouring boys. The OECD average shows a statistically significant gender difference in performance which favours boys by one score point. In Wales, boys performed significantly better than girls by an average of 11 score points. Ten countries that either outperformed Wales or were not significantly different also had a significant gender difference. These were: Finland, Latvia, Lithuania, Slovenia and Sweden in favour of girls; and Luxembourg, Japan, Denmark, Spain and Switzerland in favour of boys. The result for Wales is consistent with previous cycles of PISA; boys performed significantly better than girls in 2006 and 2009 (by between nine and 11 scores points, on average).

The range of science subjects on offer at GCSE makes a direct comparison of gender differences between the PISA 2012 scores and GCSE performance far from straightforward. Pupils are able to take science, additional science or the separate sciences of biology, chemistry and physics at GCSE. The provisional results for Wales for GCSE science from June 2013 show that, on the whole, boys and girls perform similarly, with girls tending to slightly outperform boys (www.jcq.org.uk).

4.5 Summary

This section summarises Wales' performance in science and compares the science achievement of pupils in Wales in PISA 2012 with their achievement in science in PISA 2009 and PISA 2006. In 2006, science was the main subject so there were more science questions than in PISA 2009 and 2012. The questions used for PISA 2012 and PISA 2009 are identical and are the 'link items'. They were used in PISA 2006 and some were also used in previous cycles of PISA.

Wales' performance in science in PISA 2012 was significantly below the OECD average and 25 countries significantly outperformed Wales, 12 of which were EU countries. The difference between score points of the lowest scoring pupils and highest scoring pupils in Wales was similar

to the OECD average, however the proportion of pupils in Wales at the highest levels was lower than the OECD average.

There was no clear pattern of performance by gender across participating countries. In Wales, there was a significant gender difference of 11 points in favour of boys.

Comparison with performance in science in 2006 and 2009 shows a decline in pupil performance in Wales and a significant decline since 2006, whereas OECD average performance in science has remained stable. Wales has shown particular decline in the scores of the highest achievers since 2006.

5 Reading

Chapter outline

This chapter explores attainment in reading. It draws on findings outlined in the international report (OECD, 2013) and places outcomes for Wales in the context of those findings.

Key findings

- Wales' performance in reading in PISA 2012 was significantly lower than the OECD average.
- Wales had a smaller difference between the score points of the lowest scoring pupils and the highest scoring pupils compared with the OECD average but the proportion of pupils at each level of achievement differed from the OECD averages in that Wales had lower proportions of pupils performing at the higher levels (Levels 5 and 6), and higher proportions at Level 1a and below.
- Girls scored significantly higher than boys in all countries. However in Wales, the gender difference in reading scores, while statistically significant, was not as large as that in the majority of other countries.
- In general, Wales' performance in reading in 2012 remained at a similar level to that of the last two PISA surveys in 2009 and 2006, although the number of countries outperforming Wales increased to 31, and a number of countries that were significantly below Wales in previous surveys appear to have made more improvement in reading.

5.1 Comparison countries

While findings for all countries are reported in this chapter where relevant, most findings relate to a sub-group of countries. As with mathematics and science, the comparator countries reported here include OECD countries, EU countries and other countries with relatively high scores. Since countries with very low scores are not so relevant for comparison purposes, those with a mean score for reading of less than 430 have been omitted from tables, unless they are in the OECD or the EU. As a result, the comparison group in this chapter for reading comprises 51 countries (of which 26 are EU members and 33 are OECD members), as shown in Table 5.1.

Table 5.1 Countries compared with Wales

Australia	Finland*	*Lithuania**	*Shanghai-China*
Austria*	France*	Luxembourg*	*Singapore*
Belgium*	Germany*	*Macao-China*	Slovak Republic*
*Bulgaria**	Greece*	Mexico	Slovenia*
Canada	*Hong Kong-China*	Netherlands*	Spain*
Chile	Hungary*	New Zealand	Sweden*
Chinese Taipei	Iceland	Norway	Switzerland
Costa Rica	Israel	Poland*	*Thailand*
*Croatia**	Italy*	Portugal*	Turkey
*Cyprus**	Japan	Republic of Ireland*	*United Arab Emirates*
Czech Republic*	Korea	*Romania**	United States
Denmark*	*Latvia**	*Russian Federation*	*Vietnam*
Estonia*	*Liechtenstein*	*Serbia*	

OECD countries (not italicised) *Countries not in OECD (italicised)* *EU countries

In addition to the countries listed above, tables and figures in Appendix D include the data for all four constituent parts of the United Kingdom.

Outcomes for the United Kingdom as a whole are presented in the international report (OECD, 2013) and in the appendices that accompany this chapter (Appendix D). Outcomes for Wales (and the other three constituent parts of the UK) are derived from the 'sub-national' level analysis carried out by the international consortium, as well as from additional analysis carried out by NFER using the international dataset. Comparisons between the four constituent parts of the UK are provided in Chapter 7.

Interpreting differences between countries

As for mathematics and science, it is important to know what can reasonably be concluded from the PISA data and which interpretations would be going beyond what can be reliably supported by the results. This section outlines some points that need to be kept in mind while reading this chapter.

Sources of uncertainty

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

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

the estimation is. It is important to recognise that all data on human performance or attitudes which is based on a sample carries a margin of error.

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

Interpreting rank order

Because of the areas of uncertainty described above, interpretations of very small differences between two sets of results are often meaningless. Were they to be measured again it could well be that the results would turn out the other way round. For this reason, this chapter focuses mainly on *statistically significant* differences between mean scores rather than the simple rank order of countries. Statistically significant differences are unlikely to have been caused by random fluctuations due to sampling or measurement error.

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

5.2 Scores in Wales

Wales' pupils achieved a mean score of 480 in reading, which was significantly below the OECD average of 496. The results for reading in 2012 were not significantly different from those in PISA 2009, when the mean for Wales was 476 and was significantly lower than the OECD average of 493.

Internationally, the performance in reading in almost half (31) of the other 64 participating countries was at a significantly higher level than in Wales (see Table 5.2). Ten countries performed at a level that was not significantly different from that of Wales, while the remaining 23 countries performed significantly less well. Tables 5.3 and 5.4 show the comparison group countries which performed similarly to Wales, and those whose performance was lower than in Wales. (See the box above on interpreting differences between countries for an explanation of how statistical significance should be interpreted in this report.)

Of the 31 countries with mean scores in reading that are significantly higher than in Wales, four are English speaking (Republic of Ireland, New Zealand, Australia and the United States) and one, like Wales, has a substantial number of English speakers (Canada). Two other countries (Hong Kong-China and Singapore) have strong historical links with the education system of the UK, and English is the medium of instruction in Singapore.

Sixteen of the countries that significantly outperformed Wales are EU members (Finland, Republic of Ireland, Poland, Estonia, Netherlands, Belgium, Germany, France, Denmark, Czech Republic, Italy, Austria, Latvia, Hungary, Spain and Luxembourg). Six EU countries did not perform significantly differently from Wales and four performed less well (Slovak Republic, Cyprus, Romania and Bulgaria). Among OECD countries, 23 outperformed Wales, seven performed similarly and three performed less well. This indicates that, in terms of reading achievement, scores in Wales are similar to those in other lower achieving EU and OECD countries.

Five countries that were performing at a similar level to Wales in 2009 are now significantly outperforming Wales in reading (Czech Republic, Austria, Latvia, Spain and Luxembourg) and two countries have significantly improved their performance (Turkey and the Russian Federation) so that they have moved from significantly below Wales in 2009 to not significantly different in 2012. These countries have shown greater improvement in reading between the two surveys than Wales. However, there were also four countries significantly above Wales in 2009 that are now performing at a similar level: Portugal, Sweden, Iceland and Slovenia. One country, the Slovak Republic, which was similar to Wales in 2009, is now significantly below.

Appendix D1 (significant differences between Wales and the comparison group countries) and Appendix D2 (mean scores and standard errors for Wales and the comparison group countries) provide further data.

There have been some slight changes in the distribution of reading scores between PISA 2006, PISA 2009 and PISA 2012. Compared with the OECD average, Wales' overall mean score for reading in PISA 2012 was 16 score points below. This compares with 2009, when the overall mean score was 17 points below the OECD average and 2006 when it was 11 points below. In each survey the score in Wales was significantly below the OECD average. The number of countries with mean scores significantly above Wales' has increased from 29 in 2009 to 31 in 2012. In 2006 this number was 16; however a number of high performing countries joined the survey for the first time in 2009.

Table 5.2 Countries outperforming Wales in reading (significant differences)

Country	Mean score		Country	Mean score	
Shanghai-China	570	^	Switzerland	509	^
Hong Kong-China	545	^	*Macao-China*	509	^
Singapore	542	^	*Vietnam*	508	
Japan	538	^	Germany*	508	^
Korea	536		France*	505	^
Finland*	524	v	Norway	504	
Republic of Ireland*	523	^	United States	498	
Canada	523		Denmark*	496	
Chinese Taipei	523	^	Czech Republic*	493	^
Poland*	518	^	Italy*	490	
Estonia*	516	^	Austria*	490	
Liechtenstein	516	^	*Latvia**	489	
New Zealand	512	v	Hungary*	488	
Australia	512		Spain*	488	^
Netherlands*	511		Luxembourg*	488	^
Belgium*	509				

OECD countries (not italicised) *Countries not in OECD (italicised)* *EU countries

^ v Indicates a significant change since PISA 2009

Table 5.3 Countries not significantly different from Wales in reading

Country	Mean score		Country	Mean score	
Portugal*	488		**Wales**	**480**	
Israel	486		*Lithuania**	477	^
*Croatia**	485		Greece*	477	
Sweden*	483	v	Turkey	475	^
Iceland	483	v	*Russian Federation*	475	^
Slovenia*	481				

OECD countries (not italicised) *Countries not in OECD (italicised)* *EU countries

^ v Indicates a significant change since PISA 2009

Table 5.4 Countries significantly below Wales in reading

Country	Mean score		Country	Mean score	
Slovak Republic*	463	∨	*Thailand*	441	∧
*Cyprus**	449		*Costa Rica*	441	
Serbia	446		*Romania**	438	∧
United Arab Emirates	442		*Bulgaria**	436	
Chile	441		Mexico	424	
			plus 13 other countries		

OECD countries (not italicised) *Countries not in OECD (italicised)* *EU countries

∧ ∨ Indicates a significant change since PISA 2009

5.3 Differences between highest and lowest attainers

It is important for teaching and learning purposes to know the spread of attainment between the highest and lowest scoring pupils in reading. Countries with similar mean scores may nevertheless have differences in the numbers of high or low attainers. A country with a wide spread of attainment may have large numbers of pupils who are underachieving as well as pupils performing at the highest levels. A country with a lower spread of attainment may have fewer very high achievers but may also have fewer underachievers.

The first way in which the spread of performance in each country can be examined is by looking at the distribution of scores. Appendix D2 shows the average reading score of pupils at different percentiles and the size of the difference between the highest and lowest attainers (at the 5th and 95th percentiles) in each country. The 5th percentile is the score at which five per cent of pupils score lower, while the 95th percentile is the score at which five per cent score higher. This a better measure for comparing countries than using the lowest and highest scoring pupils, as such a comparison may be affected by a small number of pupils in a country with unusually high or low scores.

The score of pupils in Wales at the 5th percentile was 325, while the score of those at the 95th percentile was 624, a difference of 299 score points. This range was lower than the OECD average difference, which was 310 score points. Approximately two thirds of the OECD countries had a wider distribution than Wales.

Since 2009, the score of Wales' high achievers at the 95th percentile has decreased by two score points, from 626 to 624. The score of low achievers at the 5th percentile has increased by six score points since 2009, from 319 to 325. The difference between the highest and lowest achievers has therefore decreased since 2009 by seven[3] points to 299, less than in 2006 when it was 323.

The highest scoring countries at the 95th percentile were Singapore (698), Shanghai-China (690) and Japan (689), compared with 624 for Wales. Of the countries that outperformed Wales overall, none had a lower score among their highest achievers. At the 5th percentile, Luxembourg, Italy and France had a lower score among the countries that scored significantly better than Wales overall.

[3] Due to rounding.

The second way of examining the spread of attainment is by looking at performance at each of the PISA proficiency levels. For reading there are seven levels, which include the sub-levels 1a and 1b and below 1b. These reading levels are outlined in Appendix D3.

In all participating countries there were some pupils at or below Level 1a, while in most countries (including all the comparison countries) at least some pupils achieved the highest level (Level 6). See Appendices D4 and D5 for details of the proportions at each level in all comparison countries.

In Wales, 1.0 per cent of pupils scored at the lowest PISA level (below Level 1b) in reading, compared with the OECD average of 1.3 per cent.

The OECD average for the proportion of pupils at Level 1a or below for reading was 18.0 per cent. Wales had 20.6 per cent of pupils at these levels. At the highest level (Level 6) the OECD average is 1.1 per cent of pupils, compared with 0.5 per cent in Wales. When the top two levels are combined (Levels 5 and 6), a percentage of 4.7 for Wales is below the OECD average of 8.4 per cent achieving these levels in reading. Wales therefore has a higher proportion of low achievers and a lower proportion of high achievers compared with the OECD average.

Forty-eight participating countries had a higher proportion of pupils at Level 5 or above, while 16 had a lower proportion. All ten comparison countries that had significantly lower overall scores than Wales also had a higher proportion of pupils at Level 1a or below.

A comparison across surveys at each of the PISA performance levels indicates a slight decrease in the proportion of low achievers, but also in the proportion of high achievers. In PISA 2009, 6.8 per cent of pupils were at Levels 1b or below whereas in 2012 this fell slightly to 5.9. However, both of these figures are lower than the proportion of low achievers in 2006 which was 7.6 per cent. Wales' proportion of high achievers (Level 5 and above) fell very slightly in 2012 to 4.7 per cent (from 5.0 per cent in 2009); both are lower than the 2006 figure of 6.4 per cent.

5.4 Differences between boys and girls

Of the 64 other countries participating in PISA 2012, all had a statistically significant difference in gender performance on the reading scale, favouring girls (see Appendix D2).

In Wales, there was a difference of 27 score points between girls and boys compared with an OECD average of 38 score points. This was one of the lowest score point differences among the comparison countries, with over four-fifths having a greater difference than Wales. Among OECD countries, Finland had the largest difference (with girls outperforming boys by 62 score points) and among the non-OECD comparison countries the largest difference was a 70 point difference in Bulgaria.

The higher attainment in reading of girls is a common pattern seen in other measurements of attainment. The PISA results confirm these findings. However, it is encouraging that the difference in Wales, while significant, is smaller than that in many other countries.

In 2009 and 2006, as in 2012, all participating countries had a statistically significant gender difference in favour of girls for reading. It appears that the gender gap in Wales has remained stable between 2009 and 2012 with a difference of 27 score points in both surveys, whereas in

2006 the difference was 31 score points. The OECD average for gender difference has decreased by one score point since 2009 to 38, the same as it was in 2006.

5.5 Summary

Wales' performance in reading in PISA 2012 was significantly lower than the OECD average. Wales had a smaller difference between the score points of the lowest scoring pupils and the highest scoring pupils compared with the OECD average. The proportion of pupils at each level of achievement differed from the OECD averages in that Wales had lower proportions of pupils performing at the higher levels (Levels 5 and 6), and higher proportions at Level 1a and below. There was a small decrease in the proportion of both low and high achievers in 2012, but this may be a result of the more extensive and detailed assessment of reading in PISA 2009 rather than an indication of a real change in the distribution of reading skills among 15-year-olds in Wales.

Girls scored significantly higher than boys, the case in every country which participated in the PISA 2012 study. However this gender difference, while statistically significant, was not as large in Wales as that in the majority of other countries.

In general, Wales' performance in reading in 2012 remains at a similar level to that of the last two PISA surveys in 2009 and 2006, although the number of countries outperforming Wales increased to 31, and a number of countries that were significantly below Wales in previous surveys appear to have made more improvement in reading.

In sum, attainment in reading shows very slight changes in Wales between PISA 2009 and PISA 2012. The spread of achievement has narrowed slightly and the proportion of both low and high achieving pupils has decreased.

6 Schools

Chapter outline

This chapter draws on responses to the School and Student Questionnaires in PISA 2012 to describe aspects of school management, school climate, assessment practices and school resources in Wales.

Key findings

- Headteachers in Wales report that they have a high level of responsibility for most aspects of school management.
- Compared with the OECD average, headteachers in Wales play a greater role in most aspects of school management.
- Headteachers report that there is a similar level of involvement from other bodies in the management of schools as was found in PISA 2009.
- Headteachers in Wales report a much greater involvement in activities in their schools than the OECD average, such as praising and developing teachers.
- A smaller proportion of headteachers report pupil-related problems that hinder learning than the OECD average.
- Teacher-related problems that hinder learning are also reported at a lower level by headteachers in Wales than the OECD average.
- Teacher morale is reported to be very high across the OECD, with headteachers in Wales also enthusiastic and valuing academic achievement.
- On the specific question of morale, fewer headteachers in Wales report that this is high for the teachers in their school, compared with the OECD average.
- Compared with headteachers, pupils in Wales report a greater degree of disruption to their lessons. The level of disruption reported by pupils is similar to the OECD average.
- Pupils in Wales are generally very positive about their relationships with their teachers, and more positive than the OECD average.
- A lack of qualified mathematics teachers is reported as the greatest staffing problem hindering schools' capacity to provide instruction. This was reported by 17 per cent of headteachers.
- In PISA 2009 a lack of qualified mathematics teachers was reported by eight per cent of headteachers in Wales.
- The greatest resource issue for headteachers is inadequacy of school buildings and grounds.
- Headteachers in Wales report much greater use of pupil assessments for a variety of purposes than the OECD average.

6.1 School management

The School Questionnaire asked about responsibility for aspects of school management. Table 6.1 summarises the responses of headteachers in Wales and shows a high degree of school autonomy, whereby headteachers reported that a high level of responsibility for most aspects of management lay within the school. The aspects on which headteachers reported the most involvement of bodies external to the school – i.e. local or national government – were in dismissing teachers, establishing starting salaries and salary increases, formulating the school budget and deciding on pupil admissions. However, even for these aspects the headteacher was still considered to have more responsibility.

Teachers were reported as having a large amount of responsibility for more instructional or classroom-related issues such as discipline policies; choosing textbooks, courses and course content; and establishing assessment policies. Responses also show considerable involvement of school governing bodies in all aspects of the school, with the exception of choosing textbooks and deciding course content.

Comparing responses to this question with those for the same question in PISA 2009, headteachers in Wales reported little change in the responsibilities of different bodies for school management. The role of local authorities in establishing teachers' starting salaries was seen to have reduced (from 40 per cent in 2009 to 29 per cent in 2012). Headteachers also reported that their own role had reduced in terms of dismissing teachers (88 per cent to 74 per cent) and establishing teachers' starting salaries (69 per cent to 54 per cent).

Table 6.1 School autonomy

Regarding your school, who has a considerable responsibility for the following tasks? *(Please tick as many boxes as appropriate in each row)*					
	Head	*Teachers*	*School governing body*	*Local or Regional Authority*	*National education authority*
Selecting teachers to recruit	95%	28%	83%	7%	-
Dismissing teachers	74%	1%	93%	38%	3%
Establishing teachers' starting salaries	54%	-	63%	29%	18%
Determining teachers' salary increases	68%	0%	82%	18%	27%
Formulating the school budget	87%	3%	87%	54%	7%
Deciding on budget allocations within the school	97%	9%	73%	5%	-
Establishing student disciplinary policies	97%	65%	88%	12%	6%
Establishing student assessment policies	96%	78%	58%	7%	5%
Approving students for admission to the school	60%	7%	28%	54%	-
Choosing which textbooks are used	13%	99%	-	2%	-
Determining course content	16%	99%	7%	1%	12%
Deciding which courses are offered	93%	83%	52%	16%	12%

- indicates no responses while 0% indicates a response from less than 0.5% of headteachers

Looking specifically at the role of headteachers, a comparison with the OECD average shows that headteachers in Wales play a greater role in school management than is the case across the OECD for all aspects except choosing textbooks, approving pupils for admission and determining course content. For other aspects of school management, as shown in Table 6.2, headteachers in Wales have greater responsibility than those across the OECD on average. In particular, their role in determining teachers' salary increases and establishing pupil assessment policies is greater than the OECD average.

Table 6.2 Headteachers' role in school management: comparing Wales and the OECD average

	Wales	OECD average
Selecting teachers to recruit	95%	71%
Dismissing teachers	74%	57%
Establishing teachers' starting salaries	54%	18%
Determining teachers' salary increases	68%	23%
Formulating the school budget	87%	56%
Deciding on budget allocations within the school	97%	75%
Establishing student disciplinary policies	97%	71%
Establishing student assessment policies	96%	57%
Approving students for admission to the school	60%	72%
Choosing which textbooks are used	13%	28%
Determining course content	16%	25%
Deciding which courses are offered	93%	60%

A second aspect of school management which was explored in the School Questionnaire is school leadership, specifically the amount of involvement which headteachers have in various activities in their school. Table 6.3 reports these responses in Wales ordered by the proportions of headteachers reporting that they did each activity on a weekly, or more frequent, basis.

It is interesting to contrast some of these responses with those reported across the OECD on average (also shown in Table 6.3). There are seven statements where the response of headteachers in Wales was at least 20 per cent higher than the OECD average and these are shaded in the table. These figures suggest that headteachers in Wales take a more direct role in the day-to-day teaching and learning in their schools than do their counterparts in many other OECD countries.

Table 6.3 School leadership

Below are statements about your management of this school. Please indicate the frequency of the following activities and behaviours in your school during the last academic year.		
	Once a week or more	
	Wales	OECD average
I pay attention to disruptive behaviour in classrooms.	80%	56%
I praise teachers whose students are actively participating in learning.	72%	38%
I engage teachers to help build a school culture of continuous improvement.	69%	42%
I work to enhance the school's reputation in the community.	68%	46%
I ensure that teachers work according to the school's educational goals.	67%	34%
When a teacher brings up a classroom problem, we solve the problem together.	53%	45%
When a teacher has problems in his/her classroom, I take the initiative to discuss matters.	49%	37%
I make sure that the professional development activities of teachers are in accordance with the teaching goals of the school.	41%	19%
I use student performance results to develop the school's educational goals.	41%	16%
I provide staff with opportunities to participate in school decision-making.	38%	37%
I draw teachers' attention to the importance of pupils' development of critical and social capacities.	38%	28%
I conduct informal observations in classrooms on a regular basis (informal observations are unscheduled, last at least 5 minutes, and may or may not involve written feedback or a formal meeting).	35%	22%
I discuss the school's academic goals with teachers at staff meetings.	30%	15%
I promote teaching practices based on recent educational research.	27%	21%
I refer to the school's academic goals when making curricular decisions with teachers.	25%	14%
I discuss academic performance results with staff to identify curricular strengths and weaknesses.	20%	9%
I evaluate the performance of staff.	20%	13%
I review work produced by students when evaluating classroom instruction.	19%	13%
I set aside time at staff meetings for teachers to share ideas or information from in-service activities.	17%	10%
I ask teachers to participate in reviewing management practices.	13%	12%
I lead or attend in-service activities concerned with instruction.	7%	8%

6.2 School climate

Information on school climate is available from questions in both the Student and School Questionnaires. Headteachers were asked the extent to which learning in their school is hindered by a variety of problems. These were divided into teacher-related and pupil-related issues. Table 6.4 shows responses from the most frequently reported to the least.

In comparison with the OECD average, headteachers in Wales were much less likely to report pupil-related factors that hindered learning. The problem reported most frequently was pupils

arriving late for school, which was said to hinder learning by nearly a quarter of headteachers in Wales (24 per cent). This compares with the OECD average of 31 per cent.

Teacher-related problems that hindered learning were also reported less frequently in Wales compared with the OECD average (for ten out of the 11 problems). For both Wales and the OECD average the most commonly reported problem was “Teachers having to teach students of mixed ability within the same class”. While the OECD average was over half (53 per cent), just under a quarter of headteachers in Wales said that this was a problem (23 per cent).

Of the options presented in this question, 12 had also appeared in a similar question in PISA 2009. The answers from headteachers in Wales differed only very slightly between the two surveys.

Table 6.4 Issues that hinder learning in school

In your school, to what extent is the learning of students hindered by the following?		
	to some extent/a lot	
	Wales	OECD average
Student-related		
Students arriving late for school	24%	31%
Disruption of classes by students	17%	32%
Student truancy	16%	32%
Students lacking respect for teachers	13%	19%
Students not attending compulsory school events (e.g. sports day) or excursions	12%	13%
Students skipping classes	11%	30%
Students intimidating or bullying other students	4%	10%
Student use of alcohol or illegal drugs	3%	6%
Teacher-related		
Teachers having to teach students of mixed ability within the same class	23%	53%
Teachers not meeting individual students’ needs	17%	23%
Staff resisting change	15%	25%
Teacher absenteeism	15%	13%
Teachers’ low expectations of students	10%	14%
Students not being encouraged to achieve their full potential	8%	21%
Teachers not being well prepared for classes	4%	8%
Teachers having to teach students of diverse ethnic backgrounds (i.e. language, culture) within the same class	3%	18%
Teachers being too strict with students	1%	10%
Teachers being late for classes	1%	7%
Poor student-teacher relations	0%	7%

Headteachers were also asked about the morale of the teachers at their school. As shown in Table 6.5, headteachers in Wales reported a very high level of pride and enthusiasm amongst

their staff. The lowest proportion of positive responses, at 83 per cent, was for the statement which asked directly about the morale of teachers. For the remaining three statements, the proportion agreeing or strongly agreeing was higher in Wales than the average across the OECD.

Table 6.5 Teacher morale

Thinking about the teachers in your school, how much do you agree with the following statements?		
	agree/strongly agree	
	Wales	OECD average
The morale of teachers in this school is high.	83%	91%
Teachers work with enthusiasm.	96%	93%
Teachers take pride in this school.	96%	94%
Teachers value academic achievement.	100%	96%

It is possible to compare the headteachers' views with pupils' reports about the climate of their schools. Pupils were asked about discipline, specifically in their mathematics lessons. Table 6.6 summarises their responses. While 17 per cent of headteachers in Wales reported that disruption of classes by pupils hindered learning, larger proportions of pupils said that disruption occurred in most or all lessons. Around a third of pupils said that there was often noise and disorder or that pupils did not listen to the teacher in their mathematics lessons. These proportions were similar to the average across the OECD. Despite this reported disruption, only 17 per cent of pupils in Wales said that pupils cannot work well. Pupils' responses were similar to those of their counterparts in other OECD countries for all but the last two categories, which were both related to actually getting on with work in class, where pupils in Wales gave a slightly more positive picture.

A similar question to this was asked in PISA 2009, but related to English (or Welsh) lessons rather than mathematics lessons. There is very little difference in the percentages of pupils reporting disruption to lessons between the two surveys.

Table 6.6 Discipline in mathematics classes

How often do these things happen in your mathematics lessons?		
	in most or all lessons	
	Wales	OECD average
There is noise and disorder.	35%	32%
Students don't listen to what the teacher says.	33%	32%
The teacher has to wait a long time for students to settle down.	28%	27%
Students don't start working for a long time after the lesson begins.	20%	27%
Students cannot work well.	17%	22%

As seen in Table 6.4 (above), none of the headteachers in Wales said that poor pupil-teacher relations hindered pupils' learning. Table 6.7 shows pupils' responses to questions on relationships with teachers. This also shows a largely positive feeling among pupils in Wales about the relationship they have with their teachers. However, a quarter of pupils did not agree or strongly agree that most of their teachers really listen to them. For all the statements, pupils in Wales were more positive about relationships with teachers than pupils across the OECD on average.

Table 6.7 Teacher-pupil relationships

Thinking about the teachers at your school, to what extent do you agree with the following statements?		
	agree/strongly agree	
	Wales	OECD average
If I need extra help, I will receive it from my teachers.	89%	80%
Most of my teachers treat me fairly.	87%	79%
Most teachers are interested in students' well-being.	85%	76%
Students get along well with most teachers.	85%	81%
Most of my teachers really listen to what I have to say.	75%	73%

See section 3.4 for further discussion of the findings from the Student Questionnaire concerning other aspects of teaching practice.

6.3 Resources

The School Questionnaire asked about the extent to which schools had problems with a lack of resources or a lack of qualified staff. Table 6.8 summarises responses sorted by frequency for Wales, plus OECD averages. The most frequent staffing problem in Wales was a lack of qualified mathematics teachers, reported by 17 per cent of headteachers. Generally, shortages of resources or of qualified staff were reported at a slightly lower level in Wales than across the OECD.

The resource most reported as inadequate in Wales was that of school buildings and grounds. This shortage represented the biggest difference between Wales and the OECD average. Just over half of the headteachers in Wales said a shortage or inadequacy of school buildings and grounds hindered the school's capacity to provide instruction to some extent or a lot, compared with about a third of headteachers on average across the OECD.

Ten of the options presented to headteachers also appeared in PISA 2009. A lack of qualified mathematics teachers was reported by a greater proportion of headteachers in 2012 than in 2009 (up from eight per cent to 17 per cent), and a similar increase was seen for a lack of qualified English teachers (up from two to 10 per cent). In contrast, shortages of resources were reported by lower proportions of headteachers in 2012 than in 2009 (except for inadequacy of internet connectivity which was reported at a similar level). The biggest difference was seen for "Shortage

or inadequacy of computer software for instruction" which reduced from 40 per cent in 2009 to 22 per cent in 2012.

Table 6.8 Staffing and resources

Is your school's capacity to provide instruction hindered by any of the following issues?		
	to some extent/a lot	
	Wales	OECD average
Staffing		
A lack of qualified mathematics teachers	17%	17%
A lack of qualified teachers of other subjects	16%	20%
A lack of qualified science teachers	10%	17%
A lack of qualified English teachers	10%	9%
Resources		
Shortage or inadequacy of school buildings and grounds	52%	34%
Shortage or inadequacy of instructional space (e.g. classrooms)	34%	32%
Shortage or inadequacy of computers for instruction	32%	33%
Lack or inadequacy of internet connectivity	28%	21%
Shortage or inadequacy of library materials	24%	25%
Shortage or inadequacy of heating/cooling and lighting systems	22%	23%
Shortage or inadequacy of computer software for instruction	22%	31%
Shortage or inadequacy of science laboratory equipment	22%	30%
Shortage or inadequacy of instructional materials (e.g. textbooks)	15%	19%

6.4 Assessment

The School Questionnaire asked about the purposes of assessment within the school. As shown in Table 6.9, schools in Wales use assessments for a variety of purposes in the vast majority of cases. More than 95 per cent of headteachers in Wales reported that assessments were used to inform parents, compare the school's performance locally or nationally, monitor the school's progress and compare the school with other schools. Across the OECD, the only similarly high response was given for using assessment to inform parents about their child's progress. The only purpose which was reported as being used more in other OECD countries was related to pupils' retention or promotion. This is likely to be related to the use of year-repetition in some education systems for underperforming pupils, which is not a feature of the Welsh education system.

The percentages for Wales are similar to those reported in 2009 by headteachers. The largest difference is an 11 percentage point increase in the proportion of headteachers saying that they use assessments to compare the school with other schools (from 85 per cent in 2009 to 96 per cent in 2012).

Table 6.9 Purposes of assessment

In your school, are assessments used for any of the following purposes for students in Years 10 and 11?		
	Yes	
	Wales	OECD average
To inform parents about their child's progress	100%	97%
To compare the school to local or national performance	99%	62%
To monitor the school's progress from year to year	99%	80%
To compare the school with other schools	96%	51%
To group students for instructional purposes	94%	50%
To identify aspects of instruction or the curriculum that could be improved	88%	79%
To make judgements about teachers' effectiveness	75%	50%
To make decisions about students' retention or promotion	73%	76%

6.5 Summary

Headteachers reported a high degree of responsibility for most aspects of management of their schools. School governing bodies also had a large influence, whereas local or national education authorities had less responsibility. Headteachers reported a similar level of involvement for all parties in the management of schools as was found in 2009. Headteachers in Wales also reported a higher frequency for most school leadership activities than their OECD counterparts.

The biggest staffing issue for headteachers in Wales was a shortage of qualified mathematics teachers. This had increased since 2009, when eight per cent of headteachers said it hindered instruction to some extent or a lot, compared with 17 per cent in this survey. The most frequently reported resource problem was a shortage or inadequacy of school buildings and grounds.

Responses to the School Questionnaire on issues which hinder learning showed a more positive school climate than the OECD average for most aspects. This was particularly the case for problems related to pupil behaviour. Pupils were on the whole very positive about the climate of their school, although they were least positive about the extent to which they felt their teachers listened to them. They were more positive about their relationship with their teachers across all aspects compared with the OECD average.

Pupil assessments served various purposes, the most frequent being to inform parents, compare the school's performance locally or nationally, and monitor the school's progress.

7 PISA in the UK

Chapter outline

This chapter describes some of the main outcomes of the PISA survey in England, Wales, Northern Ireland and Scotland. In particular, it outlines some aspects where there were differences in attainment, in the range of attainment, in the pattern of gender differences or in responses to the School and Student Questionnaires.

Key findings

- Across mathematics, science and reading, there were no significant differences between Scotland, England and Northern Ireland, with the exception of mathematics where Scotland scored significantly higher than Northern Ireland.
- In all subjects, scores for Wales were significantly below those of other UK countries and the OECD average.
- England had the widest spread of attainment in all three subjects.
- Scotland had the smallest percentage of pupils working at the lowest levels in all three subjects and their low achievers scored more highly in all subjects.
- England had the highest proportion of pupils working at Levels 5 and above, and their high achievers scored more highly in all subjects.
- Northern Ireland was the only country where boys did not significantly outperform girls in mathematics and science.
- In all subjects, Scotland had the lowest percentage of pupils at Level 1 or below, while Wales had the lowest percentage at Levels 5 and above. This pattern is consistent with findings from the 2006 and 2009 surveys.

Mathematics

- Scores in Scotland and England were similar to the OECD average. However, scores in Northern Ireland and Wales were significantly lower than the OECD average.
- Scores in Wales were lower and significantly different from those in the rest of the UK.
- Scotland had the lowest percentage of pupils working below Level 1 in mathematics (4.9 per cent).
- In each of the UK countries, gender gaps for mathematics were similar to the OECD average; however they were smaller than in many other countries.

Science

- In science, there were no significant differences between England, Scotland and Northern Ireland, but the mean score in Wales was significantly lower.
- The spread of attainment was less in Scotland than in the other parts of the UK.
- Scotland's lowest attainers in science scored 28 points higher than low attainers across the OECD and at least 22 points higher than low attainers in the rest of the UK.
- The difference between the performance of boys and girls in science was much larger in the UK than across the OECD in general, particularly in England and Wales.

Reading

- In reading, there were no significant differences between England, Scotland and Northern Ireland but the mean score in Wales was significantly lower.
- England had the widest spread of attainment for reading.
- Girls outperformed boys in all parts of the UK, as they did in every other country in the PISA survey.

Schools and pupils

- More headteachers in England reported informal observations in classrooms and weekly evaluations of staff, and fewer reported these in Northern Ireland.
- Headteachers in Scotland reported greater involvement of local authorities in dismissing teachers, formulating budgets and establishing assessment policies, and less involvement of governing bodies compared with other UK countries. They were also most likely to report that truancy hindered learning, or to report problems with pupils skipping classes or disrupting classes.
- Headteachers in Northern Ireland reported greater shortages or inadequacy of computers for instruction, instructional space (e.g. classrooms), and school buildings and grounds than those in England, Scotland and Wales.
- In Scotland, 36 per cent of teachers reported a shortage of qualified subject teachers, other than in mathematics, science or reading; this was at least twice as many as in other UK countries.
- Differences between the responses of pupils in the different UK countries were minimal.
- Pupils in England were more likely to say that they looked forward to mathematics lessons.
- Pupils in Northern Ireland were more likely to report that they often worried about mathematics classes.
- The mean scores for UK countries on the PISA index of economic, social and cultural status (ESCS) all indicate that on average pupils in the PISA samples in the UK have a higher socio-economic status than the average across OECD countries.
- Only in Northern Ireland did the figures indicate that more disadvantaged pupils have significantly less chance of performing well.

7.1 Mathematics

This section compares the findings outlined in Chapter 2 with the comparable findings for the other parts of the UK.

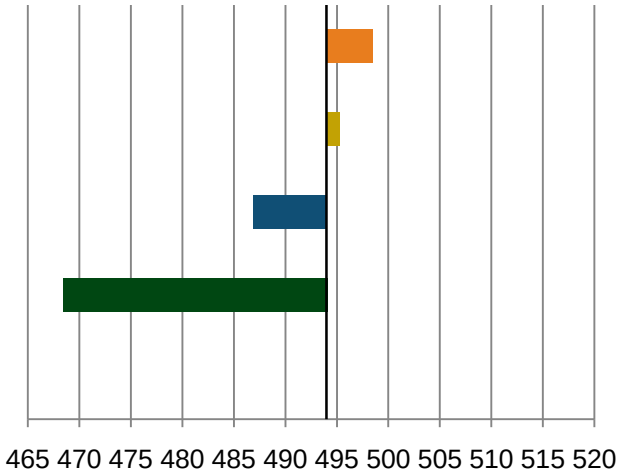
7.1.1 Mean scores in mathematics

Table 7.1 summarises the mean scores for each of England, Wales, Northern Ireland and Scotland on the mathematics achievement scale. The highest attainment for mathematics was in Scotland, followed by England and then Northern Ireland. However, scores between Scotland and England or between Northern Ireland and England were similar and differences were not

significant. The lack of a significant difference between the mean scores of England and Northern Ireland does not reflect the finding for TIMSS Grade 4 (9-10-year-olds) where pupils in Northern Ireland performed at a significantly higher level than pupils in England. However the mean score in Northern Ireland was significantly lower than that in Scotland. The lowest attainment was in Wales, where the mean score was significantly lower than the other constituent parts of the UK.

Table 7.1 Mean scores for mathematics overall

	Mean	**S**	**E**	**NI**	**W**	**OECD**
Scotland	498		*NS*	*S*	*S*	*NS*
England	495	*NS*		*NS*	*S*	*NS*
Northern Ireland	487	*S*	*NS*		*S*	*S*
Wales	468	*S*	*S*	*S*		*S*
OECD average	494	*NS*	*NS*	*S*	*S*	



S = significantly different *NS* = no significant difference

On the four content subscales, more differences emerged. Scores in these areas are shown in Tables 7.2 to 7.5 All four countries showed some difference between the mean score in each of the content areas and their overall mean score, with the exception of England where there was no difference between the mean score for *quantity* and the overall score for mathematics. However, the biggest difference for all countries was found in the *space and shape* subscale; and for all countries, their lowest mean score was in this content area. All four parts of the UK scored higher on the *uncertainty and data* subscale compared with their overall mathematics score. This suggests that in all four parts of the UK, pupils are relatively strong on the questions that focus on probability and statistics (*uncertainty and data*) and they are less strong on questions that focus on aspects of *space and shape.*

Wales' scores in all four content areas were significantly lower than those for the other three countries. Scotland's scores were significantly higher than Northern Ireland's in all content areas apart from *uncertainty and data*. England's scores on two content areas (*change and relationships* and *space and shape)* were significantly higher than Northern Ireland's.

Table 7.2 Mean scores on the Quantity scale

	Mean	**Scotland**	**England**	**Northern Ireland**	**Wales**
Scotland	501		*NS*	*S*	*S*
England	495	*NS*		*NS*	*S*
Northern Ireland	491	*S*	*NS*		*S*
Wales	465	*S*	*S*	*S*	

S = significantly different *NS* = no significant difference

Table 7.3 Mean scores on the Uncertainty and data scale

	Mean	**Scotland**	**England**	**Northern Ireland**	**Wales**
Scotland	504		*NS*	*NS*	*S*
England	503	*NS*		*NS*	*S*
Northern Ireland	496	*NS*	*NS*		*S*
Wales	483	*S*	*S*	*S*	

S = significantly different *NS* = no significant difference

Table 7.4 Mean scores on the Change and relationships scale

	Mean	**Scotland**	**England**	**Northern Ireland**	**Wales**
Scotland	497		*NS*	*S*	*S*
England	498	*NS*		*S*	*S*
Northern Ireland	486	*S*	*S*		*S*
Wales	470	*S*	*S*	*S*	

S = significantly different *NS* = no significant difference

Table 7.5 Mean scores on the Space and shape scale

	Mean	**Scotland**	**England**	**Northern Ireland**	**Wales**
Scotland	482		*NS*	*S*	*S*
England	477	*NS*		*S*	*S*
Northern Ireland	463	*S*	*S*		*S*
Wales	444	*S*	*S*	*S*	

S = significantly different *NS* = no significant difference

Tables 7.6 to 7.8 show mean scores on the process subscales: *formulate*, *employ* and *interpret*. In all four parts of the UK, pupils were relatively stronger on the *interpret* subscale and relatively weaker on the other two subscales. As was the case for the content areas, Wales' scores in the three process subscales were significantly lower than all other parts of the UK.

Table 7.6 Mean scores on the Formulate scale

	Mean	**Scotland**	**England**	**Northern Ireland**	**Wales**
Scotland	490		*NS*	*S*	*S*
England	491	*NS*		*NS*	*S*
Northern Ireland	479	*S*	*NS*		*S*
Wales	457	*S*	*S*	*S*	

S = significantly different *NS* = no significant difference

Table 7.7 Mean scores on the Employ scale

	Mean	**Scotland**	**England**	**Northern Ireland**	**Wales**
Scotland	496		*NS*	*S*	*S*
England	493	*NS*		*NS*	*S*
Northern Ireland	486	*S*	*NS*		*S*
Wales	466	*S*	*S*	*S*	

S = significantly different *NS* = no significant difference

Table 7.8 Mean scores on the Interpret scale

	Mean	**Scotland**	**England**	**Northern Ireland**	**Wales**
Scotland	510		*NS*	*S*	*S*
England	502	*NS*		*NS*	*S*
Northern Ireland	496	*S*	*NS*		*S*
Wales	483	*S*	*S*	*S*	

S = significantly different *NS* = no significant difference

7.1.2 Distribution of performance in mathematics

Chapter 2 showed that there was some degree of variation around the mean score for mathematics in all countries, as would be expected. The size of this variation indicates the extent of the gap between low and high attaining pupils. This can be seen by comparing the scores of pupils at the 5th percentile (low attainers) and that of pupils at the 95th percentile (high attainers).

The scores at the 5th and the 95th percentile and the differences[4] between them are shown in Table 7.9 The difference between the OECD average score at the 5th percentile and at the 95th percentile was 301 score points. The range was wider than this in England and Northern Ireland and narrower in Scotland and Wales. The highest difference of 316 was found in England.

[4] Differences have been calculated using unrounded mean scores.

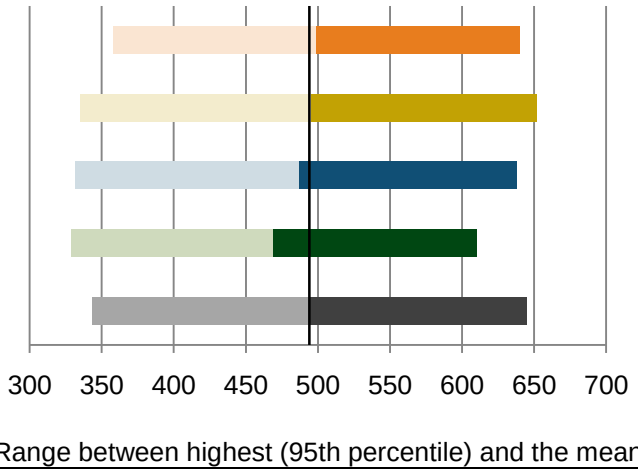
The lowest scoring pupils in England, Northern Ireland and Wales performed slightly less well than the OECD average at the 5th percentile. However, in Scotland, the score of 358 at the 5th percentile was 15 points higher than the OECD average of 343.

At the highest percentile, the OECD average was 645 and the equivalent score in England was seven points above this. The scores at the highest percentile in Wales, Northern Ireland and Scotland were lower than the OECD average; the largest difference was in Wales where the highest performers scored 35 points below the OECD average.

The impact of socio-economic status is discussed in section 7.4.2.1.

Table 7.9 Scores of highest and lowest achieving pupils in mathematics

	Lowest (5th percentile)	Highest (95th percentile)	Difference
Scotland	358	640	282
England	335	652	316
Northern Ireland	332	638	305
Wales	329	610	281
OECD average	343	645	301



Differences have been calculated using unrounded scores.

Full information on the distribution of performance is in Appendix B2.

7.1.3 Percentages at each level in mathematics

The range of achievement in each country is further emphasised by the percentages of pupils at each of the PISA proficiency levels. These percentages are summarised in Figure 7.1, which shows that all parts of the UK have some pupils at the top and bottom of the achievement range, but that the percentages vary in each case.

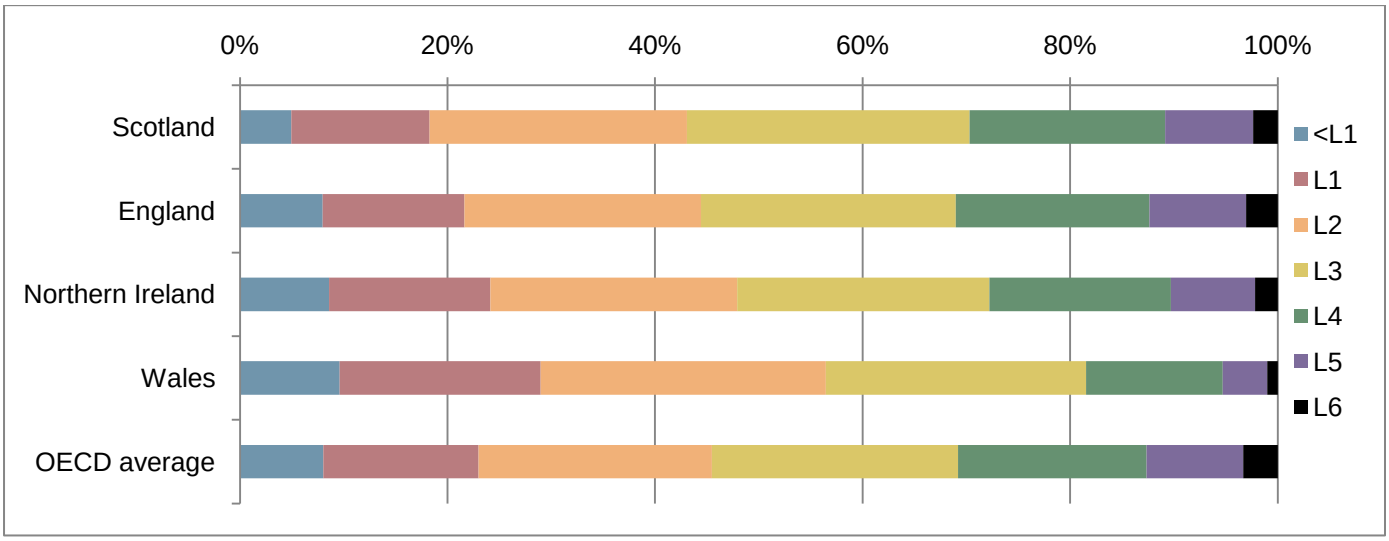
Scotland had the lowest percentage of pupils working below Level 1 in mathematics (4.9 per cent). This compares with the OECD average of 8.0 per cent. In England and Northern Ireland the proportion of pupils working at the lowest level of proficiency in mathematics was close to, or the same as, the OECD average (8 and 8.6 per cent respectively). At 9.6 per cent, Wales had the largest percentage of pupils working below Level 1, which was above the OECD average.

This pattern is highlighted when pupils at Level 1 and below are combined. Scotland had 18.3 per cent working at the lowest proficiency levels in mathematics, England 21.6 per cent, Northern Ireland 24.1 per cent and Wales 29.0 per cent. The OECD average was 23.0 per cent.

At the other end of the scale, all four parts of the UK had a lower percentage of pupils than the OECD average at Level 6 (3.3), although for England this difference from the OECD average is small and unlikely to be statistically significant.

When the top two levels (Levels 5 and 6) are combined, further differences emerge. England's proportion of high achievers (12.4 per cent) was comparable with the OECD average of 12.6 per cent. Northern Ireland and Scotland were slightly below, with 10.3 and 10.8 per cent respectively. Wales had 5.3 per cent of pupils working at the highest levels of proficiency in mathematics, a lower proportion than the other parts of the UK or the OECD average.

Figure 7.1 Percentages at PISA mathematics levels



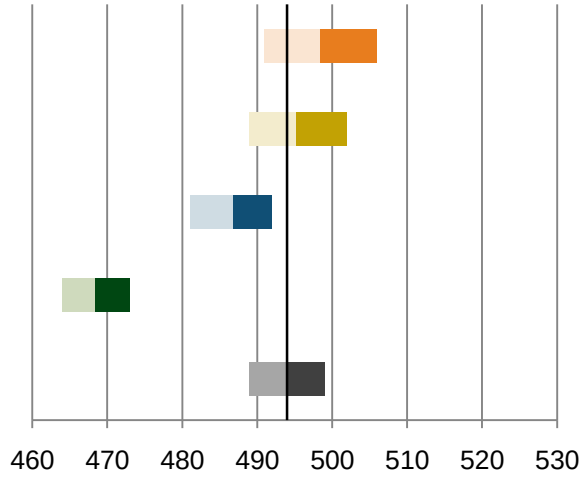
Full information on the percentages at each level is presented in Appendices B19 and B20. Level descriptions showing full details of the expected performance at each of the PISA mathematics levels are provided in Figure 2.5 in Chapter 2. It should be noted that the PISA levels are not the same as levels used in any of the educational systems of the UK.

7.1.4 Gender differences in mathematics

There were differences in the four parts of the UK in terms of the achievement of boys and girls. Table 7.10 shows the mean scores for boys and girls and highlights differences that were statistically significant.

Table 7.10 Mean scores of boys and girls in mathematics

	Overall mean score	Mean score of boys	Mean score of girls	Difference
Scotland	498	506	491	14*
England	495	502	489	13*
Northern Ireland	487	492	481	10
Wales	468	473	464	9*
OECD average	494	499	489	11*



* Statistically significant difference
Differences have been calculated using unrounded mean scores

In all cases, boys had a higher mean score than girls and, apart from in Northern Ireland, these differences were statistically significant. The differences in Scotland and England were of a similar size, whereas in Wales the difference was slightly smaller. In all parts of the UK the differences between boys and girls were not as great as those in some other countries and were similar to the OECD average.

Tables 7.11 to 7.13 show the gender differences on each of the mathematics subscales. As was the case for the overall mean score, in Northern Ireland there were no significant gender differences on the mathematics subscales. For the other three countries in the UK there were no clear patterns in terms of gender differences. In England and Wales the largest difference was on the *change and relationships* subscale, whereas for Scotland the largest difference was on the *space and shape* subscale. This is in contrast to the OECD average, where the largest difference was on the *formulate* subscale. The findings for the four constituent parts of the UK reflect what is seen across the comparison countries; that is, considerable variation in the pattern of gender differences across the subscales for mathematics.

Table 7.11 Mean scores of boys and girls in the mathematics content areas of quantity and uncertainty and data

	quantity				*uncertainty and data*			
	all	**boys**	**girls**	**diff (b-g)**	***all***	**boys**	**girls**	**diff (b-g)**
Scotland	*501*	506	495	**11***	*504*	510	498	**12***
England	*495*	502	489	**14***	*503*	511	497	**14***
Northern Ireland	*491*	495	487	**8**	*496*	501	491	**10**
Wales	*465*	470	460	**10***	*483*	487	478	**9***
OECD average	*495*	501	490	**11***	*493*	497	489	**9***

* statistically significant difference Differences have been calculated using unrounded mean scores.

Table 7.12 Mean scores of boys and girls in the mathematics content areas of change and relationships and space and shape

	change and relationships				*space and shape*			
	all	**boys**	**girls**	**diff (b-g)**	***all***	**boys**	**girls**	**diff (b-g)**
Scotland	*497*	506	487	**19***	*482*	492	471	**21***
England	*498*	506	490	**15***	*477*	484	471	**13***
Northern Ireland	*486*	491	479	**12**	*463*	467	460	**7**
Wales	*470*	476	463	**13***	*444*	449	439	**10***
OECD average	*493*	498	487	**11***	*490*	497	482	**15***

* statistically significant difference Differences have been calculated using unrounded mean scores.

Table 7.13 Mean scores of boys and girls in the mathematics process subscales

	formulate				*employ*				*interpret*			
	all	**boys**	**girls**	**diff (b-g)**	***all***	**boys**	**girls**	**diff (b-g)**	***all***	**boys**	**girls**	**diff (b-g)**
Scotland	*490*	499	481	**18***	*496*	504	488	**16***	*510*	516	504	**12***
England	*491*	497	485	**12**	*493*	499	487	**12***	*502*	509	495	**14***
Northern Ireland	*479*	484	474	**10**	*486*	491	481	**10**	*496*	500	491	**8**
Wales	*457*	463	452	**11***	*466*	470	461	**9***	*483*	489	477	**12***
OECD average	*492*	499	484	**16***	*493*	498	489	**9***	*497*	502	492	**9***

* statistically significant difference Differences have been calculated using unrounded mean scores.

7.1.5 Summary

This section has reviewed performance across the UK in mathematics. It shows that there were some significant differences in performance between the four countries of the UK. Scores overall and across the different subscales in Wales were lower than those in the rest of the UK and these differences were significant. The mean score in Northern Ireland was significantly lower than that

in Scotland, but there were no significant differences between Scotland and England, or between Northern Ireland and England.

The difference between the achievement of the highest attaining and the lowest attaining pupils in England and Northern Ireland was above the OECD average; this difference was more pronounced in England. England had a higher proportion of high scoring pupils than the rest of the UK and Scotland had the lowest proportion of low scoring pupils. Wales had a higher proportion of low attaining pupils and fewer high attaining pupils than the other parts of the UK.

In England, Scotland and Wales boys outperformed girls in mathematics. In Northern Ireland boys had a higher overall mean score than girls, but this difference was not statistically significant. The gender gaps in these countries were similar to the OECD average; however they were smaller than in many other countries.

7.2 Science

This section compares the findings outlined in Chapter 4 with the comparable findings for the other parts of the UK.

Science was a minor domain in the PISA 2012 survey.

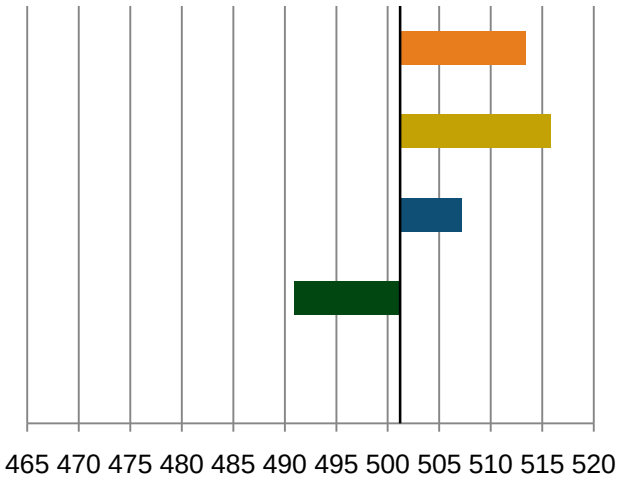
7.2.1 Mean scores in science

Table 7.14 below shows the mean scores in England, Wales, Northern Ireland and Scotland for science and indicates any significant differences between countries. Full data can be found in Appendix C2.

The highest attainment for science was in England, followed by Scotland and then Northern Ireland. However, the scores were very similar and there were no significant differences between these three countries. The lowest attainment was in Wales, where the mean score for science was significantly lower than in the rest of the UK.

Table 7.14 Mean scores for science

	Mean	**S**	**E**	**NI**	**W**	**OECD**
Scotland	513		*NS*	*NS*	*S*	*S*
England	516	*NS*		*NS*	*S*	*S*
Northern Ireland	507	*NS*	*NS*		*S*	*NS*
Wales	491	*S*	*S*	*S*		*S*
OECD average	501	*S*	*S*	*NS*	*S*	



S = significantly different *NS* = no significant difference

7.2.2 Distribution of performance in science

Table 7.15 shows the scores of pupils in each country at the 5th and the 95th percentiles, along with the OECD average score at each of these percentiles. The table indicates the range of scores in each country and also shows the difference in score points at the two percentiles. Full data can be found in Appendix C2.

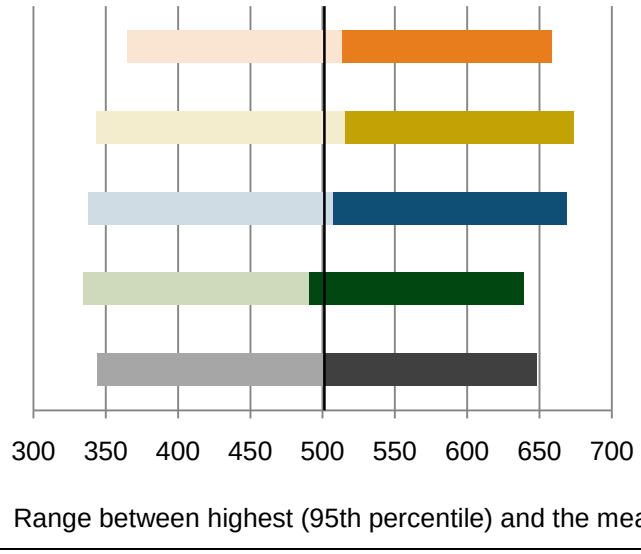
The mean score achieved by Scotland's lowest achieving pupils was 28 points above the OECD average at the 5th percentile. The means in each of the other UK countries were much closer to the OECD average. The lowest achieving pupils were in Wales, where the mean score at the 5th percentile was slightly lower than the OECD average. Northern Ireland was similar to and England slightly higher than the OECD average.

At the 95th percentile, England's highest achieving pupils had the highest mean score, 19 score points above the OECD average, followed by those in Northern Ireland (14 points above the OECD average). In Scotland the score of the highest achievers in science was similar to the OECD average, while the score of the highest achievers in Wales was 16 score points below it.

Looking at the range of performance, as shown by the difference in score points between the highest and lowest achievers, the largest gaps were in England and Northern Ireland and the smallest in Scotland, as low achievers here scored highly compared with those in the other UK countries.

Table 7.15 Scores of highest and lowest achieving pupils in science

	Lowest (5th percentile)	Highest (95th percentile)	Difference
Scotland	365	658	293
England	343	674	331
Northern Ireland	338	669	331
Wales	334	639	305
OECD average	344	648	304



Differences have been calculated using unrounded scores.

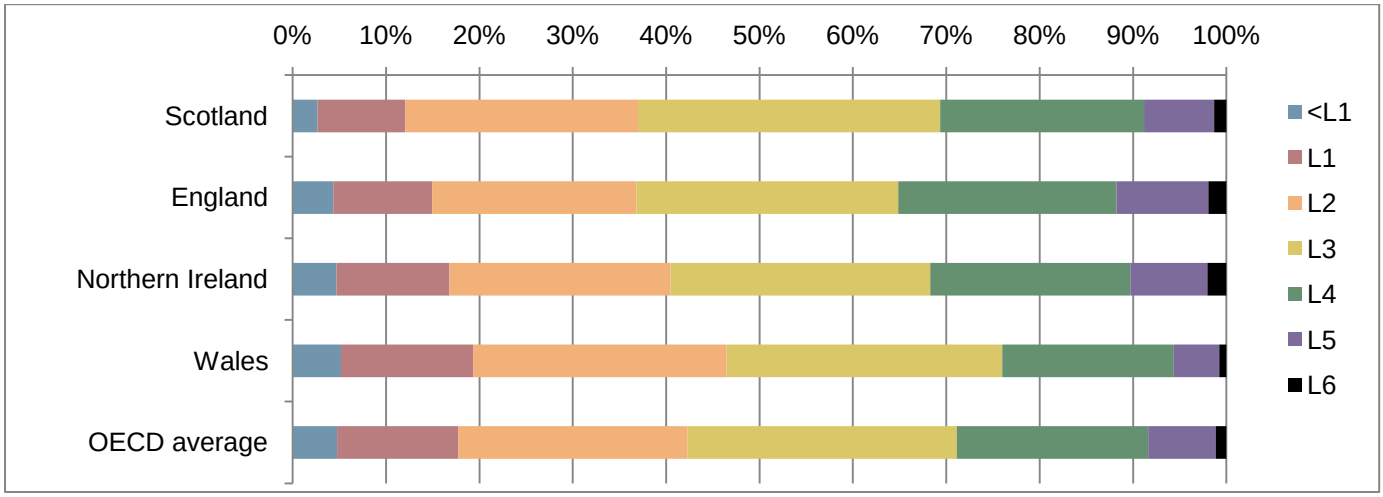
7.2.3 Percentages at each science level

Figure 7.2 shows the percentages of pupils at each of the six levels of science attainment, along with the percentages below Level 1. This indicates that all parts of the UK have some pupils at the top and bottom of the achievement range, but that the percentages vary in each case.

England had the largest percentage of pupils (11.7) at the two highest levels of attainment (Levels 5 and 6), followed by Northern Ireland (10.3); both are higher than the OECD average of 8.4 per cent at these levels. Scotland's proportion at the higher levels (8.8) is similar to the OECD average, but in Wales the proportion of high achievers was lower at 5.7 per cent.

At the other end of the scale, Scotland had the lowest proportion (12.1 per cent) of low attaining pupils at Level 1 and below for science. England had 14.9 per cent of pupils working at the lowest levels of proficiency, Northern Ireland 16.8 per cent and Wales 19.4 per cent. This compares with an OECD average of 17.8 per cent.

Figure 7.2 Percentages at PISA science levels



Full information on the percentages at each level is presented in Appendices C4 and C5.

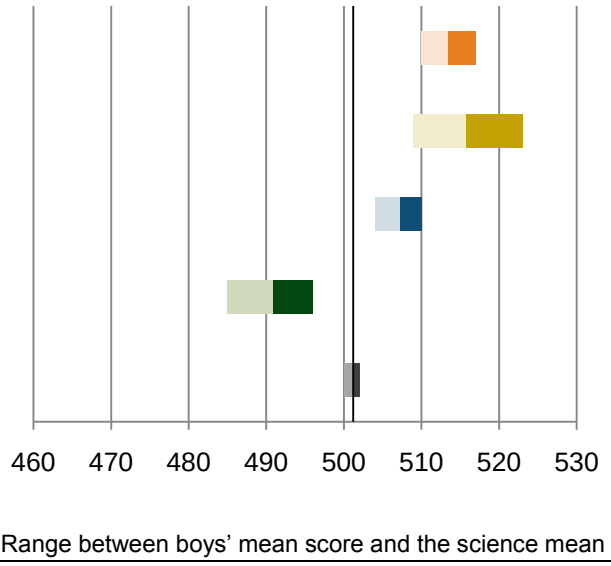
Level descriptions showing full details of the expected performance at each PISA level are in Appendix C3. It should be noted that the PISA levels are not the same as levels used in any of the educational systems of the UK.

7.2.4 Gender differences in science

Table 7.16 shows the mean scores of boys and girls, and the differences in their mean scores. Full data can be found in Appendix C2.

Table 7.16 Mean scores of boys and girls for science

	Overall mean score	Mean score of boys	Mean score of girls	Difference
Scotland	513	517	510	7*
England	516	523	509	14*
Northern Ireland	507	510	504	5
Wales	491	496	485	11*
OECD average	501	502	500	1*



* Statistically significant difference
Differences have been calculated using unrounded mean scores.

Boys' scores were higher than girls' in science in all four of the UK countries. These differences between boys and girls were statistically significant in England, Wales and Scotland, but not significantly different in Northern Ireland. In all cases the differences were larger than the OECD average. The difference between the performance of boys and girls in science was much larger in the UK than across the OECD in general, particularly in England and Wales, where boys scored 14 and 11 points higher respectively, compared with an OECD average of one score point.

7.2.5 Summary

This section has reviewed performance across the UK in science. It shows that there were some significant differences between the four countries of the UK in terms of overall attainment.

Scotland had the lowest range of attainment and the scores of their lowest achieving pupils were much higher than those in the rest of the UK or the OECD on average.

Scores in Wales were lower than those in the rest of the UK and these differences were significant. There were no significant differences between Scotland, England and Northern Ireland.

The difference between the achievement of the highest attaining and the lowest attaining pupils in England and Northern Ireland was above the OECD average. Wales had a higher proportion of low attaining pupils than the other parts of the UK and had fewer high attaining pupils.

In England, Scotland and Wales boys outperformed girls in science. In Northern Ireland boys had a higher overall mean score than girls but this difference was not statistically significant. Among other participating countries there was no clear pattern of gender difference.

The difference between the performance of boys and girls in science was much larger in the UK than across the OECD in general, particularly in England and Wales, where boys scored 14 and 11 points higher, compared with an OECD average of one point.

7.3 Reading

This section compares the findings outlined in Chapter 5 with the comparable findings for the other parts of the UK.

Reading was a minor domain in the PISA 2012 survey.

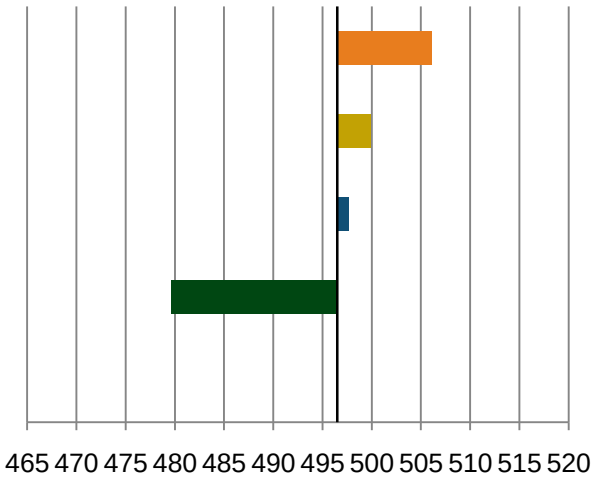
7.3.1 Mean scores for reading

Table 7.17 below shows the mean scores of England, Wales, Northern Ireland and Scotland for reading, and indicates some significant differences between the countries. Full data can be found in Appendix D2.

The mean reading scores achieved in England, Scotland and Northern Ireland were very similar, with no significant differences. The lowest attainment in reading was seen in Wales, where the mean score was significantly lower than the rest of the UK, and the OECD generally.

Table 7.17 Mean scores for reading

	Mean	S	E	NI	W	OECD
Scotland	506		*NS*	*NS*	*S*	*S*
England	500	*NS*		*NS*	*S*	*NS*
Northern Ireland	498	*NS*	*NS*		*S*	NS
Wales	480	*S*	*S*	*S*		*S*
OECD average	496	*S*	*NS*	*NS*	*S*	



S = significantly different *NS* = no significant difference

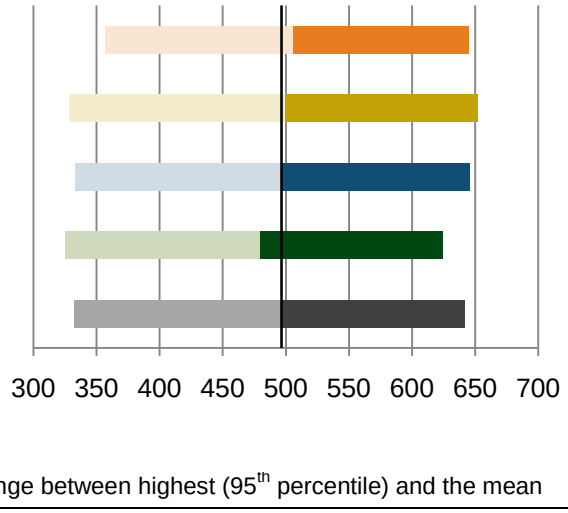
7.3.2 Distribution of performance in reading

Table 7.18 shows the scores of pupils in each country at the 5th and 95th percentiles, along with the OECD average score at each of these percentiles. The table indicates the range of scores in each country and also shows the difference in score points at the two percentiles. Full data can be found in Appendix D2.

Looking at the range of performance as shown by the difference in score points between the highest and lowest achievers, the largest performance range was in England and the smallest in Scotland.

Table 7.16 Scores of highest and lowest achieving pupils in reading

	Lowest (5th percentile)	Highest (95th percentile)	Difference
Scotland	357	645	288
England	328	652	324
Northern Ireland	333	646	313
Wales	325	624	299
OECD average	332	642	310



Differences have been calculated using unrounded scores.

Table 7.18 shows that the lowest attaining pupils in Scotland achieved higher scores than the lowest attaining pupils in England, Wales and Northern Ireland. At the 95th percentile, the highest scoring pupils were in England, followed by Northern Ireland and Scotland. The lowest scores at both percentiles were in Wales, both of which were lower than the OECD average, as was the score for the lowest achievers in England.

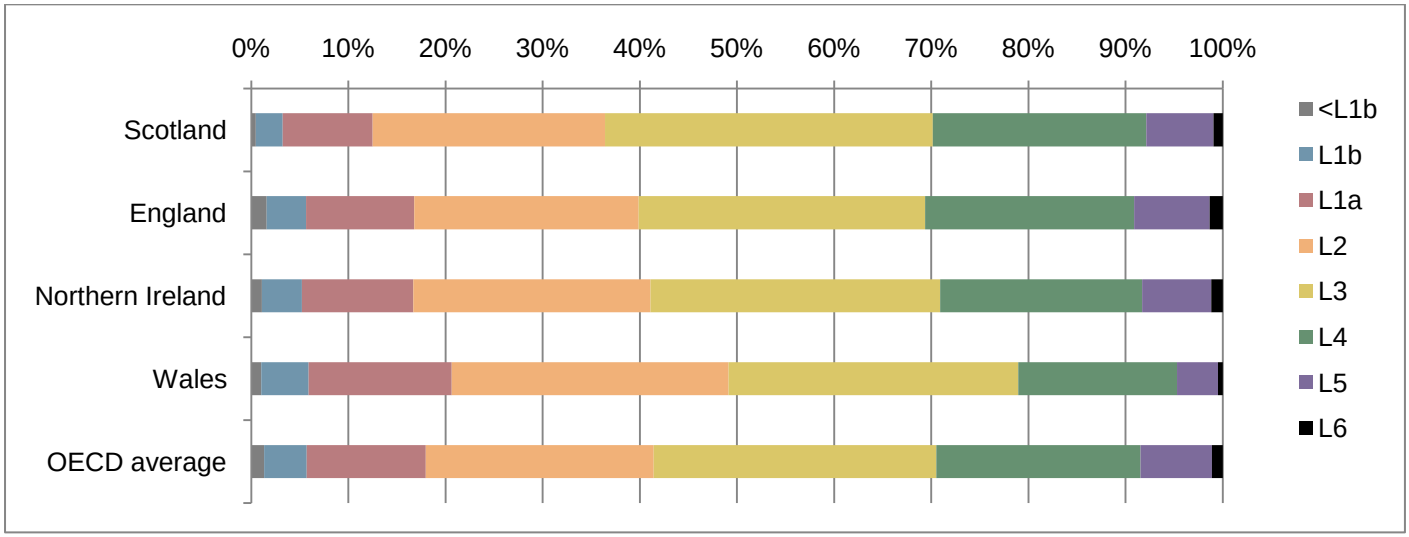
7.3.3 Percentages at each reading level

Figure 7.3 shows the percentages of pupils at each of the seven PISA levels of reading attainment, along with the percentages below Level 1b.

The information in this figure adds to that discussed above and shows that both England and Northern Ireland had a slightly higher proportion of pupils than Scotland at the top two levels (Levels 5 and 6), but also higher proportions below Level 1a. Scotland had the lowest percentage of pupils at Level 1a or below, while Wales had the lowest percentage at Levels 5 and 6. This pattern is consistent with findings from the 2006 and 2009 surveys.

Full data can be found in Appendices D4 and D5. Level descriptions showing full details of the expected performance at each PISA level are in Appendix D3. It should be noted that the PISA levels are not the same as levels used in any of the educational systems of the UK.

Figure 7.3 Percentages at PISA reading levels

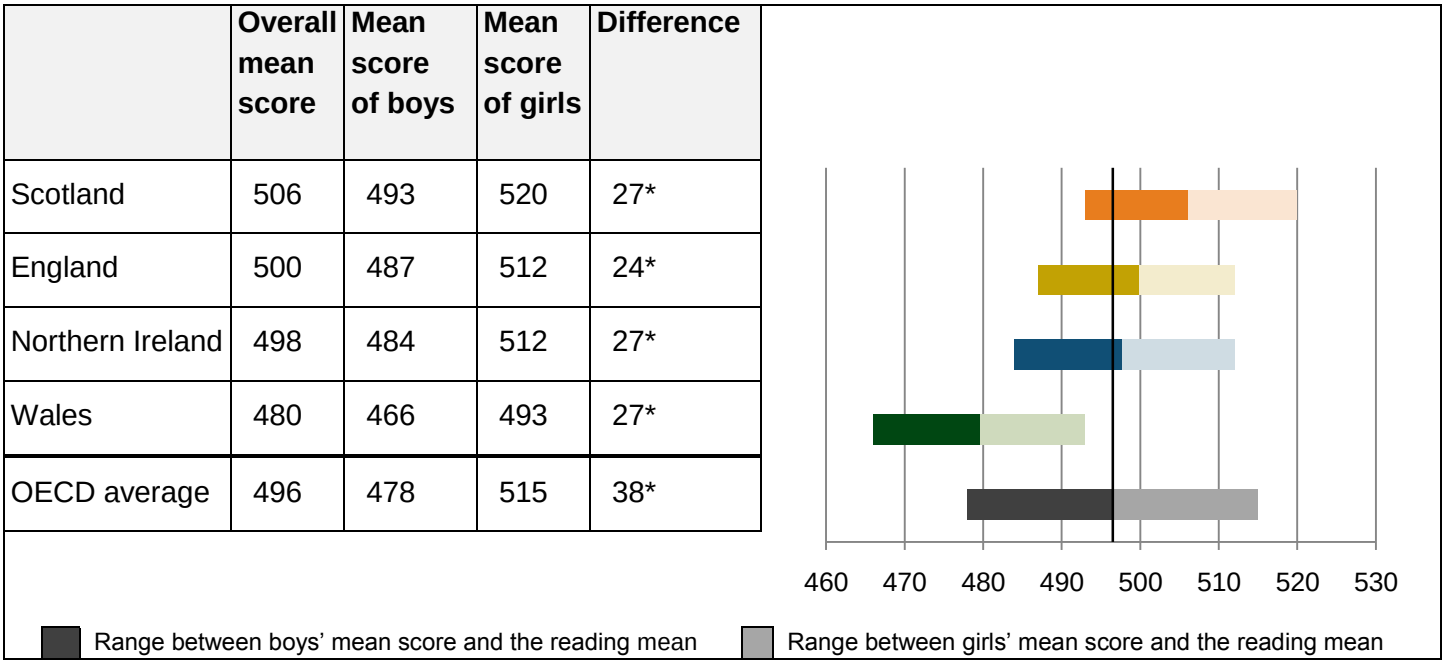


7.3.4 Gender differences in reading

Table 7.19 shows the mean scores of boys and girls, and the difference in their mean scores. Full data can be found in Appendix D2. In all constituent countries of the UK and across the OECD on average, girls had significantly higher mean scores than boys.

Table 7.19 Mean scores of boys and girls for reading

	Overall mean score	Mean score of boys	Mean score of girls	Difference
Scotland	506	493	520	27*
England	500	487	512	24*
Northern Ireland	498	484	512	27*
Wales	480	466	493	27*
OECD average	496	478	515	38*



* Statistically significant difference
Differences have been calculated using unrounded mean scores

7.3.5 Summary

This section has reviewed performance across the UK in reading. It shows that there were some significant differences between the four countries of the UK in terms of overall attainment.

Scotland had the narrowest range of attainment and the scores of their lowest achieving pupils were much higher than those in the rest of the UK or the OECD on average.

Scores in Wales were significantly lower than those in the rest of the UK and the OECD average. There were no significant differences between Scotland, England or Northern Ireland. Scotland's overall mean was significantly higher than the OECD average, while England's and Northern Ireland's were not.

The spread of achievement in England and Northern Ireland was wider than the OECD average; for Scotland and Wales the spread was narrower than the OECD average. Wales had a higher proportion of low attaining pupils than the other parts of the UK and a lower proportion of high attaining pupils.

In each of the UK countries, girls outperformed boys in reading, as they did in every participating country.

7.4 Schools and pupils

This section looks at similarities and differences in findings from the School and Student Questionnaires between England, Wales, Northern Ireland and Scotland.

7.4.1 School differences

When headteachers were asked about the management of their schools, the responses of headteachers in Scotland differed from those of headteachers in the rest of the UK. The role of school governing bodies was much smaller in Scotland, while the role of local authorities in dismissing teachers, formulating budgets and establishing assessment policies was greater. Headteachers in Scotland also had less of a role in salary matters and formulating the school budget than their colleagues in the rest of the UK.

There was some variation across UK countries in the leadership behaviours reported by headteachers. Differences greater than 30 per cent were seen for two behaviours that were asked about in the School Questionnaire; 60 per cent of headteachers in England reported that they conduct informal observations in classrooms at least once a week, while in Northern Ireland this was reported by only 13 per cent of headteachers. Weekly evaluations of staff were reported by 12 per cent of headteachers in Northern Ireland, while 44 per cent of headteachers in England said this was the case.

In England only four per cent of headteachers said that truancy hindered learning to some extent or a lot. Headteachers in Wales, Northern Ireland and Scotland reported that it was a greater problem, with the largest proportion (23 per cent) being reported by headteachers in Scotland. Headteachers in Scotland were also more likely to report problems with pupils skipping classes

(than headteachers in England and Northern Ireland) and with pupils lacking respect and disrupting classes (compared with headteachers in England).

For the question asking about issues hindering the school's capacity to provide instruction, there were a number of differences in the proportions of responses between UK countries. In particular, more issues were reported in Northern Ireland than in other parts of the UK. Most notably, headteachers in Northern Ireland reported greater shortages or inadequacy of computers for instruction (58 per cent), instructional space, e.g. classrooms (38 per cent), and school buildings and grounds (62 per cent) than headteachers in England, Scotland and Wales. Another considerable difference was seen between Scotland and the other UK countries concerning a lack of qualified teachers of subjects (other than mathematics, science or reading). In Scotland, 36 per cent of teachers said that this shortage hindered instruction in their schools; in England this was just seven per cent (with figures of 16 and 18 per cent in Wales and Northern Ireland respectively).

There were a number of differences among the UK countries in responses to questions about the purposes for which pupils in Years 10 and 11 (or equivalent) were assessed. The greatest difference was seen for the purpose of making judgements about teachers' effectiveness. While assessments were used by 63 per cent of schools in Northern Ireland for this purpose, this compared with over three quarters of schools in Wales and Scotland, and 86 per cent in England.

There were only small differences between UK countries for questions relating to headteachers' perceptions of teacher morale, discipline issues in mathematics lessons as viewed by pupils, and pupils' opinions of their relationships with their teachers.

7.4.2 Pupil differences

The amount of variation between countries in the UK was low for a number of the issues explored in the Student Questionnaire. These included: pupils' sense of belonging at school; perceived control of success in mathematics (and self-responsibility for failing in mathematics); conscientiousness and perseverance; openness to problem solving; beliefs about friends' and parents' views on mathematics; confidence in tackling mathematics problems; mathematics behaviours at school and outside of school; and views on the supportiveness of teachers.

For the questions looking at attitudes to school, there was little difference between the UK countries. One point of difference was that more pupils in Northern Ireland and Scotland than in Wales were positive about the usefulness of school; pupils in Wales were less likely to disagree with the statement "School has done little to prepare me for adult life when I leave school".

There were few differences between UK countries in the proportions of pupils saying they enjoy mathematics, or understand that it is important. The biggest difference was seen for pupils in England, who were more likely to say that they look forward to their mathematics lessons compared with pupils in Northern Ireland (52 and 42 per cent respectively).

There was little variation between countries in the measure of pupils' anxiety and self-concept in relation to mathematics. However, pupils in Northern Ireland were more likely than those in England to report that they often worry that it will be difficult for them in mathematics classes (57 per cent in Northern Ireland compared with 46 per cent in England).

When asked about instructional strategies used by teachers in their mathematics lessons, pupil responses in the different UK countries did not indicate a high level of variation. However, for the statement “The teacher gives different work to classmates who have difficulties learning and/or to those who can advance faster”, there were differences. The percentages indicate that there is less variation in the work given within classes in Northern Ireland and Wales than in Scotland and England. Pupils in England also agreed more frequently than those in Northern Ireland and in Scotland with the statement “The teacher sets clear goals for our learning”. A similar difference between England and Northern Ireland was found for the statement “The teacher tells me about how well I am doing in my mathematics class”.

7.4.2.1 Differences in pupils’ socio-economic status

The mean scores for UK countries on the PISA index of economic, social and cultural status (ESCS) all indicate that on average pupils in the PISA samples in the UK have a higher socio-economic status than the average across OECD countries (the index is set to a mean of zero across OECD countries). The means for England and Northern Ireland were both 0.29, with 0.19 for Wales and 0.13 for Scotland. Appendix E reports the mathematics scores of pupils in each quarter of the index, and shows that pupils in the top quarter of the index in Wales performed at a similar level to those in the third quarter in England.

The change in score for each unit of the index varies around the OECD average for the UK countries, as shown in Appendix E. Across the OECD, a change of one standard deviation on the ESCS Index is related to a predicted difference in score of 39 points. For England and Northern Ireland (with differences of 41 and 45 points respectively) socio-economic background is seen to have a greater effect than the average in OECD countries. In contrast, Scotland and Wales (with differences of 37 and 35 points respectively) show an effect of socio-economic background which is lower than the OECD average.

Looking at the amount of variance in scores which can be explained by socio-economic background gives a better picture of the interaction between mathematics scores and the ESCS Index. This shows the extent to which pupils in each country are able to overcome the predicted effects of socio-economic background. Across the OECD on average, 15 per cent of the variance in scores can be explained by socio-economic background. Of the UK countries, only Northern Ireland has a variance greater than the OECD average (at 17 per cent), while Wales has the lowest percentage (10 per cent). This suggests that socio-economic background has the least impact on performance in mathematics in Wales, whereas it has the biggest impact in Northern Ireland.

7.5 Summary

Across mathematics, science and reading, there were no significant differences between Scotland, England and Northern Ireland, with the exception of mathematics, where Scotland scored significantly higher than Northern Ireland. In all subjects, scores for Wales were significantly below those of other UK countries and the OECD average.

The widest spread of attainment in all three subjects was found in England. England also had the highest proportion of pupils working at Levels 5 and above, and their high achievers (at the 95th

percentile) scored more highly than those in other UK countries in all subjects. Scotland had the lowest proportion of pupils working at Level 1[5] or below in all three subjects, and their low achievers scored more highly in all subjects.

Scotland had the lowest percentage of pupils at Level 1 or below, while Wales had the lowest percentage at Levels 5 and above. This pattern is consistent with findings from the 2006 and 2009 surveys.

Gender differences followed similar patterns in each of the UK countries, except that in Northern Ireland boys did not significantly outperform girls in mathematics and science.

Mathematics

In mathematics there were some significant differences in performance between the four countries of the UK. Scores in Wales were lower and significantly different from those in the rest of the UK, and the mean score in Northern Ireland was significantly lower than that in Scotland. However, there were no significant differences between Scotland and England or between Northern Ireland and England.

The difference between the achievement of the highest attaining and the lowest attaining pupils in England and Northern Ireland was above the OECD average; this difference was more pronounced in England. Wales had a slightly higher number of low attaining pupils compared with the other parts of the UK, and had fewer high attaining pupils.

In England, Scotland and Wales boys outperformed girls in mathematics. In Northern Ireland boys had a higher overall mean score than girls, but this difference was not statistically significant. The gender gaps in these countries were similar to the OECD average; however they were smaller than in many other countries.

Science

In science there were no significant differences between England, Scotland and Northern Ireland, but the mean score in Wales was significantly lower. The spread of attainment was less in Scotland than in the other parts of the UK. Boys outperformed girls in all parts of the UK and this gender gap was statistically significant in all UK countries except Northern Ireland.

Reading

In reading there were no significant differences between England, Scotland and Northern Ireland, but the mean score in Wales was significantly lower. The spread of attainment between the highest and lowest scoring pupils was widest in England and narrowest in Scotland. Girls outperformed boys in all parts of the UK, as they did in every other country in the PISA survey.

Schools and pupils

Headteachers in England, Wales and Northern Ireland generally reported similar leadership behaviours, although more headteachers in England reported informal observations in classrooms and weekly evaluations of staff, and fewer reported these in Northern Ireland.

[5] Level 1a for reading

In terms of management, headteachers in Scotland reported greater involvement of local authorities in dismissing teachers, formulating budgets and establishing assessment policies, and less involvement of governing bodies compared with other UK countries.

Headteachers in Scotland were most likely to report that truancy hindered learning, or to report problems with pupils skipping classes or disrupting classes. Headteachers in Northern Ireland reported greater shortages or inadequacy of computers for instruction, instructional space (e.g. classrooms), and school buildings and grounds than those in England, Scotland and Wales.

In Scotland, 36 per cent of teachers reported a shortage of qualified subject teachers, other than in mathematics, science or reading; this was at least twice as many as in other UK countries.

Differences between the responses of pupils in the different UK countries were minimal. Slightly more pupils in Wales felt that school had done little to prepare them for adult life. Pupils in England were more likely to say that they looked forward to mathematics lessons. Pupils in Northern Ireland were more likely to report that they often worried about mathematics classes.

Pupil perceptions of instructional strategies indicated that pupils in England and Scotland felt their teachers were more likely to give differentiated work to classmates of different abilities than in other UK countries, and pupils in England were more likely to report that their teacher set clear learning goals.

The mean scores for UK countries on the PISA index of economic, social and cultural status (ESCS) all indicate that on average pupils in the PISA samples in the UK have a higher socio-economic status than the average across OECD countries. However, only in Northern Ireland did the figures indicate that more disadvantaged pupils have significantly less chance of performing as well as their more advantaged peers, compared with their counterparts across the OECD on average.

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Appendix A Background to the survey

The Programme for International Student Assessment (PISA) is a survey of educational achievement organised by the Organisation for Economic Co-operation and Development (OECD). The following sections outline the development of the survey, what PISA measures, how to interpret the PISA scales, how PISA is administered and detail of the PISA sample in Wales. These sections outline some of the detailed international requirements that countries must meet in order to ensure confidence in the findings.

A1 The development of the survey

The Australian Council for Educational Research (ACER) led the international consortium that designed and implemented the PISA 2012 survey on behalf of the OECD. The 2012 survey built on the experiences of the three previous cycles. By using standardised survey procedures and tests, the survey aims to collect data from around the world that can be compared despite differences in language and culture.

The framework and specification for the survey were agreed internationally by the PISA Governing Board, which comprises representatives from each participating country, and both the international consortium and participating countries submitted test questions for inclusion in the survey. After the questions were reviewed by an expert panel (convened by the international PISA consortium), countries were invited to comment on their difficulty, cultural appropriateness, and curricular and non-curricular relevance.

A field trial was carried out in every participating country in 2011 and the outcomes of this were used to finalise the contents and format of the tests and questionnaires for the main survey in 2012.

In England, Wales and Northern Ireland, pupils sat the two-hour assessment in November 2012 under test conditions, following the standardised procedures implemented by all countries. In Scotland, the PISA survey was carried out earlier in 2012. With the focus in this round on mathematics, around two-thirds of the questions were on this subject. A proportion of the questions used in the two-hour test were ones used in previous cycles. This provides continuity between cycles that can act as a measure of change. Further details on the test administration are included in A4 below.

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

A2 What PISA measures

This section briefly describes the purposes of the assessment of mathematics, science and reading in PISA 2012. Full details of the framework for the assessment of each subject are in OECD (2012).

A2.1 Mathematics

Mathematics was the main focus in the 2012 and 2003 PISA surveys.

PISA aims to assess pupils' ability to put their mathematical knowledge to functional use in different situations in adult life, rather than to assess what is taught in participating countries. Although PISA does not aim to assess mastery of a curriculum, further analysis of PISA items against the Key Stage 3 and Key Stage 4 curricula in England has shown a good match between the PISA processes and concepts in mathematics and the range of knowledge, skills and understanding in the English National Curriculum (Burdett and Sturman, 2012). It is therefore likely that, even given the differences between the Key Stage 3 and 4 curricula for mathematics in England and Wales, there will be a similar good match with the mathematics curricula followed by pupils in Wales.

PISA defines this ability as:

> *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 recognising the role that mathematics plays in the world and to make the well-founded judgements and decisions needed by constructive, engaged and reflective citizens.* (OECD, 2013)

In order to demonstrate this capacity, pupils need to have factual knowledge of mathematics, skills to carry out mathematical operations and methods, and an ability to combine these elements creatively in response to external situations.

PISA recognises the limitations of using a timed assessment in collecting information about something as complex as mathematics in this large-scale survey. It aims to tackle this by having a balanced range of questions that assess different elements of the pupil's mathematical processing ability. This is the process through which a pupil interprets a problem as mathematical and draws on his/her mathematical knowledge and skills to provide a sensible solution to the problem.

PISA prefers context-based questions which require the pupil to engage with the situation and decide how to solve the problem. Most value is placed on tasks that could be met in the real world, in which a person would authentically use mathematics and appropriate mathematical tools, such as a ruler or calculator in a paper based assessment, to solve these problems. Some more abstract questions that are purely mathematical are also included in the PISA survey.

Pupils were asked to show their responses to questions in different ways. About a third of the questions were open response which required the pupils to develop their own responses. These questions tended to assess broad mathematical constructs. A question in this category typically accepted several different responses as correct and worthy of marks. The rest of the questions were either multiple choice or simple open response questions, with approximately the same number of each. These questions, which tended to assess lower-order skills, had only one correct response. Some examples of PISA mathematics questions are included in Chapter 2.

A2.2 Science

Science was the main focus in PISA 2006 and a minor domain in 2012. It will be the main focus of PISA 2015.

The survey aims to measure not just science as it may be defined within the curriculum of participating countries, but the scientific understanding which is needed in adult life. PISA defines this as the capacity to identify questions, acquire new knowledge, explain scientific phenomena, and draw evidence-based conclusions about science-related issues (OECD, 2007). Those with this capacity also understand the characteristic features of science as a form of human knowledge and enquiry, are aware of how science and technology shape their lives and environments, and are willing and able to engage in science-related issues and with the ideas of science, as a reflective citizen. Therefore, PISA assessments measure not only scientific knowledge, but also scientific competencies and understanding of scientific contexts.

Scientific knowledge constitutes the links that aid understanding of related phenomena. In PISA, while the scientific concepts are familiar (relating to physics, chemistry, biological sciences and earth and space sciences), pupils are asked to *apply* them to the content of the test items and not simply to recall facts.

Scientific competencies are centred on the ability to acquire, interpret and act upon evidence. Three processes are identified in PISA: firstly, identifying scientific issues; secondly, explaining phenomena scientifically; and, thirdly, using scientific evidence.

Scientific contexts concern the application of scientific knowledge and the use of scientific processes. This covers personal, social and global contexts.

The science questions in PISA 2012 were of three types: open constructed response items which required pupils to write longer answers; short open response which required answers of a few words; or closed response (e.g. multiple choice). Approximately a third were of the longer open constructed type which required pupils to develop and explain their response. Such questions were generally two or three mark items. Remaining questions were worth one mark.

Although PISA does not aim to assess mastery of a curriculum, further analysis of PISA items against the Key Stage 3 and Key Stage 4 curricula in England has shown a good match between the content areas in PISA science and the range of knowledge, skills and understanding in the English National Curriculum (Burdett and Sturman, 2012). It is therefore likely that, even given the differences between the Key Stage 3 and 4 curricula for mathematics in England and Wales, there will be a similar good match with the mathematics curricula followed by pupils in Wales.

A2.3 Reading

Reading was the main focus in the first PISA study in 2000 and also in 2009. It was a minor domain in PISA 2012.

Reading in PISA focuses on the ability of pupils to use information from texts in situations which they encounter in their life. Reading in PISA is defined as ‘understanding, using, reflecting on and

engaging with written texts, in order to achieve one's goals, to develop one's knowledge and potential, and to participate in society' (OECD, 2009).

The concept of reading in PISA is defined by three dimensions: the format of the reading material, the type of reading task or reading aspects, and the situation or the use for which the text was constructed.

The first dimension, the text format, divides the reading material or texts into continuous and non-continuous texts. Continuous texts are typically composed of sentences which are organised into paragraphs. Non-continuous texts are not organised in this type of linear format and may require, for example, interpretation of tables or diagrams. Such texts require a different reading approach to that needed with continuous text.

The second dimension is defined by three reading aspects: retrieval of information, interpretation of texts and reflection on and evaluation of texts. Tasks in which pupils retrieve information involve finding single or multiple pieces of information in a text. In interpretation tasks pupils are required to construct meaning and draw inferences from written information. The third type of task requires pupils to reflect on and evaluate texts. In these tasks pupils need to relate information in a text to their prior knowledge, ideas and experiences.

The third dimension is that of situation or context. The texts in the PISA assessment are categorised according to their content and the intended purpose of the text. There are four situations: reading for private use (personal), reading for public use, reading for work (occupational) and reading for education.

The reading items included in PISA 2012 were of three types: open constructed response, short open response or closed response (e.g. multiple choice). Approximately half the questions were of the open response type, while the rest were closed response. Approximately a third were of the longer open constructed type which required pupils to develop and explain their response. Such questions were generally two or three mark questions. The remainder of the open response questions required only short answers and were generally worth one mark.

A3 What the scales mean

PISA uses proficiency levels to describe the types of skills that are likely to demonstrate and the tasks that they are able to complete. Test questions that focus on simple tasks are categorised at lower levels whereas those that are more demanding are categorised at higher levels. The question categorisations are based on both quantitative and qualitative analysis, taking into account question difficulty as well as expert views on the specific cognitive demands of each individual question. All PISA questions have been categorised in this manner.

Pupils described as being at a particular level not only demonstrate the knowledge and skills associated with that level but also the proficiencies required at lower levels. For example, all pupils proficient at Level 3 are also considered to be proficient at Levels 1 and 2. The proficiency level of a pupil is the highest level at which they answer more than half of the questions correctly.

The table below shows the score points for each level in each subject.

	Below Level 1	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
Science	below 335	335-410	410-484	484-559	559-633	633-708	above 708
Mathematics	below 358	358-420	420-482	482-545	545-607	607-669	above 669

	Below Level 1b	Level 1b	Level 1a	Level 2	Level 3	Level 4	Level 5	Level 6
Reading	below 262	262-335	335-407	407-480	480-553	553-626	626-698	above 698

Every cycle of PISA focuses on a different subject and no one pupil is presented with all PISA questions. Instead, statistical methods are used to estimate the likelihood that the pupil would be able to answer correctly the questions which they have not actually done.

The mean score for each subject scale was set to 500 among OECD countries in the PISA cycle when the subject was the major domain for the first time. Thus, the reading scale was set to 500 in its first year in 2000. Similarly the mathematics scale was set to 500 in 2003 and the science scale was set to a mean of 500 in 2006. The method by which these scales are derived is explained further in Appendix F and in the PISA Technical Report (OECD, forthcoming).

As with any repeated measurement that uses samples, the mean will vary slightly from year to year without necessarily indicating any real change in the global level of skills.

A4 Survey administration

The survey administration was carried out internationally on behalf of OECD by a consortium led by the Australian Council for Educational Research (ACER). The consortium worked with the PISA National Centre within each country, through the National Project Manager (NPM). For England, Wales, Northern Ireland and Scotland, the National Foundation for Educational Research (NFER) was the PISA National Centre.

National Centres were responsible for making local adaptations to instruments and manuals and for translation where necessary. NFER made appropriate adaptations to all PISA instruments and accompanying documentation. All materials were translated into Welsh and pupils in Wales were asked to choose the language in which they wished to complete tests and questionnaires.

National Centres were also responsible for supplying the information necessary for sampling to be carried out. School samples were selected by the PISA consortium, while pupil samples within schools were selected by NFER using software supplied by the consortium.

Test items were organised into 13 test booklets with items repeated across booklets. Approximately half the total test items assessed mathematics while the others were divided

between science and reading. All pupils were assessed in mathematics, which was the main focus of PISA 2012. Random sub-samples of pupils were also assessed in science and reading, with approximately 70 per cent of pupils taking the tests in each. In addition to the tests, there was a School Questionnaire and three Student Questionnaires. Each pupil completed one questionnaire. All Student Questionnaires contained a set of core questions that asked about pupils' backgrounds. The remaining questions were divided into three sets of questions and pupils answered two of the three sets of questions.

Tests and questionnaires were generally administered to pupils in a single session, with a two-hour period for the tests and approximately half an hour, in addition, for completion of the Student Questionnaire. The total length of a survey session was around three and a half hours. The survey was administered by test administrators employed and trained by NFER. In England, students that participated in the problem solving assessment usually returned for one hour in the afternoon to carry out the assessment. Results for English pupils in problem solving will be reported in 2014.

In each country participating in PISA, the minimum number of participating schools was 150, and the minimum number of pupils 4500. In the case of the UK and of some other countries, the number exceeds this. In some cases this is due to the need to over-sample some parts of the country. In the case of the UK, for example, larger samples were drawn for Wales, Scotland and Northern Ireland than would be required for a representative UK sample. This was to make it possible to provide separate PISA results for the four constituent parts of the UK. In some countries additional samples were drawn for other purposes, for example to enable reporting of results for a sub-group such as a separate language group. In very small countries with less than 150 schools the survey was completed as a school census with all secondary schools included.

The pupils included in the PISA survey are generally described as '15-year-olds', but there is a small amount of leeway in this definition depending on the time of testing. In the case of England, Wales and Northern Ireland the sample consisted of pupils aged from 15 years and two months to 16 years and two months at the beginning of the testing period.

Countries were required to carry out the survey during a six-week period between March and August 2012. However England, Wales and Northern Ireland were permitted to test outside this period because of the problems for schools caused by the overlap with the GCSE preparation and examination period. In England, Wales and Northern Ireland the survey took place in November-December 2012.

A5 The PISA sample

Countries must follow strict international sampling procedures to ensure comparability of countries' samples. The first stage of sampling was agreement of the school stratification variables to be used for each country. Table A.1 shows the variables which were used for sampling of schools in Wales for PISA 2012. The sample in Wales contained Welsh and English medium schools and bilingual schools, although language of instruction was not a stratification variable.

Table A.1 Stratification variables for Wales

Variables	Levels
School type	Maintained Independent
Region	North Powys and South West South East
Gender	Male Female Mixed
GCSE school performance	Band 1 (lowest) Band 2 Band 3 Band 4 Band 5 (highest) Band not known
Local Authority	Varies within region

Countries are allowed to exempt schools from the sampling frame if it is expected that the majority of pupils would not be eligible to participate in PISA (see below). In Wales, special schools and Pupil Referral Units were excluded from the sampling frame on this basis.

Following agreement of the sampling plan and the establishment of population estimates in the age group, the list of all eligible schools and their populations was sent to the PISA consortium. The consortium carried out the school sampling then sent the list of selected schools back to NFER.

The schools which had been selected in the sample were then invited to participate, and those which agreed were asked to supply details of all pupils who would be in Year 11 at the time of the beginning of the PISA survey period in November 2012. In addition they were asked to supply details of any who were born in the relevant period but were in other year groups.

When the pupil data was obtained from schools, the Keyquest software supplied by the PISA consortium was used to randomly select 30 pupils within each school from those who met the PISA age definition.

The PISA study has strict sampling requirements regarding both the participation rate which is acceptable and the replacement of schools which decline. Within each country three separate samples are selected, the first being the main sample and the other two back-up samples. In the back-up samples each school is a replacement for a specific school in the main sample. So, if a main sample school declines to participate, there are two other schools which can be used as replacements for that school. In Wales, for PISA 2012, there were 153 schools in the main sample, with 84 and 46 schools in the first and second back-up samples respectively. There were fewer schools in the back-up samples than the main sample due to the overall number of secondary schools in Wales.

School recruitment is an issue to which particular attention has to be given in PISA. According to the PISA sampling rules, an acceptable school response in the main sample is 85 per cent. If the response from the main sample meets this percentage, replacement of non-participating schools is not necessary. If the response from the main sample is below this percentage, but above 65 per cent, it is still possible to achieve an acceptable response by using replacement schools from the back-up samples. However, the target then moves upwards – for example, with a main sample response of 70 per cent, the after-replacement target is 94 per cent.

There is also a response rate requirement for pupils within each school. It is possible for pupils to be excluded from participation and not counted within the total because they have special needs such that they could not participate, because they have limited language skills, or because they are no longer at the school. The remaining pupils are deemed eligible for PISA participation, and at least 50 per cent of these must participate for the school to be counted as a participating school.

In Wales, a total of 137 schools and 3305 pupils took part in PISA 2012. The required pupil participation rate, of at least 50 per cent of sampled pupils, was achieved in all but one participating school. The final response rate for Wales was 91.8 per cent of main sample schools and 93.9 per cent after replacement.

The international response rate for the United Kingdom is calculated based on the results for England, Wales, Northern Ireland and Scotland, with weighting according to the population in each country as well as school size. The school response rate for the England, Wales and Northern Ireland combined sample was 78.5 per cent of main sample schools, and 88.3 per cent after replacement. This fully met the PISA 2012 participation requirements and so NFER were not required to carry out non-response bias analysis.

The final response requirement was for the total number of participating pupils, and the target here was for 80 per cent overall. Across England, Wales and Northern Ireland, the pupil response rate target was met with a final weighted response rate of 86.4 per cent. A total of 397 schools and 9714 pupils participated across England, Wales and Northern Ireland. This is a good response rate and means that UK findings are regarded by PISA as fully comparable with other countries.

The tests and questionnaires were available in both English and Welsh. Translation was completed by professional translators, supervised by NFER's Swansea Office. Research staff in the Swansea Office are experienced in the development of Welsh language tests and curriculum materials so were able to ensure that the correct subject-specific terminology was used. The translated materials were trialled by researchers from NFER's Swansea Office with pupils in a small number of schools to check understanding of the translated versions. Schools in Wales were asked if they wished each pupil to complete the survey in English or in Welsh. Pupils were not allowed to choose mixed languages – each pupil had to complete the survey in just one language. Twenty-two schools opted for Welsh for some or all of their pupils. In 14 of these schools all pupils completed Welsh versions while in the other eight schools both language versions were used. The total number of pupils completing the Welsh versions was 381. Schools were sent both language versions of the School Questionnaire. The Welsh language version of the School Questionnaire was completed by 15 schools.

Appendix B

B1 Significant differences in mean scores on the mathematics scale

	Mean score		
	Mean	S.E.	Significance
Shanghai-China	613	(3.3)	^
Singapore	573	(1.3)	^
Hong Kong-China	561	(3.2)	^
Chinese Taipei	560	(3.3)	^
Korea	554	(4.6)	^
Macao-China	538	(1.0)	^
Japan	536	(3.6)	^
Liechtenstein	535	(4.0)	^
Switzerland	531	(3.0)	^
Netherlands*	523	(3.5)	^
Estonia*	521	(2.0)	^
Finland*	519	(1.9)	^
Canada	518	(1.8)	^
Poland*	518	(3.6)	^
Belgium*	515	(2.1)	^
Germany*	514	(2.9)	^
Vietnam	511	(4.8)	^
Austria*	506	(2.7)	^
Australia	504	(1.6)	^
Republic of Ireland*	501	(2.2)	^
Slovenia*	501	(1.2)	^
Denmark*	500	(2.3)	^
New Zealand	500	(2.2)	^
Czech Republic*	499	(2.9)	^
Scotland	498	(2.6)	^
England	495	(3.9)	^
France*	495	(2.5)	^
United Kingdom*	494	(3.3)	
OECD Average	**494**	**(0.5)**	^
Iceland	493	(1.7)	^
*Latvia**	491	(2.8)	^
Luxembourg*	490	(1.1)	^
Norway	489	(2.7)	^
Portugal*	487	(3.8)	^
Northern Ireland	487	(3.1)	^
Italy*	485	(2.0)	^
Spain*	484	(1.9)	^
Russian Federation	482	(3.0)	^
Slovak Republic*	482	(3.4)	^
United States	481	(3.6)	^
*Lithuania**	479	(2.6)	^
Sweden*	478	(2.3)	^
Hungary*	477	(3.2)	^
*Croatia**	471	(3.5)	*NS*
Wales	468	(2.2)	
Israel	466	(4.7)	*NS*
Greece*	453	(2.5)	v
Serbia	449	(3.4)	v
Turkey	448	(4.8)	v
*Romania**	445	(3.8)	v
Cyprus	440	(1.1)	v
*Bulgaria**	439	(4.0)	v
United Arab Emirates	434	(2.4)	v
Kazakhstan	432	(3.0)	v
Chile	423	(3.1)	v
Mexico	413	(1.4)	v

Key

^ significantly higher

NS no significant difference

v significantly lower

OECD countries (not italicised)
Countries not in OECD (italicised)
*EU countries

14 countries with scores below 430 omitted
Simple comparison P-value = 5%

B2 Mean score, variation and gender differences in student performance on the mathematics scale

	All students				Gender differences						Percentiles												Difference between 5th and 95th percentile
	Mean score		Standard deviation		Boys		Girls		Difference (B - G)		5th		10th		25th		75th		90th		95th		
	Mean score	S.E.	S.D.	S.E.	Mean score	S.E.	Mean score	S.E.	Score dif.	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	
Australia	504	(1.6)	96	(1.2)	510	(2.4)	498	(2.0)	**12**	(3.1)	348	(2.9)	382	(2.3)	437	(2.0)	571	(2.3)	630	(3.0)	663	(3.4)	315
Austria*	506	(2.7)	92	(1.7)	517	(3.9)	494	(3.3)	**22**	(4.9)	353	(4.1)	384	(3.9)	440	(3.2)	572	(3.5)	624	(3.8)	654	(4.3)	301
Belgium*	515	(2.1)	102	(1.4)	518	(2.8)	512	(2.6)	6	(3.4)	343	(4.5)	378	(4.0)	444	(3.1)	589	(2.4)	646	(2.7)	677	(2.9)	335
*Bulgaria**	439	(4.0)	94	(2.2)	438	(4.7)	440	(4.2)	-2	(4.1)	290	(5.7)	320	(4.8)	372	(4.7)	503	(5.2)	565	(5.6)	597	(6.2)	307
Canada	518	(1.8)	89	(0.8)	523	(2.1)	513	(2.1)	**10**	(2.0)	370	(2.8)	402	(2.4)	457	(2.1)	580	(2.3)	633	(2.3)	663	(2.7)	293
Chile	423	(3.1)	81	(1.5)	436	(3.8)	411	(3.1)	**25**	(3.6)	299	(4.1)	323	(3.7)	365	(3.5)	476	(4.2)	532	(4.2)	563	(4.1)	264
Chinese Taipei	560	(3.3)	116	(1.9)	563	(5.4)	557	(5.7)	5	(8.9)	363	(5.6)	402	(4.8)	478	(4.8)	645	(3.4)	703	(4.9)	738	(5.1)	375
*Croatia**	471	(3.5)	88	(2.5)	477	(4.4)	465	(3.7)	**12**	(4.1)	334	(4.2)	360	(3.3)	408	(3.6)	531	(4.5)	589	(7.3)	623	(8.8)	289
Cyprus	440	(1.1)	93	(0.8)	440	(1.5)	440	(1.6)	0	(2.2)	287	(2.8)	320	(2.6)	376	(1.6)	503	(2.0)	561	(2.1)	595	(3.1)	308
Czech Republic*	499	(2.9)	95	(1.6)	505	(3.7)	493	(3.6)	**12**	(4.6)	344	(6.4)	377	(4.9)	432	(3.9)	566	(3.3)	621	(3.6)	653	(4.0)	309
Denmark*	500	(2.3)	82	(1.3)	507	(2.9)	493	(2.3)	**14**	(2.3)	363	(4.6)	393	(4.0)	444	(3.3)	556	(2.7)	607	(3.1)	635	(4.2)	272
England	495	(3.9)	96	(2.0)	502	(5.0)	489	(4.5)	**13**	(5.5)	335	(5.7)	370	(6.0)	430	(5.0)	562	(4.2)	618	(4.9)	652	(5.8)	316
Estonia*	521	(2.0)	81	(1.2)	523	(2.6)	518	(2.2)	**5**	(2.6)	389	(3.5)	417	(3.0)	465	(2.7)	576	(2.7)	626	(3.2)	657	(4.1)	268
Finland*	519	(1.9)	85	(1.2)	517	(2.6)	520	(2.2)	-3	(2.9)	376	(4.5)	409	(3.3)	463	(2.5)	577	(2.4)	629	(3.1)	657	(3.2)	281
France*	495	(2.5)	97	(1.7)	499	(3.4)	491	(2.5)	**9**	(3.4)	330	(5.0)	365	(4.7)	429	(2.7)	565	(3.4)	621	(3.5)	652	(3.7)	321
Germany*	514	(2.9)	96	(1.6)	520	(3.0)	507	(3.4)	**14**	(2.8)	353	(5.4)	385	(4.7)	447	(3.6)	583	(3.6)	637	(3.8)	667	(4.1)	314
Greece*	453	(2.5)	88	(1.3)	457	(3.3)	449	(2.6)	**8**	(3.2)	308	(4.6)	338	(3.8)	393	(3.6)	513	(2.8)	567	(3.1)	597	(3.7)	289
Hong Kong-China	561	(3.2)	96	(1.9)	568	(4.6)	553	(3.9)	**15**	(5.7)	391	(5.9)	430	(6.2)	499	(4.7)	629	(3.5)	679	(4.2)	709	(4.3)	318
Hungary*	477	(3.2)	94	(2.4)	482	(3.7)	473	(3.6)	**9**	(3.7)	327	(4.6)	358	(4.2)	411	(3.3)	540	(4.8)	603	(6.4)	637	(7.9)	310
Iceland	493	(1.7)	92	(1.3)	490	(2.3)	496	(2.3)	**-6**	(3.0)	339	(4.1)	372	(2.8)	431	(2.6)	557	(3.0)	612	(3.3)	641	(3.7)	302
Israel	466	(4.7)	105	(1.8)	472	(7.8)	461	(3.5)	12	(7.6)	292	(7.3)	328	(5.7)	393	(5.1)	541	(5.3)	603	(6.0)	639	(6.1)	347
Italy*	485	(2.0)	93	(1.1)	494	(2.4)	476	(2.2)	**18**	(2.5)	333	(2.6)	366	(2.2)	421	(2.3)	550	(2.7)	607	(3.0)	639	(3.4)	306
Japan	536	(3.6)	94	(2.2)	545	(4.6)	527	(3.6)	**18**	(4.3)	377	(6.1)	415	(5.1)	473	(4.2)	603	(4.4)	657	(5.1)	686	(5.5)	309
Kazakhstan	432	(3.0)	71	(1.8)	432	(3.4)	432	(3.3)	0	(2.9)	319	(3.1)	343	(2.5)	383	(2.8)	478	(4.4)	527	(5.7)	554	(6.0)	235
Korea	554	(4.6)	99	(2.1)	562	(5.8)	544	(5.1)	**18**	(6.2)	386	(7.4)	425	(5.8)	486	(4.8)	624	(5.1)	679	(6.0)	710	(7.5)	323
*Latvia**	491	(2.8)	82	(1.5)	489	(3.4)	493	(3.2)	-4	(3.6)	360	(4.8)	387	(4.4)	434	(3.3)	546	(3.8)	597	(3.7)	626	(4.6)	266
Liechtenstein	535	(4.0)	95	(3.7)	546	(6.0)	523	(5.8)	**23**	(8.8)	370	(16.8)	403	(11.2)	470	(8.0)	606	(5.0)	656	(9.2)	680	(12.5)	310
*Lithuania**	479	(2.6)	89	(1.4)	479	(2.8)	479	(3.0)	0	(2.4)	334	(3.9)	364	(3.5)	418	(3.1)	540	(3.3)	596	(3.5)	627	(4.0)	293
Luxembourg*	490	(1.1)	95	(0.9)	502	(1.5)	477	(1.4)	**25**	(2.0)	334	(3.3)	363	(3.0)	422	(1.5)	558	(1.6)	613	(2.2)	644	(2.3)	310
Macao-China	538	(1.0)	94	(0.9)	540	(1.4)	537	(1.3)	3	(1.9)	379	(3.9)	415	(2.8)	476	(1.7)	605	(1.7)	657	(2.3)	685	(2.4)	306
Mexico	413	(1.4)	74	(0.7)	420	(1.6)	406	(1.4)	**14**	(1.2)	295	(1.8)	320	(1.9)	362	(1.6)	462	(1.7)	510	(2.0)	539	(2.1)	245
Netherlands*	523	(3.5)	92	(2.1)	528	(3.6)	518	(3.9)	**10**	(2.8)	367	(4.8)	397	(5.5)	457	(5.1)	591	(4.3)	638	(3.7)	665	(4.0)	297
New Zealand	500	(2.2)	100	(1.2)	507	(3.2)	492	(2.9)	**15**	(4.3)	340	(4.9)	371	(3.6)	428	(3.2)	570	(2.8)	632	(3.0)	665	(4.4)	325
Northern Ireland	487	(3.1)	93	(2.0)	492	(5.0)	481	(5.4)	10	(8.3)	332	(6.9)	365	(6.2)	422	(3.7)	553	(4.2)	609	(5.5)	638	(3.9)	305
Norway	489	(2.7)	90	(1.3)	490	(2.8)	488	(3.4)	2	(3.0)	341	(5.1)	373	(3.9)	428	(2.9)	552	(3.3)	604	(3.4)	638	(5.1)	297
Poland*	518	(3.6)	90	(1.9)	520	(4.3)	516	(3.8)	4	(3.4)	373	(3.9)	402	(2.8)	454	(3.3)	580	(4.9)	636	(6.0)	669	(7.1)	296
Portugal*	487	(3.8)	94	(1.4)	493	(4.1)	481	(3.9)	**11**	(2.5)	333	(4.5)	363	(4.2)	421	(5.0)	554	(4.3)	610	(3.9)	640	(4.1)	307
Republic of Ireland*	501	(2.2)	85	(1.3)	509	(3.3)	494	(2.6)	**15**	(3.8)	359	(5.0)	391	(3.6)	445	(3.2)	559	(2.4)	610	(2.5)	640	(3.2)	280
*Romania**	445	(3.8)	81	(2.2)	447	(4.3)	443	(4.0)	4	(3.6)	322	(3.9)	344	(3.5)	386	(3.8)	497	(4.8)	553	(6.1)	588	(7.4)	266
Russian Federation	482	(3.0)	86	(1.6)	481	(3.7)	483	(3.1)	-2	(3.0)	341	(4.2)	371	(3.9)	423	(3.1)	540	(3.6)	595	(4.7)	626	(5.3)	285
Scotland	498	(2.6)	86	(1.6)	506	(3.0)	491	(3.2)	**14**	(3.3)	358	(4.8)	388	(4.7)	439	(3.5)	558	(3.1)	611	(3.7)	640	(4.8)	282
Serbia	449	(3.4)	91	(2.2)	453	(4.1)	444	(3.7)	**9**	(3.9)	306	(4.4)	335	(4.1)	386	(3.7)	508	(4.4)	567	(5.8)	603	(6.7)	296
Shanghai-China	613	(3.3)	101	(2.3)	616	(4.0)	610	(3.4)	6	(3.3)	435	(6.9)	475	(5.8)	546	(4.4)	685	(3.5)	737	(3.5)	765	(5.6)	331
Singapore	573	(1.3)	105	(0.9)	572	(1.9)	575	(1.8)	-3	(2.5)	393	(3.6)	432	(3.6)	501	(2.7)	650	(1.9)	707	(2.3)	737	(2.5)	344
Slovak Republic*	482	(3.4)	101	(2.5)	486	(4.1)	477	(4.1)	**9**	(4.5)	314	(6.7)	352	(6.2)	413	(4.2)	553	(4.7)	613	(5.3)	647	(6.7)	334
Slovenia*	501	(1.2)	92	(1.0)	503	(2.0)	499	(2.0)	3	(3.1)	357	(3.9)	384	(2.5)	434	(2.0)	566	(2.1)	624	(2.9)	655	(4.3)	298
Spain*	484	(1.9)	88	(0.7)	492	(2.4)	476	(2.0)	**16**	(2.2)	339	(3.6)	370	(3.1)	424	(2.6)	546	(2.1)	597	(2.4)	626	(2.0)	287
Sweden*	478	(2.3)	92	(1.3)	477	(3.0)	480	(2.4)	-3	(3.0)	329	(4.4)	360	(3.5)	415	(2.9)	543	(2.7)	596	(2.9)	627	(3.6)	298
Switzerland	531	(3.0)	94	(1.5)	537	(3.5)	524	(3.1)	**13**	(2.7)	374	(3.9)	408	(3.3)	466	(3.4)	597	(3.6)	651	(4.3)	681	(4.7)	308
Turkey	448	(4.8)	91	(3.1)	452	(5.1)	444	(5.7)	8	(4.7)	313	(4.3)	339	(3.3)	382	(3.6)	507	(8.0)	577	(9.7)	614	(9.4)	302
United Arab Emirates	434	(2.4)	90	(1.2)	432	(3.8)	436	(3.0)	-5	(4.7)	297	(3.0)	323	(2.5)	370	(2.9)	494	(2.9)	555	(3.9)	591	(3.4)	294
United Kingdom*	494	(3.3)	95	(1.7)	500	(4.2)	488	(3.8)	**12**	(4.7)	336	(4.7)	371	(5.0)	429	(4.2)	560	(3.7)	616	(4.1)	648	(5.1)	312
United States	481	(3.6)	90	(1.3)	484	(3.8)	479	(3.9)	5	(2.8)	339	(4.2)	368	(3.9)	418	(3.7)	543	(4.4)	600	(4.3)	634	(5.4)	295
Vietnam	511	(4.8)	86	(2.7)	517	(5.6)	507	(4.7)	**10**	(3.0)	371	(8.1)	401	(7.4)	454	(5.3)	568	(5.5)	623	(6.8)	654	(7.9)	283
Wales	468	(2.2)	85	(1.3)	473	(2.6)	464	(2.9)	**9**	(3.4)	329	(4.9)	360	(3.6)	410	(2.7)	526	(2.8)	578	(3.4)	610	(5.0)	281
OECD average	494	(0.5)	92	(0.3)	499	(0.6)	489	(0.5)	**11**	(0.6)	343	(0.8)	375	(0.7)	430	(0.6)	558	(0.6)	614	(0.7)	645	(0.8)	301

OECD countries (not italicised) *Countries not in OECD (italicised)* *EU countries
14 countries with scores below 430 omitted
Note: Values that are statistically significant are indicated in bold

B3 Mean performance on each mathematics content category sub-scale

	Mean Score									
	Overall mathematics score		Quantity		Uncertainty and data		Change and relationships		Space and shape	
	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.
Australia	504	(1.6)	500	(1.9)	508	(1.5)	509	(1.7)	497	(1.8)
Austria*	506	(2.7)	510	(2.9)	499	(2.7)	506	(3.4)	501	(3.1)
Belgium*	515	(2.1)	519	(2.0)	508	(2.5)	513	(2.6)	509	(2.4)
*Bulgaria**	439	(4.0)	443	(4.3)	432	(3.9)	434	(4.5)	442	(4.3)
Canada	518	(1.8)	515	(2.2)	516	(1.8)	525	(2.0)	510	(2.1)
Chile	423	(3.1)	421	(3.3)	430	(2.9)	411	(3.5)	419	(3.2)
Chinese Taipei	560	(3.3)	543	(3.1)	549	(3.2)	561	(3.5)	592	(3.8)
*Croatia**	471	(3.5)	480	(3.7)	468	(3.5)	468	(4.2)	460	(3.9)
Cyprus	440	(1.1)	439	(1.1)	442	(1.1)	440	(1.2)	436	(1.1)
Czech Republic*	499	(2.9)	505	(3.0)	488	(2.8)	499	(3.5)	499	(3.4)
Denmark*	500	(2.3)	502	(2.4)	505	(2.4)	494	(2.7)	497	(2.5)
England	495	(3.9)	495	(4.5)	503	(3.6)	498	(4.1)	477	(4.1)
Estonia*	521	(2.0)	525	(2.2)	510	(2.0)	530	(2.3)	513	(2.5)
Finland*	519	(1.9)	527	(1.9)	519	(2.4)	520	(2.6)	507	(2.1)
France*	495	(2.5)	496	(2.6)	492	(2.7)	497	(2.7)	489	(2.7)
Germany*	514	(2.9)	517	(3.1)	509	(3.0)	516	(3.8)	507	(3.2)
Greece*	453	(2.5)	455	(3.0)	460	(2.6)	446	(3.2)	436	(2.6)
Hong Kong-China	561	(3.2)	566	(3.4)	553	(3.0)	564	(3.6)	567	(4.0)
Hungary*	477	(3.2)	476	(3.4)	476	(3.3)	481	(3.5)	474	(3.4)
Iceland	493	(1.7)	496	(1.9)	496	(1.8)	487	(1.9)	489	(1.5)
Israel	466	(4.7)	480	(5.2)	465	(4.7)	462	(5.3)	449	(4.8)
Italy*	485	(2.0)	491	(2.0)	482	(2.0)	477	(2.1)	487	(2.5)
Japan	536	(3.6)	518	(3.6)	528	(3.5)	542	(4.0)	558	(3.7)
Kazakhstan	432	(3.0)	428	(3.5)	414	(2.6)	433	(3.2)	450	(3.9)
Korea	554	(4.6)	537	(4.1)	538	(4.2)	559	(5.2)	573	(5.2)
*Latvia**	491	(2.8)	487	(2.9)	478	(2.8)	496	(3.4)	497	(3.3)
Liechtenstein	535	(4.0)	538	(4.1)	526	(3.9)	542	(4.0)	539	(4.5)
*Lithuania**	479	(2.6)	483	(2.8)	474	(2.7)	479	(3.2)	472	(3.1)
Luxembourg*	490	(1.1)	495	(1.0)	483	(1.0)	488	(1.0)	486	(1.0)
Macao-China	538	(1.0)	531	(1.1)	525	(1.1)	542	(1.2)	558	(1.4)
Mexico	413	(1.4)	414	(1.5)	413	(1.2)	405	(1.6)	413	(1.6)
Netherlands*	523	(3.5)	532	(3.6)	532	(3.8)	518	(3.9)	507	(3.5)
New Zealand	500	(2.2)	499	(2.4)	506	(2.6)	501	(2.5)	491	(2.4)
Northern Ireland	487	(3.1)	491	(3.7)	496	(3.4)	486	(3.8)	463	(3.6)
Norway	489	(2.7)	492	(2.9)	497	(3.0)	478	(3.1)	480	(3.3)
Poland*	518	(3.6)	519	(3.5)	517	(3.5)	509	(4.1)	524	(4.2)
Portugal*	487	(3.8)	481	(4.0)	486	(3.8)	486	(4.1)	491	(4.2)
Republic of Ireland*	501	(2.2)	505	(2.6)	509	(2.5)	501	(2.6)	478	(2.6)
*Romania**	445	(3.8)	443	(4.5)	437	(3.3)	446	(3.9)	447	(4.1)
Russian Federation	482	(3.0)	478	(3.0)	463	(3.3)	491	(3.4)	496	(3.9)
Scotland	498	(2.6)	501	(3.0)	504	(2.6)	497	(3.1)	482	(3.1)
Serbia	449	(3.4)	456	(3.7)	448	(3.3)	442	(4.1)	446	(3.9)
Shanghai-China	613	(3.3)	591	(3.2)	592	(3.0)	624	(3.6)	649	(3.6)
Singapore	573	(1.3)	569	(1.2)	559	(1.5)	580	(1.5)	580	(1.5)
Slovak Republic*	482	(3.4)	486	(3.5)	472	(3.6)	474	(4.0)	490	(4.1)
Slovenia*	501	(1.2)	504	(1.2)	496	(1.2)	499	(1.1)	503	(1.4)
Spain*	484	(1.9)	491	(2.3)	487	(2.3)	482	(2.0)	477	(2.0)
Sweden*	478	(2.3)	482	(2.5)	483	(2.5)	469	(2.8)	469	(2.5)
Switzerland	531	(3.0)	531	(3.1)	522	(3.2)	530	(3.4)	544	(3.1)
Turkey	448	(4.8)	442	(5.0)	447	(4.6)	448	(5.0)	443	(5.5)
United Arab Emirates	434	(2.4)	431	(2.7)	432	(2.4)	442	(2.6)	425	(2.4)
United Kingdom*	494	(3.3)	494	(3.8)	502	(3.0)	496	(3.4)	475	(3.5)
United States	481	(3.6)	478	(3.9)	488	(3.5)	488	(3.5)	463	(4.0)
Vietnam	511	(4.8)	509	(5.5)	519	(4.5)	509	(5.1)	507	(5.1)
Wales	468	(2.2)	465	(2.3)	483	(2.7)	470	(2.5)	444	(2.6)
OECD average	494	(0.5)	495	(0.5)	493	(0.5)	493	(0.6)	490	(0.5)

	Difference from overall mean			
	Quantity	Uncertainty and data	Change and relationships	Space and shape
Australia	-4	4	5	-8
Austria*	5	-7	1	-5
Belgium*	4	-7	-1	-6
*Bulgaria**	4	-7	-4	3
Canada	-3	-2	7	-8
Chile	-1	8	-12	-4
Chinese Taipei	-16	-11	1	32
*Croatia**	9	-3	-3	-11
Cyprus	-1	3	0	-3
Czech Republic*	6	-11	0	0
Denmark*	2	5	-6	-3
England	0	8	3	-18
Estonia*	4	-10	9	-8
Finland*	8	0	2	-12
France*	1	-3	2	-6
Germany*	4	-5	2	-6
Greece*	2	7	-7	-17
Hong Kong-China	4	-8	3	6
Hungary*	-2	-1	4	-3
Iceland	4	3	-6	-4
Israel	13	-1	-4	-17
Italy*	5	-3	-9	2
Japan	-18	-8	6	21
Kazakhstan	-4	-18	1	18
Korea	-16	-16	5	19
*Latvia**	-3	-12	6	6
Liechtenstein	3	-9	7	4
*Lithuania**	4	-5	0	-7
Luxembourg*	5	-7	-2	-3
Macao-China	-8	-13	4	20
Mexico	0	0	-9	-1
Netherlands*	9	9	-5	-16
New Zealand	-1	6	1	-9
Northern Ireland	4	9	-1	-23
Norway	3	7	-12	-10
Poland*	1	-1	-8	7
Portugal*	-6	-1	-1	4
Republic of Ireland*	4	7	0	-24
*Romania**	-1	-8	1	3
Russian Federation	-4	-19	9	14
Scotland	2	6	-2	-17
Serbia	7	-1	-7	-3
Shanghai-China	-22	-21	11	36
Singapore	-5	-14	7	6
Slovak Republic*	5	-10	-7	8
Slovenia*	3	-5	-2	2
Spain*	7	2	-3	-7
Sweden*	3	4	-9	-10
Switzerland	0	-9	-1	13
Turkey	-6	-1	0	-5
United Arab Emirates	-3	-2	8	-9
United Kingdom*	0	8	2	-19
United States	-4	7	7	-18
Vietnam	-2	8	-2	-4
Wales	-4	14	1	-25
OECD average	1	-1	-1	-4

OECD countries (not italicised)
14 countries with scores below 430 omitted

Countries not in OECD (italicised)

*EU countries

B4 Mean performance on each mathematics process sub-scale

	Mean Score							
	Overall mathematics score		Formulate		Employ		Interpret	
	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.
Australia	504	(1.6)	498	(1.9)	500	(1.7)	514	(1.7)
Austria*	506	(2.7)	499	(3.2)	510	(2.5)	509	(3.3)
Belgium*	515	(2.1)	512	(2.4)	516	(2.1)	513	(2.4)
*Bulgaria**	439	(4.0)	437	(4.2)	439	(4.1)	441	(4.2)
Canada	518	(1.8)	516	(2.2)	517	(1.9)	521	(2.0)
Chile	423	(3.1)	420	(3.2)	416	(3.3)	433	(3.1)
Chinese Taipei	560	(3.3)	578	(4.0)	549	(3.1)	549	(3.0)
*Croatia**	471	(3.5)	453	(4.0)	478	(3.7)	477	(3.5)
Cyprus	440	(1.1)	437	(1.2)	443	(1.1)	436	(1.3)
Czech Republic*	499	(2.9)	495	(3.4)	504	(2.9)	494	(3.0)
Denmark*	500	(2.3)	502	(2.4)	495	(2.4)	508	(2.5)
England	495	(3.9)	491	(4.4)	493	(3.6)	502	(4.2)
Estonia*	521	(2.0)	517	(2.3)	524	(2.1)	513	(2.1)
Finland*	519	(1.9)	519	(2.4)	516	(1.8)	528	(2.2)
France*	495	(2.5)	483	(2.8)	496	(2.3)	511	(2.5)
Germany*	514	(2.9)	511	(3.4)	516	(2.8)	517	(3.2)
Greece*	453	(2.5)	448	(2.3)	449	(2.7)	467	(3.1)
Hong Kong-China	561	(3.2)	568	(3.7)	558	(3.1)	551	(3.4)
Hungary*	477	(3.2)	469	(3.6)	481	(3.2)	477	(3.1)
Iceland	493	(1.7)	500	(1.7)	490	(1.6)	492	(1.9)
Israel	466	(4.7)	465	(4.7)	469	(4.6)	462	(5.2)
Italy*	485	(2.0)	475	(2.2)	485	(2.1)	498	(2.1)
Japan	536	(3.6)	554	(4.2)	530	(3.5)	531	(3.5)
Kazakhstan	432	(3.0)	442	(3.8)	433	(3.2)	420	(2.6)
Korea	554	(4.6)	562	(5.1)	553	(4.3)	540	(4.2)
*Latvia**	491	(2.8)	488	(3.0)	495	(2.8)	486	(3.0)
Liechtenstein	535	(4.0)	535	(4.4)	536	(3.7)	540	(4.1)
*Lithuania**	479	(2.6)	477	(3.1)	482	(2.7)	471	(2.8)
Luxembourg*	490	(1.1)	482	(1.0)	493	(0.9)	495	(1.1)
Macao-China	538	(1.0)	545	(1.4)	536	(1.1)	530	(1.0)
Mexico	413	(1.4)	409	(1.7)	413	(1.4)	413	(1.3)
Netherlands*	523	(3.5)	527	(3.8)	518	(3.4)	526	(3.6)
New Zealand	500	(2.2)	496	(2.5)	495	(2.2)	511	(2.5)
Northern Ireland	487	(3.1)	479	(3.8)	486	(3.1)	496	(3.5)
Norway	489	(2.7)	489	(3.1)	486	(2.7)	499	(3.1)
Poland*	518	(3.6)	516	(4.2)	519	(3.5)	515	(3.5)
Portugal*	487	(3.8)	479	(4.3)	489	(3.7)	490	(4.0)
Republic of Ireland*	501	(2.2)	492	(2.4)	502	(2.4)	507	(2.5)
*Romania**	445	(3.8)	445	(4.1)	446	(4.1)	438	(3.1)
Russian Federation	482	(3.0)	481	(3.6)	487	(3.1)	471	(2.9)
Scotland	498	(2.6)	490	(3.3)	496	(2.8)	510	(2.7)
Serbia	449	(3.4)	447	(3.8)	451	(3.4)	445	(3.4)
Shanghai-China	613	(3.3)	624	(4.1)	613	(3.0)	579	(2.9)
Singapore	573	(1.3)	582	(1.6)	574	(1.2)	555	(1.4)
Slovak Republic*	482	(3.4)	480	(4.1)	C	(3.4)	473	(3.3)
Slovenia*	501	(1.2)	492	(1.5)	505	(1.2)	498	(1.4)
Spain*	484	(1.9)	477	(2.2)	481	(2.0)	495	(2.2)
Sweden*	478	(2.3)	479	(2.7)	474	(2.5)	485	(2.4)
Switzerland	531	(3.0)	538	(3.1)	529	(2.9)	529	(3.4)
Turkey	448	(4.8)	449	(5.2)	448	(5.0)	446	(4.6)
United Arab Emirates	434	(2.4)	426	(2.7)	440	(2.4)	428	(2.4)
United Kingdom*	494	(3.3)	489	(3.7)	492	(3.1)	501	(3.5)
United States	481	(3.6)	475	(4.1)	480	(3.5)	489	(3.9)
Vietnam	511	(4.8)	497	(5.1)	523	(5.1)	497	(4.5)
Wales	468	(2.2)	457	(2.4)	466	(2.2)	483	(2.6)
OECD average	494	(0.5)	492	(0.5)	493	(0.5)	497	(0.5)

	Difference from overall mean		
	Formulate	Employ	Interpret
Australia	-6	-4	10
Austria*	-6	4	3
Belgium*	-2	1	-2
*Bulgaria**	-2	0	2
Canada	-2	-2	3
Chile	-3	-6	10
Chinese Taipei	19	-11	-11
*Croatia**	-19	6	6
Cyprus	-3	3	-4
Czech Republic*	-4	5	-5
Denmark*	2	-5	8
England	-5	-2	6
Estonia*	-3	4	-8
Finland*	0	-3	9
France*	-12	1	16
Germany*	-3	2	3
Greece*	-5	-4	14
Hong Kong-China	7	-3	-10
Hungary*	-8	4	0
Iceland	7	-3	0
Israel	-2	2	-5
Italy*	-10	0	13
Japan	18	-6	-5
Kazakhstan	10	1	-12
Korea	8	-1	-14
*Latvia**	-3	5	-4
Liechtenstein	0	1	5
*Lithuania**	-1	3	-8
Luxembourg*	-8	3	5
Macao-China	7	-2	-9
Mexico	-4	0	0
Netherlands*	4	-4	3
New Zealand	-4	-5	11
Northern Ireland	-7	-1	9
Norway	0	-3	9
Poland*	-2	1	-3
Portugal*	-8	2	3
Republic of Ireland*	-9	1	5
*Romania**	0	1	-6
Russian Federation	-1	5	-11
Scotland	-9	-3	11
Serbia	-2	2	-3
Shanghai-China	12	0	-34
Singapore	8	1	-18
Slovak Republic*	-1	4	-8
Slovenia*	-9	4	-3
Spain*	-8	-3	11
Sweden*	1	-4	7
Switzerland	7	-2	-2
Turkey	1	0	-2
United Arab Emirates	-8	6	-6
United Kingdom*	-5	-2	7
United States	-6	-1	8
Vietnam	-14	12	-15
Wales	-11	-3	15
OECD average	-2	-1	3

OECD countries (not italicised)
14 countries with scores below 430 omitted

Countries not in OECD (italicised)

*EU countries

B5 Mean score, variation and gender differences in student performance on the mathematics sub-scale quantity

	All students				Gender differences						Percentiles												Difference between 5th and 95th percentile
	Mean score		Standard deviation		Boys		Girls		Difference (B - G)		5th		10th		25th		75th		90th		95th		
	Mean	S.E.	S.D.	S.E.	Mean score	S.E.	Mean score	S.E.	Score dif.	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	
Australia	500	(1.9)	104	(1.3)	505	(2.7)	495	(2.2)	**10**	(3.1)	330	(2.8)	367	(2.2)	429	(2.0)	572	(2.7)	634	(3.1)	669	(3.5)	339
Austria*	510	(2.9)	91	(1.7)	519	(3.6)	502	(3.8)	**17**	(4.8)	358	(5.1)	391	(3.9)	446	(3.8)	576	(3.6)	627	(3.9)	656	(5.3)	298
Belgium*	519	(2.0)	104	(1.4)	524	(2.8)	513	(2.5)	**11**	(3.4)	341	(4.6)	381	(4.0)	447	(3.1)	594	(2.5)	650	(2.4)	681	(2.5)	340
*Bulgaria**	443	(4.3)	102	(2.8)	442	(5.1)	443	(4.7)	-1	(4.6)	280	(7.1)	313	(5.6)	373	(4.5)	513	(5.7)	576	(5.8)	612	(8.3)	332
Canada	515	(2.2)	99	(1.0)	520	(2.5)	511	(2.4)	**9**	(2.3)	349	(3.0)	386	(3.1)	448	(2.3)	585	(2.6)	643	(3.1)	676	(3.2)	327
Chile	421	(3.3)	90	(1.6)	433	(4.0)	411	(3.4)	**22**	(3.6)	280	(4.4)	310	(4.2)	359	(4.0)	482	(4.2)	541	(4.0)	575	(4.3)	296
Chinese Taipei	543	(3.1)	108	(1.8)	548	(4.8)	540	(5.0)	8	(7.5)	357	(5.9)	396	(5.1)	470	(4.6)	622	(3.2)	677	(3.1)	707	(3.5)	350
*Croatia**	480	(3.7)	93	(2.5)	488	(4.6)	472	(4.0)	**15**	(4.5)	332	(4.3)	363	(3.8)	414	(3.5)	543	(5.3)	603	(7.4)	637	(8.3)	305
Cyprus	439	(1.1)	100	(1.1)	439	(1.8)	438	(1.8)	1	(2.7)	276	(3.0)	310	(2.5)	370	(2.1)	508	(3.3)	568	(2.4)	604	(3.4)	329
Czech Republic*	505	(3.0)	101	(2.0)	510	(3.5)	500	(4.0)	**10**	(4.5)	336	(6.5)	373	(5.8)	438	(4.4)	576	(3.5)	633	(3.6)	668	(4.5)	333
Denmark*	502	(2.4)	91	(1.3)	510	(3.2)	495	(2.4)	**15**	(3.0)	354	(4.3)	387	(3.8)	441	(2.9)	565	(2.9)	619	(3.7)	648	(3.2)	295
England	495	(4.5)	103	(2.2)	502	(5.7)	489	(4.8)	**14**	(5.6)	324	(8.9)	361	(8.0)	425	(6.5)	569	(4.3)	627	(4.2)	661	(4.6)	337
Estonia*	525	(2.2)	86	(1.2)	528	(2.6)	521	(2.5)	**7**	(2.6)	382	(4.6)	415	(3.2)	466	(2.8)	583	(2.6)	636	(3.3)	667	(4.4)	285
Finland*	527	(1.9)	87	(1.0)	525	(2.6)	528	(2.1)	-3	(2.8)	382	(4.0)	415	(2.9)	469	(2.5)	586	(2.3)	638	(3.3)	669	(3.8)	287
France*	496	(2.6)	103	(1.8)	501	(3.7)	492	(2.7)	**9**	(3.8)	324	(6.0)	362	(4.9)	425	(2.9)	570	(3.1)	628	(3.6)	661	(4.5)	337
Germany*	517	(3.1)	100	(1.9)	524	(3.3)	510	(3.6)	**14**	(2.9)	348	(6.4)	384	(5.1)	449	(4.0)	588	(3.4)	643	(4.1)	674	(4.2)	325
Greece*	455	(3.0)	97	(1.6)	461	(4.0)	450	(3.1)	**10**	(3.8)	295	(5.0)	330	(4.4)	388	(4.0)	523	(3.4)	579	(3.7)	613	(4.6)	318
Hong Kong-China	566	(3.4)	101	(2.0)	570	(4.4)	561	(4.2)	9	(5.1)	383	(7.5)	430	(6.0)	501	(4.9)	637	(3.4)	688	(4.2)	718	(3.6)	335
Hungary*	476	(3.4)	99	(2.2)	480	(3.8)	472	(3.9)	**8**	(3.8)	314	(5.9)	350	(4.3)	406	(4.0)	545	(5.0)	606	(6.5)	641	(5.9)	327
Iceland	496	(1.9)	102	(1.5)	494	(2.6)	499	(2.5)	-5	(3.4)	322	(4.9)	362	(4.7)	429	(2.5)	567	(3.2)	627	(3.6)	661	(3.3)	339
Israel	480	(5.2)	116	(2.1)	486	(8.6)	473	(3.8)	13	(8.2)	284	(9.1)	327	(6.2)	398	(6.1)	563	(5.9)	629	(6.1)	667	(6.5)	383
Italy*	491	(2.0)	101	(1.0)	499	(2.5)	482	(2.3)	**17**	(2.7)	321	(3.2)	360	(2.7)	423	(2.2)	561	(2.5)	619	(2.6)	652	(2.8)	331
Japan	518	(3.6)	94	(2.2)	527	(4.5)	508	(3.5)	**19**	(4.0)	359	(7.4)	395	(5.2)	456	(4.2)	584	(4.0)	638	(4.2)	670	(4.7)	311
Kazakhstan	428	(3.5)	79	(2.1)	429	(3.7)	427	(4.1)	2	(3.5)	305	(3.4)	331	(3.0)	373	(2.8)	479	(5.0)	533	(6.3)	564	(6.9)	259
Korea	537	(4.1)	94	(2.0)	543	(5.0)	531	(5.0)	**12**	(5.9)	377	(7.1)	416	(6.1)	477	(4.6)	604	(4.3)	654	(4.9)	682	(6.1)	305
*Latvia**	487	(2.9)	84	(1.5)	487	(3.5)	487	(3.3)	0	(3.5)	350	(6.3)	381	(4.3)	430	(3.2)	546	(3.5)	596	(4.0)	624	(4.3)	275
Liechtenstein	538	(4.1)	100	(3.6)	548	(6.3)	527	(6.4)	**22**	(9.7)	364	(13.9)	398	(13.3)	467	(8.5)	615	(6.0)	660	(9.9)	686	(10.9)	322
*Lithuania**	483	(2.8)	93	(1.4)	484	(3.1)	482	(3.2)	3	(2.8)	331	(4.5)	363	(4.2)	420	(3.6)	547	(3.4)	605	(3.7)	637	(4.6)	306
Luxembourg*	495	(1.0)	100	(0.9)	506	(1.5)	483	(1.3)	**23**	(2.0)	326	(3.8)	362	(2.9)	424	(2.0)	567	(1.6)	623	(2.2)	656	(2.9)	330
Macao-China	531	(1.1)	92	(1.0)	533	(1.5)	528	(1.4)	**5**	(1.9)	375	(2.8)	411	(2.7)	469	(1.9)	595	(1.8)	646	(1.9)	675	(3.6)	300
Mexico	414	(1.5)	87	(0.9)	422	(1.7)	406	(1.7)	**16**	(1.4)	271	(2.8)	304	(2.2)	355	(1.7)	472	(1.9)	526	(2.2)	559	(2.3)	288
Netherlands*	532	(3.6)	97	(2.3)	537	(3.8)	527	(4.0)	**10**	(3.1)	365	(7.0)	398	(6.0)	463	(5.0)	604	(3.7)	653	(3.1)	682	(3.4)	317
New Zealand	499	(2.4)	103	(1.3)	506	(3.3)	492	(3.1)	**14**	(4.4)	331	(4.3)	365	(3.9)	426	(3.3)	572	(2.8)	634	(3.4)	667	(4.1)	337
Northern Ireland	491	(3.7)	100	(2.6)	495	(5.6)	487	(5.9)	8	(8.8)	324	(6.4)	360	(5.4)	422	(5.4)	561	(4.9)	620	(5.3)	653	(7.7)	328
Norway	492	(2.9)	95	(1.6)	494	(3.0)	491	(3.5)	3	(3.2)	335	(6.1)	372	(4.5)	429	(3.5)	556	(3.2)	613	(3.5)	648	(4.4)	313
Poland*	519	(3.5)	89	(1.6)	521	(4.1)	516	(3.7)	5	(3.4)	375	(4.4)	406	(3.8)	457	(3.5)	579	(4.5)	634	(5.3)	664	(6.6)	289
Portugal*	481	(4.0)	96	(1.5)	487	(4.4)	475	(4.1)	**12**	(2.6)	321	(5.7)	355	(5.8)	415	(4.9)	550	(4.2)	604	(3.9)	636	(4.2)	315
Republic of Ireland*	505	(2.6)	92	(1.4)	512	(3.7)	498	(3.0)	**14**	(4.4)	350	(4.6)	386	(4.6)	443	(3.2)	569	(3.0)	624	(3.1)	653	(3.6)	303
*Romania**	443	(4.5)	94	(2.5)	444	(5.2)	442	(4.8)	2	(4.3)	298	(5.0)	327	(4.7)	376	(4.6)	505	(5.6)	567	(7.2)	605	(7.6)	307
Russian Federation	478	(3.0)	93	(1.6)	478	(3.5)	478	(3.2)	0	(3.2)	326	(4.9)	360	(3.9)	417	(3.7)	540	(4.2)	598	(5.0)	632	(5.8)	306
Scotland	501	(3.0)	92	(1.7)	506	(3.5)	495	(3.5)	**11**	(3.4)	348	(6.4)	383	(5.7)	438	(4.4)	565	(3.5)	620	(3.7)	650	(5.3)	302
Serbia	456	(3.7)	97	(2.6)	460	(4.3)	452	(4.3)	8	(4.4)	303	(6.0)	334	(4.9)	390	(4.4)	521	(4.6)	582	(5.6)	619	(8.4)	317
Shanghai-China	591	(3.2)	98	(2.4)	596	(3.8)	586	(3.5)	**9**	(3.3)	419	(7.2)	460	(5.8)	528	(4.5)	658	(3.2)	710	(4.2)	741	(6.3)	322
Singapore	569	(1.2)	104	(0.9)	566	(1.8)	572	(1.7)	**-6**	(2.4)	390	(3.5)	428	(2.9)	500	(1.9)	642	(2.1)	699	(2.2)	731	(3.6)	341
Slovak Republic*	486	(3.5)	105	(2.2)	492	(4.1)	481	(4.2)	**11**	(4.5)	312	(7.9)	350	(5.8)	414	(4.8)	560	(4.3)	621	(4.2)	658	(5.3)	346
Slovenia*	504	(1.2)	94	(1.0)	508	(1.8)	500	(2.1)	**7**	(3.0)	351	(3.9)	382	(2.4)	438	(2.3)	570	(2.1)	629	(2.7)	661	(3.8)	310
Spain*	491	(2.3)	101	(1.0)	501	(2.7)	481	(2.4)	**20**	(2.3)	321	(3.8)	360	(4.0)	423	(3.3)	562	(2.2)	618	(2.0)	651	(2.9)	330
Sweden*	482	(2.5)	97	(1.3)	478	(3.1)	485	(2.9)	**-7**	(3.2)	320	(4.9)	357	(4.0)	417	(3.2)	549	(3.1)	607	(3.1)	639	(3.9)	320
Switzerland	531	(3.1)	96	(1.4)	536	(3.8)	526	(3.0)	**10**	(3.0)	369	(4.5)	404	(3.3)	467	(3.3)	598	(3.8)	652	(4.8)	684	(4.5)	315
Turkey	442	(5.0)	97	(3.0)	449	(5.5)	435	(5.7)	**14**	(5.1)	295	(5.0)	324	(4.0)	373	(4.0)	506	(8.0)	576	(9.3)	613	(8.6)	319
United Arab Emirates	431	(2.7)	101	(1.2)	428	(4.3)	434	(3.5)	-7	(5.5)	273	(2.8)	304	(3.2)	360	(3.0)	500	(3.6)	567	(4.0)	603	(3.9)	330
United Kingdom*	494	(3.8)	102	(1.9)	501	(4.8)	488	(4.1)	**13**	(4.7)	325	(7.2)	362	(6.4)	424	(5.5)	567	(3.9)	625	(3.7)	658	(4.3)	334
United States	478	(3.9)	99	(1.7)	481	(4.3)	475	(4.1)	6	(3.1)	322	(5.5)	354	(5.5)	408	(4.0)	545	(4.9)	610	(5.1)	646	(5.5)	325
Vietnam	509	(5.5)	93	(2.7)	512	(6.2)	506	(5.4)	**6**	(3.0)	354	(9.4)	391	(8.5)	446	(5.8)	571	(6.1)	629	(6.7)	662	(8.5)	308
Wales	465	(2.3)	92	(1.3)	470	(2.8)	460	(2.9)	**10**	(3.3)	313	(4.8)	346	(3.9)	402	(3.1)	527	(2.5)	582	(3.6)	615	(4.1)	302
OECD average	495	(0.5)	97	(0.3)	501	(0.6)	490	(0.6)	**11**	(3.0)	334	(0.9)	369	(0.8)	429	(0.6)	563	(0.6)	620	(0.7)	653	(0.8)	320

OECD countries (not italicised) *Countries not in OECD (italicised)* *EU countries
14 countries with scores below 430 omitted
Note: Values that are statistically significant are indicated in bold

B6 Mean score, variation and gender differences in student performance on the mathematics sub-scale uncertainty and data

	All students				Gender differences						Percentiles												Difference between 5th and 95th percentile
	Mean score		Standard deviation		Boys		Girls		Difference (B - G)		5th		10th		25th		75th		90th		95th		
	Mean	S.E.	S.D.	S.E.	Mean score	S.E.	Mean score	S.E.	Score dif.	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	
Australia	508	(1.5)	97	(1.1)	511	(2.3)	504	(1.9)	**7**	(3.0)	349	(2.5)	384	(2.2)	441	(1.8)	575	(2.0)	633	(2.7)	666	(3.1)	316
Austria*	499	(2.7)	95	(1.9)	508	(3.6)	489	(3.6)	**18**	(4.7)	339	(7.0)	374	(4.8)	433	(3.8)	567	(3.0)	618	(3.1)	647	(3.9)	308
Belgium*	508	(2.5)	110	(2.3)	511	(3.2)	504	(2.9)	**7**	(3.5)	323	(7.8)	366	(5.4)	435	(3.3)	585	(2.8)	647	(3.4)	681	(3.2)	358
*Bulgaria**	432	(3.9)	90	(2.4)	430	(4.7)	433	(4.2)	-3	(4.4)	285	(6.7)	318	(5.4)	370	(4.3)	493	(4.7)	549	(5.5)	581	(6.3)	296
Canada	516	(1.8)	90	(0.9)	521	(2.2)	512	(2.0)	**9**	(2.1)	367	(2.9)	401	(2.4)	456	(2.4)	579	(2.3)	632	(2.5)	661	(2.6)	294
Chile	430	(2.9)	76	(1.4)	440	(3.6)	421	(2.8)	**19**	(3.1)	309	(3.9)	335	(3.4)	378	(3.1)	481	(3.6)	531	(4.0)	561	(4.1)	252
Chinese Taipei	549	(3.2)	108	(2.1)	550	(5.0)	547	(5.6)	4	(8.5)	364	(6.6)	403	(4.7)	474	(4.4)	627	(3.9)	684	(4.6)	716	(4.7)	352
*Croatia**	468	(3.5)	90	(2.2)	473	(4.3)	463	(3.8)	**10**	(4.2)	324	(4.3)	354	(3.4)	405	(3.4)	529	(4.7)	587	(6.4)	619	(7.0)	295
Cyprus	442	(1.1)	90	(1.1)	440	(1.7)	444	(1.8)	-4	(2.8)	292	(2.8)	326	(2.9)	381	(1.8)	504	(2.1)	557	(2.4)	589	(3.4)	297
Czech Republic*	488	(2.8)	92	(2.0)	493	(3.4)	483	(3.3)	**11**	(3.9)	338	(6.3)	371	(4.3)	426	(3.5)	551	(3.2)	606	(3.5)	638	(3.5)	301
Denmark*	505	(2.4)	84	(1.3)	512	(2.9)	498	(2.5)	**14**	(2.5)	363	(4.4)	396	(3.8)	448	(3.2)	564	(2.7)	613	(3.5)	641	(4.6)	278
England	503	(3.6)	98	(1.9)	511	(4.9)	497	(4.1)	**14**	(5.5)	340	(5.7)	377	(4.8)	437	(4.5)	572	(3.9)	628	(4.5)	662	(4.9)	322
Estonia*	510	(2.0)	81	(1.1)	513	(2.5)	507	(2.2)	**6**	(2.5)	378	(4.0)	408	(2.9)	456	(2.5)	565	(2.4)	615	(2.7)	645	(4.1)	267
Finland*	519	(2.4)	91	(1.4)	516	(2.9)	521	(2.6)	**-5**	(2.8)	367	(4.6)	403	(3.3)	460	(2.6)	580	(2.8)	634	(3.0)	664	(3.8)	297
France*	492	(2.7)	103	(1.8)	492	(3.7)	492	(2.8)	1	(3.7)	317	(6.7)	355	(4.2)	421	(3.7)	567	(3.3)	622	(4.0)	653	(3.4)	335
Germany*	509	(3.0)	101	(1.8)	516	(3.2)	502	(3.6)	**14**	(3.0)	340	(4.6)	376	(4.2)	439	(3.7)	581	(3.9)	639	(4.4)	669	(5.0)	329
Greece*	460	(2.6)	87	(1.4)	463	(3.5)	458	(2.7)	5	(3.6)	312	(4.4)	347	(4.3)	402	(3.5)	519	(3.1)	572	(3.3)	602	(3.5)	290
Hong Kong-China	553	(3.0)	91	(1.8)	559	(4.4)	547	(3.5)	**12**	(5.3)	392	(5.6)	430	(4.8)	494	(4.0)	617	(3.3)	666	(3.5)	694	(4.9)	302
Hungary*	476	(3.3)	94	(2.5)	479	(3.5)	472	(4.0)	7	(3.7)	318	(6.2)	353	(4.8)	412	(3.8)	541	(4.6)	599	(6.7)	632	(7.2)	313
Iceland	496	(1.8)	98	(1.7)	491	(2.4)	501	(2.5)	**-11**	(3.3)	329	(4.0)	365	(3.9)	430	(3.1)	565	(2.6)	620	(3.0)	652	(3.6)	323
Israel	465	(4.7)	108	(2.0)	471	(7.9)	459	(3.4)	11	(7.7)	283	(8.0)	323	(6.3)	391	(5.5)	542	(5.4)	605	(6.2)	641	(5.8)	358
Italy*	482	(2.0)	96	(1.1)	490	(2.4)	475	(2.2)	**15**	(2.5)	321	(2.9)	359	(2.7)	418	(2.4)	549	(2.4)	605	(2.6)	637	(2.8)	316
Japan	528	(3.5)	90	(2.0)	534	(4.6)	522	(3.4)	**12**	(4.2)	376	(6.3)	410	(5.1)	468	(4.4)	591	(4.1)	642	(4.6)	671	(4.9)	295
Kazakhstan	414	(2.6)	58	(1.3)	413	(3.0)	414	(2.9)	-1	(2.5)	318	(2.8)	339	(2.9)	374	(2.7)	453	(3.4)	490	(3.9)	511	(5.3)	193
Korea	538	(4.2)	97	(1.9)	546	(5.3)	528	(4.8)	**18**	(5.8)	374	(7.0)	413	(5.7)	473	(4.1)	606	(4.8)	661	(4.8)	690	(5.6)	316
*Latvia**	478	(2.8)	79	(1.2)	477	(3.2)	480	(3.2)	-3	(3.1)	350	(5.4)	378	(3.4)	424	(2.9)	533	(3.5)	581	(2.9)	607	(5.1)	258
Liechtenstein	526	(3.9)	97	(3.3)	536	(6.1)	514	(5.7)	**22**	(9.0)	359	(11.8)	390	(12.6)	456	(9.1)	599	(5.9)	648	(8.6)	679	(11.4)	321
*Lithuania**	474	(2.7)	91	(1.3)	472	(3.0)	475	(3.0)	-2	(2.6)	324	(4.0)	357	(3.7)	412	(3.4)	536	(3.2)	593	(4.4)	624	(4.5)	300
Luxembourg*	483	(1.0)	100	(1.0)	494	(1.5)	471	(1.4)	**23**	(2.1)	319	(3.4)	352	(2.5)	411	(2.0)	555	(1.6)	613	(2.2)	645	(2.6)	326
Macao-China	525	(1.1)	89	(0.9)	526	(1.6)	524	(1.5)	2	(2.2)	374	(2.7)	409	(2.3)	467	(1.6)	587	(1.9)	637	(2.1)	666	(2.3)	292
Mexico	413	(1.2)	67	(0.7)	417	(1.4)	409	(1.3)	**9**	(1.1)	303	(1.8)	328	(2.0)	368	(1.5)	457	(1.4)	499	(1.8)	524	(2.1)	221
Netherlands*	532	(3.8)	99	(2.6)	536	(4.0)	527	(4.4)	**9**	(3.3)	367	(7.4)	399	(6.3)	461	(5.2)	606	(4.7)	659	(4.2)	687	(4.1)	320
New Zealand	506	(2.6)	106	(1.6)	509	(3.9)	502	(3.1)	8	(4.7)	332	(5.3)	370	(4.5)	432	(3.2)	580	(3.3)	644	(3.8)	680	(4.5)	348
Northern Ireland	496	(3.4)	95	(2.3)	501	(5.2)	491	(5.5)	10	(8.2)	336	(7.1)	373	(5.6)	428	(4.9)	564	(4.2)	619	(5.5)	651	(5.9)	315
Norway	497	(3.0)	91	(2.1)	496	(3.2)	497	(3.5)	-1	(3.0)	345	(5.6)	381	(4.4)	437	(3.1)	558	(2.8)	613	(3.6)	644	(4.3)	299
Poland*	517	(3.5)	87	(1.9)	518	(4.0)	516	(3.8)	2	(3.4)	374	(3.6)	403	(3.7)	456	(3.4)	578	(3.8)	630	(5.8)	660	(6.8)	286
Portugal*	486	(3.8)	91	(1.5)	492	(4.1)	480	(3.8)	**12**	(2.4)	334	(5.2)	366	(4.4)	422	(5.5)	550	(4.0)	604	(3.7)	632	(3.9)	298
Republic of Ireland*	509	(2.5)	88	(1.4)	516	(3.7)	501	(2.9)	**14**	(4.3)	361	(5.9)	395	(4.4)	450	(3.5)	569	(2.7)	619	(2.5)	648	(3.2)	288
*Romania**	437	(3.3)	76	(1.8)	437	(3.9)	436	(3.6)	1	(3.5)	314	(4.6)	340	(4.1)	384	(3.4)	487	(3.7)	536	(4.9)	567	(5.9)	253
Russian Federation	463	(3.3)	85	(1.5)	461	(3.8)	465	(3.4)	-5	(3.0)	323	(5.9)	355	(4.8)	406	(3.5)	521	(3.4)	572	(4.0)	601	(4.8)	279
Scotland	504	(2.6)	87	(1.7)	510	(2.9)	498	(3.5)	**12**	(3.5)	358	(6.3)	393	(4.8)	446	(3.7)	565	(3.0)	615	(3.0)	646	(4.4)	288
Serbia	448	(3.3)	86	(1.9)	454	(4.1)	443	(3.4)	**12**	(3.8)	310	(5.7)	341	(4.1)	391	(3.9)	505	(4.5)	559	(4.7)	592	(5.4)	283
Shanghai-China	592	(3.0)	96	(1.9)	594	(3.7)	590	(3.1)	4	(3.2)	427	(5.9)	464	(5.1)	528	(4.1)	660	(3.2)	712	(3.6)	741	(5.7)	314
Singapore	559	(1.5)	104	(0.8)	558	(2.0)	561	(2.0)	-4	(2.7)	384	(3.4)	421	(2.8)	487	(2.8)	634	(2.0)	692	(2.4)	725	(2.6)	341
Slovak Republic*	472	(3.6)	100	(2.5)	477	(4.2)	466	(4.0)	**11**	(4.2)	305	(7.7)	343	(5.9)	405	(4.8)	541	(4.4)	599	(4.7)	633	(5.8)	328
Slovenia*	496	(1.2)	92	(0.9)	495	(1.7)	497	(2.1)	-3	(2.9)	347	(3.1)	378	(2.3)	430	(2.0)	562	(2.2)	619	(2.4)	648	(3.2)	301
Spain*	487	(2.3)	94	(1.1)	495	(2.8)	478	(2.3)	**16**	(2.3)	329	(4.6)	367	(3.5)	425	(2.8)	552	(2.5)	605	(2.4)	635	(2.6)	307
Sweden*	483	(2.5)	93	(1.3)	482	(3.2)	483	(2.7)	-1	(3.1)	327	(5.8)	363	(3.4)	420	(3.2)	547	(3.4)	603	(3.2)	634	(4.1)	306
Switzerland	522	(3.2)	97	(1.6)	529	(3.6)	514	(3.3)	**14**	(2.8)	357	(4.7)	396	(3.6)	457	(3.4)	589	(3.9)	644	(4.3)	677	(4.4)	320
Turkey	447	(4.6)	91	(2.7)	452	(5.0)	443	(5.3)	9	(4.6)	307	(3.8)	336	(3.3)	383	(3.6)	506	(7.2)	573	(9.0)	610	(8.4)	303
United Arab Emirates	432	(2.4)	86	(1.1)	428	(3.7)	435	(3.1)	-7	(4.7)	296	(3.3)	324	(2.7)	372	(2.4)	489	(3.2)	546	(3.5)	581	(4.0)	286
United Kingdom*	502	(3.0)	97	(1.6)	509	(4.1)	496	(3.5)	**13**	(4.7)	341	(5.0)	378	(4.0)	436	(3.7)	570	(3.3)	626	(3.7)	659	(4.3)	318
United States	488	(3.5)	89	(1.5)	489	(3.8)	487	(3.8)	2	(2.8)	344	(4.9)	374	(3.9)	426	(4.1)	551	(4.2)	604	(4.3)	635	(4.6)	291
Vietnam	519	(4.5)	79	(2.4)	520	(5.1)	519	(4.1)	1	(2.6)	385	(8.4)	416	(6.8)	466	(5.9)	574	(3.9)	619	(4.8)	646	(6.7)	261
Wales	483	(2.7)	88	(1.3)	487	(3.2)	478	(3.2)	**9**	(3.4)	336	(4.8)	369	(3.9)	423	(3.8)	543	(2.9)	596	(4.1)	627	(4.4)	291
OECD average	493	(0.5)	93	(0.3)	497	(0.6)	489	(0.5)	**9**	(0.6)	338	(0.9)	373	(0.7)	430	(0.6)	558	(0.6)	613	(0.7)	644	(0.8)	306

OECD countries (not italicised) *Countries not in OECD (italicised)* *EU countries
14 countries with scores below 430 omitted
Note: Values that are statistically significant are indicated in bold

B7 Mean score, variation and gender differences in student performance on the mathematics sub-scale change and relationships

	All students				Gender differences						Percentiles												Difference between 5th and 95th percentile
	Mean score		Standard deviation		Boys		Girls		Difference (B - G)		5th		10th		25th		75th		90th		95th		
	Mean	S.E.	S.D.	S.E.	Mean score	S.E.	Mean score	S.E.	Score dif.	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	
Australia	509	(1.7)	104	(1.2)	515	(2.5)	503	(2.2)	**12**	(3.2)	339	(2.8)	375	(2.4)	437	(2.1)	581	(2.4)	645	(2.9)	680	(3.7)	341
Austria*	506	(3.4)	109	(2.7)	518	(4.8)	495	(4.1)	**23**	(5.8)	326	(7.2)	365	(5.2)	433	(4.6)	584	(4.7)	643	(4.6)	677	(6.7)	350
Belgium*	513	(2.6)	116	(3.2)	517	(3.6)	509	(2.9)	**8**	(4.1)	312	(7.9)	362	(5.6)	443	(3.5)	596	(2.5)	653	(2.6)	684	(2.9)	372
*Bulgaria**	434	(4.5)	109	(2.5)	433	(5.3)	436	(4.9)	-2	(5.0)	263	(6.7)	299	(5.4)	358	(4.7)	507	(5.7)	579	(6.7)	620	(7.7)	358
Canada	525	(2.0)	94	(0.9)	532	(2.2)	518	(2.2)	**14**	(2.0)	367	(3.1)	403	(2.7)	461	(2.2)	591	(2.8)	647	(2.5)	679	(2.9)	312
Chile	411	(3.5)	95	(1.6)	428	(4.5)	396	(3.4)	**32**	(4.1)	263	(5.2)	293	(3.8)	345	(3.5)	475	(4.6)	537	(4.7)	574	(5.5)	310
Chinese Taipei	561	(3.5)	121	(2.2)	563	(5.7)	559	(5.8)	4	(9.0)	355	(6.4)	398	(5.7)	476	(5.0)	648	(3.7)	714	(5.2)	752	(5.4)	396
*Croatia**	468	(4.2)	103	(2.8)	470	(5.1)	465	(4.6)	5	(4.9)	301	(5.9)	336	(5.5)	395	(4.5)	539	(5.5)	602	(7.3)	640	(9.0)	339
Cyprus	440	(1.2)	102	(1.0)	439	(1.9)	441	(1.8)	-2	(2.8)	272	(3.4)	310	(2.8)	371	(1.9)	509	(2.5)	572	(2.7)	608	(3.5)	336
Czech Republic*	499	(3.5)	112	(3.3)	503	(4.5)	496	(4.2)	7	(5.3)	317	(11.2)	364	(6.5)	430	(4.5)	576	(3.6)	636	(3.5)	674	(4.2)	357
Denmark*	494	(2.7)	91	(1.3)	502	(3.3)	486	(2.7)	**16**	(2.8)	345	(4.7)	377	(3.7)	432	(3.1)	557	(3.1)	613	(3.5)	643	(4.0)	298
England	498	(4.1)	100	(2.1)	506	(5.3)	490	(4.6)	**15**	(5.6)	333	(6.2)	368	(6.2)	430	(5.3)	568	(4.5)	628	(5.1)	662	(5.4)	329
Estonia*	530	(2.3)	84	(1.1)	533	(2.8)	527	(2.4)	**6**	(2.7)	394	(4.4)	422	(2.6)	472	(2.8)	587	(2.6)	639	(3.7)	669	(4.1)	276
Finland*	520	(2.6)	97	(2.3)	521	(3.2)	520	(2.8)	1	(3.0)	363	(5.9)	400	(3.5)	458	(2.7)	584	(2.5)	643	(3.4)	677	(4.4)	314
France*	497	(2.7)	107	(2.4)	503	(3.7)	491	(2.8)	**11**	(3.6)	313	(9.6)	355	(6.3)	425	(3.6)	572	(3.2)	632	(4.2)	667	(4.9)	354
Germany*	516	(3.8)	114	(3.4)	521	(3.9)	510	(4.2)	**11**	(3.0)	321	(8.4)	368	(6.6)	443	(4.4)	597	(3.7)	656	(4.2)	688	(5.4)	368
Greece*	446	(3.2)	101	(1.6)	448	(4.3)	444	(3.1)	4	(3.7)	278	(5.6)	317	(5.4)	378	(4.1)	515	(3.7)	574	(3.9)	609	(4.7)	331
Hong Kong-China	564	(3.6)	103	(2.2)	572	(5.0)	556	(4.3)	**16**	(5.9)	380	(7.9)	426	(7.1)	497	(4.9)	636	(3.6)	691	(4.0)	723	(5.3)	343
Hungary*	481	(3.5)	100	(2.7)	485	(4.0)	479	(4.0)	6	(3.8)	320	(6.9)	352	(5.5)	411	(3.9)	550	(4.9)	614	(7.0)	651	(7.3)	331
Iceland	487	(1.9)	100	(1.5)	485	(2.5)	488	(2.5)	-3	(3.4)	318	(5.0)	355	(4.4)	420	(3.0)	557	(2.7)	614	(3.2)	647	(3.6)	329
Israel	462	(5.3)	117	(2.4)	469	(8.9)	456	(4.0)	13	(8.6)	266	(9.1)	308	(7.4)	382	(6.3)	545	(5.5)	613	(6.0)	651	(6.6)	385
Italy*	477	(2.1)	100	(1.3)	486	(2.4)	467	(2.3)	**19**	(2.6)	310	(3.3)	348	(2.9)	410	(2.5)	546	(2.5)	604	(2.9)	638	(3.4)	328
Japan	542	(4.0)	107	(2.4)	553	(5.0)	531	(4.2)	**22**	(4.8)	362	(7.0)	404	(5.8)	470	(4.5)	618	(5.0)	680	(6.0)	715	(7.1)	353
Kazakhstan	433	(3.2)	84	(1.9)	429	(3.7)	437	(3.6)	**-8**	(3.6)	298	(3.0)	327	(3.3)	375	(2.7)	489	(4.4)	541	(6.1)	573	(6.4)	275
Korea	559	(5.2)	107	(2.7)	569	(6.6)	548	(5.4)	**21**	(6.5)	382	(8.4)	422	(6.2)	488	(5.1)	633	(5.7)	692	(7.0)	727	(9.0)	346
*Latvia**	496	(3.4)	90	(1.8)	492	(4.0)	501	(3.6)	**-9**	(3.7)	347	(6.4)	381	(4.4)	434	(3.9)	558	(4.2)	613	(3.9)	642	(4.5)	295
Liechtenstein	542	(4.0)	104	(3.6)	552	(6.3)	531	(6.5)	**21**	(10.0)	363	(17.8)	400	(11.4)	469	(8.2)	621	(6.4)	675	(11.8)	703	(11.6)	340
*Lithuania**	479	(3.2)	92	(1.6)	480	(3.5)	479	(3.3)	1	(2.5)	330	(5.0)	364	(4.2)	417	(3.5)	542	(3.6)	599	(4.1)	632	(4.9)	301
Luxembourg*	488	(1.0)	102	(1.0)	500	(1.5)	475	(1.3)	**25**	(1.9)	317	(3.4)	352	(2.6)	415	(2.0)	562	(1.9)	619	(2.3)	652	(3.0)	335
Macao-China	542	(1.2)	100	(1.1)	542	(1.7)	543	(1.5)	0	(2.0)	375	(3.5)	413	(2.5)	478	(1.7)	612	(2.1)	667	(2.8)	700	(3.5)	324
Mexico	405	(1.6)	87	(0.8)	410	(1.9)	399	(1.7)	**11**	(1.5)	264	(2.6)	295	(2.3)	347	(1.9)	462	(1.9)	516	(2.1)	549	(2.4)	285
Netherlands*	518	(3.9)	103	(3.2)	522	(4.3)	514	(4.2)	**8**	(3.4)	345	(10.0)	388	(6.5)	453	(5.2)	593	(4.0)	642	(3.7)	669	(3.7)	324
New Zealand	501	(2.5)	112	(1.6)	509	(3.6)	492	(3.5)	**17**	(5.0)	319	(5.1)	356	(4.1)	422	(3.5)	578	(3.7)	646	(4.1)	686	(4.7)	367
Northern Ireland	486	(3.8)	99	(2.3)	491	(5.6)	479	(5.8)	12	(8.4)	321	(7.4)	358	(6.2)	416	(5.1)	555	(5.1)	614	(6.3)	651	(5.6)	329
Norway	478	(3.1)	102	(1.3)	479	(3.2)	476	(3.8)	3	(3.4)	306	(5.2)	346	(4.7)	409	(3.4)	547	(3.4)	608	(4.1)	644	(4.7)	338
Poland*	509	(4.1)	100	(2.1)	510	(4.7)	509	(4.3)	1	(3.6)	347	(4.4)	380	(4.0)	440	(4.1)	578	(5.2)	641	(6.8)	677	(9.3)	330
Portugal*	486	(4.1)	98	(1.4)	490	(4.4)	482	(4.1)	**9**	(2.6)	323	(5.6)	356	(4.7)	417	(5.4)	556	(4.0)	615	(4.0)	645	(3.9)	323
Republic of Ireland*	501	(2.6)	87	(1.5)	508	(3.6)	494	(3.1)	**13**	(4.3)	355	(6.1)	389	(4.8)	443	(3.3)	561	(2.6)	613	(2.5)	642	(3.5)	287
*Romania**	446	(3.9)	89	(2.4)	446	(4.7)	445	(4.1)	1	(3.9)	307	(4.4)	336	(4.6)	382	(3.9)	504	(5.0)	566	(6.8)	602	(7.1)	295
Russian Federation	491	(3.4)	93	(1.8)	489	(4.0)	493	(3.5)	-5	(3.1)	338	(5.5)	371	(4.7)	428	(4.0)	553	(3.8)	611	(5.0)	644	(6.3)	306
Scotland	497	(3.1)	93	(2.1)	506	(3.5)	487	(3.6)	**19**	(3.5)	344	(7.0)	380	(4.9)	434	(4.0)	561	(3.3)	618	(4.4)	650	(6.8)	306
Serbia	442	(4.1)	104	(2.7)	445	(4.9)	439	(4.6)	5	(4.7)	274	(7.6)	311	(5.7)	371	(4.9)	512	(4.4)	578	(6.3)	618	(6.5)	344
Shanghai-China	624	(3.6)	112	(2.4)	629	(4.4)	619	(3.9)	**10**	(3.9)	431	(6.7)	473	(6.5)	547	(5.4)	704	(3.6)	764	(4.1)	797	(5.3)	367
Singapore	580	(1.5)	114	(0.9)	581	(2.2)	580	(1.9)	1	(2.6)	387	(4.4)	428	(3.9)	502	(2.7)	662	(2.1)	725	(2.8)	759	(2.8)	373
Slovak Republic*	474	(4.0)	114	(2.9)	476	(4.9)	472	(4.5)	4	(4.9)	282	(9.2)	327	(6.9)	401	(5.5)	553	(4.6)	617	(4.8)	655	(6.7)	373
Slovenia*	499	(1.1)	100	(1.0)	501	(1.7)	497	(2.2)	4	(3.1)	338	(2.9)	372	(2.7)	429	(2.3)	570	(2.2)	632	(3.8)	667	(3.7)	329
Spain*	482	(2.0)	93	(0.8)	490	(2.5)	473	(2.1)	**17**	(2.2)	326	(3.0)	361	(3.1)	420	(2.9)	547	(2.1)	600	(1.9)	630	(1.9)	304
Sweden*	469	(2.8)	107	(1.6)	466	(3.6)	472	(3.1)	-5	(3.8)	291	(5.4)	331	(4.1)	397	(4.0)	544	(3.4)	606	(3.8)	641	(4.0)	350
Switzerland	530	(3.4)	103	(1.6)	536	(3.9)	524	(3.6)	**12**	(3.0)	359	(4.1)	396	(3.4)	459	(3.7)	602	(4.0)	661	(4.8)	695	(5.3)	336
Turkey	448	(5.0)	92	(3.1)	448	(5.4)	449	(5.7)	-1	(4.7)	310	(4.7)	336	(4.9)	383	(3.9)	508	(7.3)	575	(9.1)	612	(10.6)	301
United Arab Emirates	442	(2.6)	95	(1.2)	440	(4.2)	445	(3.0)	-4	(5.0)	294	(3.9)	325	(3.0)	376	(2.8)	505	(3.4)	570	(3.8)	607	(4.2)	313
United Kingdom*	496	(3.4)	99	(1.8)	504	(4.4)	489	(3.9)	**15**	(4.8)	333	(5.3)	368	(5.2)	429	(4.4)	565	(3.9)	626	(4.4)	659	(5.2)	326
United States	488	(3.5)	95	(1.4)	490	(3.9)	486	(3.9)	4	(3.2)	339	(4.2)	368	(4.0)	421	(4.1)	552	(4.2)	614	(4.3)	649	(5.1)	310
Vietnam	509	(5.1)	94	(2.7)	514	(5.9)	506	(4.9)	**8**	(3.2)	355	(8.0)	389	(7.1)	445	(6.1)	572	(5.7)	631	(6.6)	664	(6.7)	309
Wales	470	(2.5)	90	(1.3)	476	(3.0)	463	(3.0)	**13**	(3.3)	321	(4.8)	353	(4.9)	409	(3.3)	532	(2.9)	584	(3.7)	616	(5.2)	295
OECD average	493	(0.6)	101	(0.4)	498	(0.7)	487	(0.6)	**11**	(0.7)	325	(1.1)	362	(0.8)	424	(0.7)	563	(0.7)	622	(0.8)	657	(0.9)	332

OECD countries (not italicised) *Countries not in OECD (italicised)* *EU countries
14 countries with scores below 430 omitted
Note: Values that are statistically significant are indicated in bold

B8 Mean score, variation and gender differences in student performance on the mathematics sub-scale space and shape

	All students				Gender differences						Percentiles												Difference between 5th and 95th percentile
	Mean score		Standard deviation		Boys		Girls		Difference (B - G)		5th		10th		25th		75th		90th		95th		
	Mean	S.E.	S.D.	S.E.	Mean score	S.E.	Mean score	S.E.	Score dif.	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	
Australia	497	(1.8)	102	(1.4)	506	(2.5)	486	(2.3)	**20**	(3.2)	334	(2.9)	368	(2.4)	425	(2.0)	564	(2.5)	630	(3.4)	669	(4.1)	335
Austria*	501	(3.1)	98	(2.2)	519	(4.5)	483	(3.4)	**37**	(5.4)	340	(4.6)	375	(4.1)	432	(3.7)	569	(3.8)	627	(5.2)	662	(7.1)	322
Belgium*	509	(2.4)	108	(1.5)	518	(3.0)	500	(2.8)	**18**	(3.5)	330	(4.5)	368	(4.2)	434	(3.6)	585	(2.9)	649	(3.1)	684	(3.1)	354
*Bulgaria**	442	(4.3)	95	(2.2)	442	(5.0)	442	(4.6)	0	(4.2)	291	(5.4)	321	(5.8)	376	(4.9)	506	(5.2)	569	(5.4)	604	(6.4)	313
Canada	510	(2.1)	95	(0.9)	515	(2.4)	505	(2.3)	**10**	(2.2)	355	(2.9)	388	(2.6)	444	(2.3)	576	(2.7)	636	(3.2)	670	(3.1)	314
Chile	419	(3.2)	86	(1.5)	435	(3.8)	404	(3.2)	**31**	(3.5)	288	(4.3)	313	(3.7)	358	(3.3)	475	(4.3)	533	(4.5)	569	(4.7)	281
Chinese Taipei	592	(3.8)	136	(2.3)	596	(6.2)	589	(6.4)	7	(10.0)	362	(5.3)	407	(5.5)	494	(5.5)	693	(4.1)	764	(5.4)	803	(5.9)	441
*Croatia**	460	(3.9)	88	(3.4)	468	(4.7)	452	(4.1)	**15**	(3.9)	328	(3.6)	354	(3.1)	399	(3.1)	516	(4.9)	575	(8.1)	615	(13.4)	287
Cyprus	436	(1.1)	92	(1.0)	439	(1.6)	433	(1.5)	**6**	(2.3)	289	(2.5)	320	(2.4)	373	(2.2)	498	(2.1)	555	(2.8)	592	(3.6)	303
Czech Republic*	499	(3.4)	102	(1.9)	509	(4.2)	487	(3.7)	**22**	(4.4)	331	(7.1)	369	(4.8)	428	(4.7)	569	(4.0)	630	(4.2)	666	(4.8)	335
Denmark*	497	(2.5)	84	(1.2)	504	(3.0)	490	(2.5)	**14**	(2.3)	357	(4.6)	388	(3.8)	441	(3.3)	553	(2.9)	604	(3.7)	633	(4.1)	276
England	477	(4.1)	100	(2.0)	484	(5.1)	471	(4.9)	**13**	(5.8)	314	(6.6)	348	(5.6)	408	(4.8)	544	(5.1)	607	(4.8)	643	(5.8)	329
Estonia*	513	(2.5)	94	(1.1)	515	(3.0)	510	(3.0)	4	(3.1)	364	(4.2)	395	(3.8)	449	(3.4)	575	(2.7)	634	(3.2)	671	(4.8)	307
Finland*	507	(2.1)	90	(1.3)	506	(2.7)	507	(2.3)	-1	(2.8)	361	(4.2)	393	(2.7)	446	(2.5)	567	(2.7)	624	(3.1)	658	(3.8)	297
France*	489	(2.7)	99	(1.9)	497	(3.6)	481	(2.9)	**16**	(3.4)	326	(4.4)	360	(3.7)	418	(3.7)	558	(3.7)	619	(4.4)	652	(5.4)	326
Germany*	507	(3.2)	98	(1.9)	515	(3.4)	499	(3.7)	**16**	(2.8)	346	(5.6)	379	(5.1)	440	(4.2)	575	(3.8)	633	(4.5)	667	(5.2)	321
Greece*	436	(2.6)	90	(1.4)	442	(3.3)	431	(2.8)	**11**	(3.3)	290	(5.6)	324	(3.4)	375	(3.0)	497	(3.3)	552	(3.9)	585	(4.3)	295
Hong Kong-China	567	(4.0)	107	(2.3)	576	(5.6)	555	(4.5)	**21**	(6.4)	382	(7.1)	422	(6.4)	495	(5.1)	642	(4.5)	701	(4.8)	734	(5.2)	352
Hungary*	474	(3.4)	96	(2.7)	482	(3.8)	465	(4.1)	**17**	(3.9)	325	(4.0)	354	(4.0)	406	(3.3)	536	(5.3)	604	(7.2)	643	(10.4)	318
Iceland	489	(1.5)	88	(1.3)	485	(2.0)	493	(2.2)	**-8**	(3.0)	339	(3.7)	373	(3.1)	430	(2.6)	549	(2.4)	604	(2.4)	634	(3.3)	295
Israel	449	(4.8)	105	(1.9)	456	(8.0)	443	(3.6)	13	(7.7)	278	(7.0)	314	(5.7)	376	(4.9)	522	(5.4)	586	(6.0)	622	(5.7)	344
Italy*	487	(2.5)	106	(1.4)	498	(2.8)	476	(2.7)	**23**	(2.6)	316	(2.8)	354	(2.8)	415	(2.5)	559	(3.5)	627	(3.9)	665	(4.2)	348
Japan	558	(3.7)	100	(2.4)	566	(4.6)	548	(4.0)	**18**	(4.7)	393	(6.2)	429	(4.9)	489	(4.2)	627	(4.8)	688	(5.2)	723	(6.3)	330
Kazakhstan	450	(3.9)	85	(2.3)	454	(4.2)	446	(4.3)	**8**	(3.5)	317	(4.3)	344	(3.9)	391	(3.3)	506	(5.4)	562	(6.6)	595	(8.2)	278
Korea	573	(5.2)	112	(2.4)	583	(6.6)	562	(5.9)	**20**	(7.0)	388	(7.1)	428	(5.6)	495	(5.3)	653	(6.2)	716	(7.5)	753	(8.6)	365
*Latvia**	497	(3.3)	88	(1.5)	496	(3.8)	497	(3.6)	-1	(3.4)	356	(5.6)	386	(4.2)	437	(3.3)	556	(4.1)	611	(5.2)	645	(5.2)	289
Liechtenstein	539	(4.5)	99	(4.3)	550	(6.2)	527	(7.5)	**23**	(10.4)	373	(18.5)	406	(13.5)	475	(10.8)	611	(8.4)	667	(11.0)	695	(13.2)	322
*Lithuania**	472	(3.1)	98	(1.7)	471	(3.3)	473	(3.5)	-2	(2.8)	313	(4.6)	347	(4.1)	404	(4.2)	539	(3.5)	600	(4.7)	637	(5.0)	324
Luxembourg*	486	(1.0)	96	(1.1)	503	(1.4)	469	(1.5)	**34**	(2.1)	332	(3.1)	364	(2.6)	418	(2.2)	554	(2.1)	612	(3.0)	645	(3.2)	312
Macao-China	558	(1.4)	109	(1.0)	561	(2.0)	554	(1.6)	**7**	(2.4)	375	(3.4)	416	(2.4)	485	(2.5)	635	(2.1)	697	(2.6)	732	(3.6)	358
Mexico	413	(1.6)	82	(0.9)	423	(1.9)	402	(1.7)	**21**	(1.4)	280	(3.1)	309	(2.4)	358	(1.9)	466	(1.9)	519	(2.4)	550	(2.3)	270
Netherlands*	507	(3.5)	94	(2.3)	515	(3.5)	499	(4.0)	**16**	(2.8)	350	(6.5)	385	(5.2)	442	(4.2)	573	(4.5)	628	(4.8)	660	(6.5)	310
New Zealand	491	(2.4)	100	(1.7)	504	(3.5)	477	(3.1)	**27**	(4.6)	334	(5.5)	366	(4.3)	421	(3.2)	558	(2.9)	624	(4.7)	663	(5.5)	330
Northern Ireland	463	(3.6)	99	(2.5)	467	(5.4)	460	(5.4)	7	(8.1)	304	(7.8)	340	(5.1)	397	(4.5)	529	(4.3)	591	(6.6)	626	(6.8)	322
Norway	480	(3.3)	102	(1.4)	481	(3.4)	478	(4.1)	3	(3.3)	312	(6.3)	351	(4.6)	412	(3.2)	548	(3.9)	610	(4.2)	647	(5.1)	335
Poland*	524	(4.2)	101	(2.2)	528	(4.9)	520	(4.4)	**8**	(3.8)	370	(4.0)	398	(3.4)	450	(3.6)	593	(6.0)	660	(6.8)	697	(7.8)	327
Portugal*	491	(4.2)	109	(1.9)	498	(4.6)	483	(4.4)	**15**	(2.9)	318	(6.7)	351	(5.5)	414	(4.5)	568	(4.7)	633	(4.6)	669	(5.1)	351
Republic of Ireland*	478	(2.6)	94	(1.4)	490	(3.7)	465	(3.0)	**25**	(4.3)	323	(4.9)	357	(4.2)	415	(3.4)	542	(2.8)	598	(2.8)	631	(3.9)	308
*Romania**	447	(4.1)	91	(2.6)	452	(4.7)	443	(4.4)	**10**	(4.1)	306	(4.4)	335	(3.9)	383	(3.6)	505	(5.3)	567	(7.6)	607	(7.8)	300
Russian Federation	496	(3.9)	95	(2.1)	498	(4.6)	494	(3.8)	4	(3.1)	344	(3.9)	376	(3.7)	430	(4.2)	560	(5.1)	622	(6.2)	657	(7.9)	313
Scotland	482	(3.1)	95	(1.8)	492	(3.4)	471	(3.7)	**21**	(3.4)	328	(6.3)	361	(5.2)	417	(4.0)	546	(3.7)	606	(4.2)	642	(5.4)	315
Serbia	446	(3.9)	98	(2.5)	452	(4.5)	441	(4.2)	**11**	(3.9)	293	(5.4)	324	(5.0)	377	(4.3)	510	(4.6)	576	(6.8)	616	(9.0)	323
Shanghai-China	649	(3.6)	114	(2.5)	649	(4.4)	649	(3.7)	0	(3.8)	445	(8.2)	493	(7.1)	575	(5.6)	728	(3.1)	787	(4.3)	822	(5.3)	376
Singapore	580	(1.5)	117	(1.1)	577	(2.3)	582	(1.9)	-5	(3.0)	380	(4.1)	423	(3.6)	500	(2.1)	664	(2.5)	727	(2.8)	764	(3.5)	383
Slovak Republic*	490	(4.1)	109	(2.7)	496	(4.7)	482	(4.7)	**15**	(4.8)	311	(8.5)	351	(6.3)	416	(4.5)	564	(5.5)	632	(6.3)	670	(6.9)	359
Slovenia*	503	(1.4)	99	(1.2)	506	(2.0)	500	(2.2)	**6**	(3.1)	345	(3.8)	379	(2.8)	433	(2.1)	572	(3.2)	636	(4.2)	671	(3.1)	325
Spain*	477	(2.0)	94	(0.9)	486	(2.5)	468	(2.3)	**18**	(2.4)	324	(3.6)	357	(2.9)	412	(2.3)	542	(2.5)	599	(2.4)	631	(2.5)	308
Sweden*	469	(2.5)	94	(1.6)	470	(3.0)	467	(2.8)	3	(3.1)	313	(5.7)	348	(3.6)	405	(3.1)	533	(3.1)	590	(3.1)	623	(5.0)	310
Switzerland	544	(3.1)	101	(1.7)	554	(3.5)	535	(3.4)	**19**	(3.1)	375	(4.7)	413	(3.9)	475	(3.4)	614	(4.5)	675	(4.4)	711	(5.4)	336
Turkey	443	(5.5)	109	(3.8)	449	(5.8)	437	(6.8)	12	(6.1)	280	(5.3)	312	(3.9)	365	(4.1)	512	(9.2)	597	(12.2)	641	(12.1)	360
United Arab Emirates	425	(2.4)	97	(1.4)	424	(3.5)	425	(3.5)	-1	(5.0)	274	(3.7)	304	(3.1)	356	(2.7)	490	(3.1)	553	(4.0)	591	(3.9)	316
United Kingdom*	475	(3.5)	99	(1.8)	482	(4.3)	469	(4.2)	**13**	(5.0)	313	(5.5)	347	(4.6)	407	(4.1)	542	(4.1)	605	(4.3)	641	(4.9)	328
United States	463	(4.0)	96	(1.5)	467	(4.3)	460	(4.4)	**7**	(3.3)	314	(4.4)	342	(4.4)	396	(3.9)	527	(5.2)	591	(5.2)	631	(6.2)	317
Vietnam	507	(5.1)	99	(2.8)	519	(5.9)	496	(5.0)	**23**	(3.2)	346	(7.6)	382	(6.3)	439	(5.3)	573	(6.6)	637	(7.4)	674	(8.4)	328
Wales	444	(2.6)	89	(1.3)	449	(2.8)	439	(3.3)	**10**	(3.4)	299	(4.2)	330	(4.2)	383	(3.1)	505	(3.2)	559	(4.4)	592	(5.8)	292
OECD average	490	(0.5)	98	(0.3)	497	(0.7)	482	(0.6)	**15**	(0.7)	331	(0.9)	365	(0.7)	422	(0.6)	556	(0.7)	618	(0.8)	653	(1.0)	322

OECD countries (not italicised) *Countries not in OECD (italicised)* *EU countries
14 countries with scores below 430 omitted
Note: Values that are statistically significant are indicated in bold

B9 Mean score, variation and gender differences in student performance on the mathematics sub-scale formulating

	All students				Gender differences						Percentiles												Difference between 5th and 95th percentile
	Mean score		Standard deviation		Boys		Girls		Difference (B - G)		5th		10th		25th		75th		90th		95th		
	Mean	S.E.	S.D.	S.E.	Mean score	S.E.	Mean score	S.E.	Score dif.	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	
Australia	498	(1.9)	110	(1.5)	506	(2.8)	489	(2.3)	**17**	(3.5)	323	(3.3)	359	(2.6)	421	(1.8)	573	(2.7)	643	(3.8)	683	(4.7)	360
Austria*	499	(3.2)	105	(2.1)	515	(4.6)	484	(3.6)	**32**	(5.5)	328	(6.6)	365	(4.9)	425	(3.9)	575	(3.9)	635	(5.0)	668	(5.4)	341
Belgium*	512	(2.4)	111	(1.5)	520	(3.2)	505	(2.6)	**15**	(3.4)	328	(5.3)	367	(4.1)	435	(3.3)	591	(2.9)	656	(3.1)	692	(3.6)	365
*Bulgaria**	437	(4.2)	99	(2.4)	439	(4.8)	434	(4.9)	5	(4.6)	282	(6.4)	313	(5.0)	368	(4.4)	503	(5.7)	567	(6.9)	607	(7.3)	325
Canada	516	(2.2)	101	(0.9)	522	(2.6)	510	(2.4)	**13**	(2.4)	350	(2.8)	385	(2.7)	446	(2.7)	587	(2.8)	648	(3.6)	685	(3.2)	334
Chile	420	(3.2)	88	(1.6)	434	(3.8)	406	(3.3)	**29**	(3.7)	284	(4.6)	311	(4.3)	359	(3.5)	477	(3.7)	535	(4.9)	573	(5.4)	289
Chinese Taipei	578	(4.0)	137	(2.4)	584	(6.3)	573	(6.9)	11	(10.5)	345	(6.7)	393	(6.2)	482	(6.0)	678	(4.1)	751	(5.5)	791	(6.7)	446
*Croatia**	453	(4.0)	96	(3.0)	461	(5.1)	444	(4.2)	**16**	(4.7)	304	(3.7)	332	(3.5)	384	(3.2)	515	(5.1)	580	(8.6)	622	(13.0)	318
Cyprus	437	(1.2)	93	(0.9)	441	(1.6)	432	(1.8)	**9**	(2.5)	290	(3.2)	320	(2.3)	372	(1.9)	498	(2.0)	559	(2.5)	596	(4.0)	307
Czech Republic*	495	(3.4)	103	(2.6)	503	(4.3)	486	(3.8)	**17**	(4.4)	330	(7.5)	365	(5.1)	425	(4.2)	565	(3.6)	626	(4.6)	663	(4.3)	333
Denmark*	502	(2.4)	89	(1.3)	511	(2.8)	494	(2.6)	**17**	(2.5)	355	(4.9)	387	(4.3)	441	(3.3)	565	(2.7)	618	(3.7)	649	(4.2)	293
England	491	(4.4)	105	(2.3)	497	(5.6)	485	(5.2)	12	(6.2)	319	(7.7)	355	(7.6)	418	(6.0)	563	(4.7)	630	(5.9)	665	(5.8)	346
Estonia*	517	(2.3)	91	(1.1)	523	(2.9)	512	(2.4)	**11**	(2.7)	371	(3.5)	402	(3.9)	454	(2.8)	578	(3.0)	637	(3.1)	673	(4.2)	302
Finland*	519	(2.4)	97	(1.4)	520	(3.0)	518	(2.6)	2	(3.0)	359	(4.9)	393	(3.4)	453	(2.5)	585	(3.0)	645	(3.3)	678	(3.8)	319
France*	483	(2.8)	106	(2.0)	491	(3.8)	476	(3.0)	**15**	(3.9)	309	(5.7)	346	(4.1)	410	(3.3)	558	(3.8)	620	(4.1)	656	(6.0)	348
Germany*	511	(3.4)	105	(1.7)	520	(3.6)	501	(3.9)	**19**	(3.2)	337	(4.7)	372	(4.5)	438	(4.2)	586	(4.3)	647	(4.3)	681	(5.3)	344
Greece*	448	(2.3)	89	(1.6)	454	(3.2)	442	(2.6)	**13**	(3.4)	303	(5.3)	334	(3.8)	387	(3.4)	507	(2.9)	563	(3.7)	596	(3.9)	292
Hong Kong-China	568	(3.7)	115	(2.1)	579	(5.3)	557	(4.8)	**22**	(7.1)	369	(7.0)	415	(7.0)	493	(5.2)	649	(4.1)	711	(4.0)	744	(5.0)	375
Hungary*	469	(3.6)	101	(2.9)	478	(4.0)	461	(4.2)	**17**	(3.9)	312	(5.5)	344	(4.1)	398	(3.9)	536	(5.2)	605	(8.4)	645	(9.5)	332
Iceland	500	(1.7)	94	(1.2)	499	(2.4)	501	(2.4)	-1	(3.3)	344	(4.5)	377	(3.9)	436	(2.5)	565	(3.0)	623	(3.1)	654	(4.4)	309
Israel	465	(4.7)	109	(2.5)	472	(7.7)	457	(3.6)	**15**	(7.3)	284	(7.9)	323	(6.1)	388	(5.4)	541	(5.9)	605	(6.2)	643	(6.4)	359
Italy*	475	(2.2)	102	(1.2)	487	(2.6)	463	(2.4)	**24**	(2.6)	309	(3.0)	345	(2.6)	406	(2.4)	545	(2.7)	608	(3.4)	645	(3.5)	336
Japan	554	(4.2)	110	(2.7)	563	(5.2)	544	(4.4)	**19**	(4.9)	370	(7.5)	410	(6.6)	481	(5.2)	631	(4.7)	695	(5.8)	730	(6.5)	359
Kazakhstan	442	(3.8)	82	(2.1)	446	(4.1)	438	(4.2)	**7**	(3.3)	313	(3.7)	339	(3.9)	385	(3.8)	496	(5.0)	548	(6.3)	582	(7.5)	269
Korea	562	(5.1)	111	(2.4)	573	(6.5)	550	(5.8)	**22**	(7.0)	377	(7.5)	417	(6.0)	487	(5.2)	642	(6.2)	704	(6.9)	738	(8.5)	361
*Latvia**	488	(3.0)	90	(1.6)	487	(4.0)	489	(3.4)	-2	(4.3)	343	(5.4)	373	(4.4)	426	(3.1)	549	(4.0)	606	(5.2)	639	(4.7)	296
Liechtenstein	535	(4.4)	101	(3.6)	548	(6.4)	520	(6.5)	**28**	(9.7)	362	(20.2)	395	(11.8)	467	(8.7)	608	(8.3)	665	(12.0)	698	(12.5)	337
*Lithuania**	477	(3.1)	102	(1.6)	479	(3.3)	476	(3.6)	3	(2.9)	312	(5.3)	348	(4.4)	407	(4.1)	547	(3.9)	613	(5.0)	651	(6.1)	338
Luxembourg*	482	(1.0)	102	(1.0)	498	(1.4)	465	(1.5)	**33**	(2.1)	317	(3.4)	349	(2.5)	409	(2.0)	554	(1.9)	615	(2.5)	650	(3.4)	333
Macao-China	545	(1.4)	112	(1.2)	549	(1.7)	540	(2.2)	**9**	(2.7)	360	(3.2)	400	(3.7)	471	(2.2)	623	(2.4)	685	(2.6)	721	(3.4)	361
Mexico	409	(1.7)	86	(0.8)	419	(1.9)	400	(1.8)	**20**	(1.7)	270	(2.8)	301	(2.1)	351	(1.9)	466	(2.1)	521	(2.4)	555	(2.3)	285
Netherlands*	527	(3.8)	101	(2.4)	535	(3.8)	519	(4.2)	**16**	(2.8)	358	(5.6)	393	(5.0)	455	(5.2)	600	(4.9)	657	(5.4)	689	(6.3)	330
New Zealand	496	(2.5)	109	(1.4)	507	(3.6)	484	(3.3)	**23**	(4.8)	326	(4.2)	359	(3.6)	417	(2.9)	571	(3.3)	641	(4.7)	683	(5.4)	357
Northern Ireland	479	(3.8)	100	(2.4)	484	(5.4)	474	(5.8)	10	(8.2)	317	(7.2)	350	(6.5)	409	(5.8)	548	(4.5)	609	(5.8)	648	(7.4)	331
Norway	489	(3.1)	100	(1.5)	490	(3.1)	488	(3.7)	2	(3.2)	328	(5.4)	363	(4.5)	421	(3.7)	557	(3.4)	618	(4.2)	655	(4.8)	327
Poland*	516	(4.2)	102	(2.1)	522	(4.8)	509	(4.4)	**13**	(3.8)	353	(4.8)	387	(4.2)	443	(4.0)	585	(5.7)	650	(7.1)	687	(8.9)	334
Portugal*	479	(4.3)	107	(1.5)	487	(4.6)	471	(4.3)	**17**	(2.8)	304	(4.9)	339	(4.8)	401	(5.1)	554	(5.0)	619	(4.7)	655	(5.6)	351
Republic of Ireland*	492	(2.4)	95	(1.4)	502	(3.7)	482	(2.8)	**20**	(4.4)	335	(4.5)	369	(4.4)	427	(3.5)	557	(2.4)	615	(3.1)	650	(3.3)	314
*Romania**	445	(4.1)	93	(2.7)	449	(4.7)	441	(4.2)	7	(3.8)	301	(4.9)	329	(3.6)	380	(4.0)	505	(5.5)	567	(7.4)	604	(8.1)	303
Russian Federation	481	(3.6)	95	(2.1)	484	(4.4)	479	(3.5)	5	(3.4)	327	(4.5)	358	(3.6)	416	(4.0)	546	(4.3)	605	(5.7)	639	(7.6)	311
Scotland	490	(3.3)	99	(2.1)	499	(3.6)	481	(4.2)	**18**	(4.0)	330	(7.4)	364	(5.4)	423	(5.3)	557	(3.7)	620	(5.1)	658	(5.6)	328
Serbia	447	(3.8)	98	(2.5)	453	(4.4)	441	(4.3)	**12**	(4.3)	294	(6.3)	326	(3.9)	379	(4.1)	509	(4.7)	576	(6.8)	617	(7.9)	323
Shanghai-China	624	(4.1)	119	(2.8)	629	(4.9)	620	(4.2)	**8**	(3.9)	413	(8.9)	462	(7.4)	547	(5.1)	710	(3.9)	769	(5.2)	807	(7.5)	394
Singapore	582	(1.6)	122	(1.3)	581	(2.2)	582	(2.1)	-1	(2.9)	374	(3.5)	419	(3.2)	496	(3.0)	670	(2.4)	737	(2.9)	773	(4.8)	398
Slovak Republic*	480	(4.1)	110	(2.7)	488	(4.8)	472	(4.7)	**16**	(4.8)	301	(8.4)	341	(6.2)	405	(4.4)	557	(5.6)	623	(6.0)	662	(7.3)	361
Slovenia*	492	(1.5)	104	(1.2)	496	(2.4)	488	(2.2)	**8**	(3.6)	328	(4.8)	360	(3.0)	418	(2.7)	565	(2.7)	630	(3.7)	667	(3.6)	340
Spain*	477	(2.2)	102	(1.1)	486	(2.8)	467	(2.3)	**19**	(2.6)	305	(4.5)	346	(3.7)	408	(2.9)	547	(2.4)	607	(2.9)	640	(2.9)	335
Sweden*	479	(2.7)	102	(1.5)	480	(3.4)	478	(2.9)	2	(3.3)	313	(6.0)	348	(3.9)	407	(3.3)	550	(2.9)	612	(3.8)	647	(4.0)	334
Switzerland	538	(3.1)	104	(1.6)	548	(3.5)	528	(3.4)	**20**	(3.1)	361	(4.2)	402	(3.8)	468	(3.7)	611	(3.8)	672	(4.2)	707	(4.5)	345
Turkey	449	(5.2)	96	(3.1)	454	(5.4)	444	(6.0)	**10**	(4.8)	307	(4.9)	334	(3.9)	380	(4.1)	512	(8.0)	583	(10.5)	622	(9.2)	315
United Arab Emirates	426	(2.7)	100	(1.4)	427	(3.7)	425	(3.6)	2	(4.9)	271	(3.2)	302	(2.7)	354	(3.0)	494	(3.4)	559	(4.5)	599	(3.8)	327
United Kingdom*	489	(3.7)	104	(2.0)	495	(4.6)	483	(4.4)	**12**	(5.3)	319	(6.2)	355	(6.2)	417	(5.0)	560	(4.0)	626	(5.2)	663	(4.6)	344
United States	475	(4.1)	98	(1.6)	479	(4.2)	471	(4.6)	**8**	(3.0)	323	(4.4)	352	(4.9)	406	(4.4)	540	(5.6)	606	(6.0)	645	(5.8)	322
Vietnam	497	(5.1)	98	(3.0)	507	(5.9)	489	(5.0)	**18**	(3.2)	336	(8.4)	373	(7.0)	432	(6.1)	561	(5.8)	624	(8.0)	661	(8.6)	325
Wales	457	(2.4)	93	(1.4)	463	(2.7)	452	(3.2)	**11**	(3.6)	308	(4.3)	339	(3.8)	395	(3.3)	521	(3.0)	577	(4.1)	612	(5.1)	304
OECD average	492	(0.5)	101	(0.3)	499	(0.7)	484	(0.6)	**16**	(0.7)	327	(0.9)	362	(0.8)	421	(0.6)	562	(0.7)	624	(0.8)	660	(0.9)	332

OECD countries (not italicised) *Countries not in OECD (italicised)* *EU countries
14 countries with scores below 430 omitted
Note: Values that are statistically significant are indicated in bold

B10 Mean score, variation and gender differences in student performance on the mathematics sub-scale employing

	All students				Gender differences						Percentiles												Difference between 5th and 95th percentile
	Mean score		Standard deviation		Boys		Girls		Difference (B - G)		5th		10th		25th		75th		90th		95th		
	Mean	S.E.	S.D.	S.E.	Mean score	S.E.	Mean score	S.E.	Score dif.	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	
Australia	500	(1.7)	95	(1.1)	505	(2.3)	495	(2.0)	**10**	(2.9)	345	(3.1)	378	(2.2)	435	(1.9)	567	(2.1)	624	(2.6)	655	(3.2)	311
Austria*	510	(2.5)	87	(1.6)	520	(3.5)	499	(3.2)	**20**	(4.6)	366	(4.7)	397	(3.4)	448	(3.2)	572	(2.9)	621	(3.6)	649	(3.4)	283
Belgium*	516	(2.1)	101	(1.6)	521	(2.7)	510	(2.7)	**11**	(3.4)	342	(5.1)	380	(3.8)	446	(3.0)	590	(2.6)	644	(2.9)	673	(2.4)	331
*Bulgaria**	439	(4.1)	96	(2.3)	437	(5.0)	441	(4.3)	-4	(4.4)	287	(5.7)	318	(5.1)	371	(4.8)	506	(5.1)	567	(6.2)	603	(7.1)	315
Canada	517	(1.9)	87	(0.9)	521	(2.1)	512	(2.2)	**10**	(2.2)	370	(2.9)	403	(2.6)	457	(2.3)	578	(2.1)	629	(2.3)	657	(2.9)	287
Chile	416	(3.3)	86	(1.5)	430	(4.1)	404	(3.3)	**26**	(3.8)	283	(4.4)	309	(4.1)	356	(3.7)	474	(4.3)	532	(4.6)	563	(4.3)	281
Chinese Taipei	549	(3.1)	110	(1.9)	551	(5.1)	547	(5.2)	4	(8.1)	359	(5.4)	398	(5.0)	473	(4.6)	630	(3.4)	683	(4.1)	715	(5.0)	355
*Croatia**	478	(3.7)	91	(2.5)	481	(4.6)	474	(3.9)	7	(4.3)	334	(4.2)	363	(3.8)	413	(3.6)	538	(4.9)	597	(6.9)	633	(9.7)	299
Cyprus	443	(1.1)	91	(0.9)	443	(1.5)	443	(1.6)	0	(2.1)	295	(2.7)	327	(2.0)	381	(1.9)	505	(1.8)	561	(2.1)	594	(3.7)	299
Czech Republic*	504	(2.9)	94	(1.8)	509	(3.6)	498	(3.6)	**12**	(4.5)	349	(6.5)	384	(4.8)	440	(4.1)	569	(3.4)	623	(3.6)	656	(3.6)	307
Denmark*	495	(2.4)	81	(1.3)	500	(3.0)	489	(2.4)	**12**	(2.6)	360	(5.3)	390	(3.3)	438	(2.9)	551	(2.8)	599	(2.9)	626	(3.6)	266
England	493	(3.6)	95	(1.8)	499	(4.7)	487	(4.2)	**12**	(5.2)	335	(5.9)	369	(5.5)	428	(5.4)	559	(3.8)	615	(4.3)	647	(4.8)	313
Estonia*	524	(2.1)	79	(1.1)	527	(2.4)	522	(2.4)	4	(2.5)	394	(4.1)	423	(2.8)	471	(2.4)	578	(2.8)	628	(3.1)	656	(3.7)	262
Finland*	516	(1.8)	81	(0.9)	514	(2.5)	517	(1.9)	-3	(2.7)	380	(3.7)	411	(3.0)	463	(1.9)	571	(2.4)	619	(2.8)	646	(2.7)	266
France*	496	(2.3)	97	(1.8)	501	(3.3)	492	(2.5)	**8**	(3.5)	331	(6.1)	367	(4.6)	429	(2.7)	567	(3.4)	620	(3.8)	650	(3.4)	319
Germany*	516	(2.8)	95	(1.6)	521	(3.0)	510	(3.3)	**11**	(2.8)	354	(6.4)	389	(4.7)	451	(3.9)	584	(3.7)	636	(3.0)	663	(3.7)	309
Greece*	449	(2.7)	90	(1.4)	452	(3.6)	446	(2.9)	6	(3.4)	299	(5.8)	332	(3.8)	387	(3.6)	511	(3.8)	565	(3.0)	596	(4.0)	297
Hong Kong-China	558	(3.1)	89	(1.9)	563	(4.3)	552	(3.7)	**11**	(5.0)	396	(6.0)	438	(5.8)	501	(4.3)	620	(3.1)	666	(3.6)	690	(3.8)	294
Hungary*	481	(3.2)	95	(2.4)	486	(3.7)	477	(3.7)	**8**	(3.6)	327	(5.0)	359	(4.2)	415	(4.2)	547	(4.9)	608	(6.1)	640	(6.9)	312
Iceland	490	(1.6)	90	(1.1)	487	(2.2)	493	(2.2)	**-7**	(3.1)	340	(4.2)	372	(3.2)	429	(2.4)	553	(2.7)	604	(3.2)	635	(3.1)	295
Israel	469	(4.6)	105	(2.1)	473	(7.7)	464	(3.5)	9	(7.5)	292	(7.8)	330	(6.3)	397	(5.5)	544	(4.8)	603	(5.5)	636	(4.7)	344
Italy*	485	(2.1)	93	(1.2)	494	(2.4)	476	(2.3)	**17**	(2.5)	332	(2.5)	365	(2.7)	422	(2.2)	550	(2.6)	606	(3.0)	637	(3.1)	305
Japan	530	(3.5)	90	(2.1)	539	(4.4)	521	(3.5)	**17**	(4.1)	376	(6.1)	412	(5.2)	471	(4.1)	595	(4.2)	645	(4.0)	673	(4.8)	296
Kazakhstan	433	(3.2)	79	(2.1)	433	(3.5)	432	(3.6)	0	(3.2)	308	(3.4)	334	(3.9)	378	(2.9)	485	(4.5)	536	(6.0)	567	(6.9)	259
Korea	553	(4.3)	95	(2.0)	561	(5.5)	544	(4.9)	**17**	(6.0)	395	(6.5)	430	(5.2)	489	(4.5)	620	(5.0)	672	(5.6)	700	(6.8)	306
*Latvia**	495	(2.8)	79	(1.5)	492	(3.3)	498	(3.2)	**-6**	(3.3)	364	(5.2)	393	(3.4)	441	(3.6)	550	(3.5)	598	(4.2)	626	(3.7)	262
Liechtenstein	536	(3.7)	94	(3.2)	545	(5.7)	527	(5.9)	**18**	(9.1)	374	(10.8)	407	(9.9)	469	(7.4)	608	(5.5)	654	(8.9)	685	(11.8)	311
*Lithuania**	482	(2.7)	86	(1.4)	481	(2.9)	483	(3.0)	-1	(2.3)	341	(4.2)	371	(3.5)	423	(3.8)	542	(3.3)	594	(3.9)	623	(4.0)	282
Luxembourg*	493	(0.9)	93	(0.8)	505	(1.2)	481	(1.3)	**24**	(1.8)	340	(2.4)	371	(2.8)	426	(1.6)	560	(1.3)	614	(2.3)	642	(2.6)	302
Macao-China	536	(1.1)	90	(1.0)	537	(1.3)	535	(1.7)	2	(2.1)	386	(3.6)	421	(2.9)	478	(2.2)	598	(1.6)	646	(1.9)	672	(2.4)	286
Mexico	413	(1.4)	78	(0.9)	420	(1.5)	407	(1.6)	**13**	(1.3)	287	(2.5)	315	(2.0)	360	(1.6)	465	(1.7)	514	(2.0)	544	(2.1)	257
Netherlands*	518	(3.4)	88	(2.2)	522	(3.7)	515	(3.8)	**8**	(2.8)	367	(7.1)	398	(5.4)	457	(5.1)	584	(4.5)	628	(3.6)	650	(3.8)	284
New Zealand	495	(2.2)	100	(1.2)	502	(3.2)	488	(2.9)	**14**	(4.2)	335	(4.3)	367	(3.4)	424	(2.7)	566	(3.0)	626	(3.1)	660	(3.9)	325
Northern Ireland	486	(3.1)	93	(2.1)	491	(5.1)	481	(5.6)	10	(8.8)	334	(4.9)	364	(4.9)	420	(4.5)	552	(4.5)	609	(5.6)	638	(5.4)	305
Norway	486	(2.7)	89	(1.3)	487	(2.7)	486	(3.4)	2	(2.9)	341	(5.5)	374	(3.8)	426	(3.1)	548	(2.8)	600	(4.0)	632	(3.7)	291
Poland*	519	(3.5)	88	(1.7)	518	(4.1)	519	(3.7)	-1	(3.5)	377	(3.6)	406	(3.7)	456	(3.5)	580	(4.3)	636	(5.3)	666	(6.5)	289
Portugal*	489	(3.7)	94	(1.4)	493	(4.0)	484	(3.8)	**9**	(2.5)	330	(4.5)	364	(4.7)	422	(5.0)	556	(3.6)	610	(3.5)	640	(3.9)	310
Republic of Ireland*	502	(2.4)	84	(1.3)	509	(3.4)	496	(2.7)	**13**	(3.9)	360	(4.4)	394	(4.6)	447	(3.5)	561	(2.6)	609	(3.0)	637	(3.1)	276
*Romania**	446	(4.1)	87	(2.3)	447	(4.6)	444	(4.4)	2	(3.7)	312	(4.2)	337	(4.1)	383	(4.4)	504	(5.2)	563	(7.0)	597	(7.2)	285
Russian Federation	487	(3.1)	87	(1.6)	485	(3.5)	489	(3.3)	-4	(2.9)	343	(4.3)	374	(4.1)	428	(3.3)	546	(3.8)	599	(4.7)	628	(5.0)	286
Scotland	496	(2.8)	89	(1.7)	504	(3.4)	488	(3.3)	**16**	(3.6)	347	(5.5)	380	(5.8)	436	(4.0)	558	(3.1)	611	(3.9)	640	(4.8)	292
Serbia	451	(3.4)	92	(2.3)	456	(4.1)	446	(3.8)	**9**	(4.1)	305	(4.9)	335	(4.8)	387	(3.9)	512	(4.1)	572	(5.4)	609	(6.8)	303
Shanghai-China	613	(3.0)	93	(2.2)	614	(3.6)	611	(3.2)	3	(3.1)	447	(6.5)	486	(6.5)	553	(4.7)	679	(2.7)	726	(2.8)	752	(3.6)	304
Singapore	574	(1.2)	98	(1.0)	571	(1.8)	577	(1.7)	**-6**	(2.4)	404	(3.1)	441	(2.7)	507	(2.2)	645	(1.8)	696	(1.8)	724	(3.8)	320
Slovak Republic*	485	(3.4)	101	(2.4)	489	(3.9)	481	(4.2)	7	(4.4)	316	(7.2)	355	(5.9)	418	(4.6)	556	(3.9)	614	(4.5)	645	(5.6)	330
Slovenia*	505	(1.2)	90	(1.0)	506	(2.0)	503	(2.0)	3	(3.1)	361	(3.4)	389	(2.6)	440	(2.5)	569	(2.0)	626	(3.3)	656	(3.9)	295
Spain*	481	(2.0)	87	(0.8)	488	(2.5)	474	(2.1)	**14**	(2.3)	336	(3.6)	367	(3.2)	422	(2.7)	544	(2.1)	592	(2.0)	619	(2.1)	283
Sweden*	474	(2.5)	90	(1.5)	471	(3.1)	476	(2.6)	-5	(2.9)	325	(4.6)	357	(4.2)	413	(2.9)	536	(3.3)	591	(3.5)	621	(3.4)	296
Switzerland	529	(2.9)	90	(1.5)	534	(3.3)	525	(3.0)	**9**	(2.7)	377	(4.1)	411	(3.1)	468	(3.1)	593	(4.0)	644	(4.3)	675	(4.5)	298
Turkey	448	(5.0)	94	(3.1)	451	(5.4)	445	(5.8)	6	(5.0)	308	(6.0)	333	(4.3)	380	(3.9)	510	(8.0)	582	(9.6)	616	(9.0)	308
United Arab Emirates	440	(2.4)	92	(1.2)	437	(3.7)	443	(3.1)	-6	(4.9)	297	(3.4)	325	(2.8)	374	(2.7)	502	(3.1)	563	(3.7)	597	(3.5)	300
United Kingdom*	492	(3.1)	94	(1.5)	498	(4.0)	486	(3.6)	**12**	(4.4)	335	(5.0)	368	(4.7)	427	(4.5)	557	(3.2)	613	(3.9)	645	(4.0)	310
United States	480	(3.5)	90	(1.4)	481	(3.8)	479	(3.7)	2	(2.8)	337	(3.9)	365	(4.0)	416	(3.5)	541	(4.2)	600	(4.8)	631	(5.3)	294
Vietnam	523	(5.1)	88	(2.6)	527	(5.9)	519	(4.9)	**8**	(3.1)	377	(8.8)	409	(7.7)	464	(5.6)	583	(5.7)	637	(7.0)	668	(7.8)	291
Wales	466	(2.2)	85	(1.3)	470	(2.7)	461	(2.7)	**9**	(3.2)	325	(4.0)	356	(4.1)	408	(3.1)	524	(3.0)	574	(3.3)	605	(3.9)	280
OECD average	493	(0.5)	91	(0.3)	498	(0.6)	489	(0.5)	**9**	(0.6)	343	(0.9)	375	(0.7)	431	(0.6)	557	(0.6)	611	(0.7)	641	(0.7)	298

OECD countries (not italicised) *Countries not in OECD (italicised)* *EU countries
14 countries with scores below 430 omitted
Note: Values that are statistically significant are indicated in bold

B11 Mean score, variation and gender differences in student performance on the mathematics sub-scale interpreting

	All students				Gender differences						Percentiles												Difference between 5th and 95th percentile
	Mean score		Standard deviation		Boys		Girls		Difference (B - G)		5th		10th		25th		75th		90th		95th		
	Mean	S.E.	S.D.	S.E.	Mean score	S.E.	Mean score	S.E.	Score dif.	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	
Australia	514	(1.7)	101	(1.1)	519	(2.4)	509	(2.0)	**9**	(2.9)	348	(3.3)	384	(2.3)	445	(2.0)	584	(2.2)	645	(2.8)	680	(3.3)	332
Austria*	509	(3.3)	106	(2.0)	517	(4.5)	501	(4.1)	**16**	(5.6)	331	(5.8)	368	(4.9)	433	(4.6)	587	(3.9)	644	(4.6)	677	(5.2)	346
Belgium*	513	(2.4)	106	(1.5)	518	(3.2)	508	(2.6)	**10**	(3.5)	335	(4.6)	374	(3.5)	439	(3.6)	590	(2.8)	649	(3.2)	681	(2.9)	346
*Bulgaria**	441	(4.2)	99	(2.4)	437	(5.1)	445	(4.4)	-8	(4.8)	282	(6.6)	314	(6.1)	372	(5.1)	510	(4.8)	570	(5.4)	604	(6.0)	322
Canada	521	(2.0)	93	(0.9)	526	(2.3)	517	(2.3)	**9**	(2.2)	366	(2.9)	401	(2.7)	459	(2.5)	585	(2.6)	641	(2.8)	672	(3.2)	306
Chile	433	(3.1)	82	(1.7)	444	(3.9)	422	(3.0)	**22**	(3.3)	305	(5.1)	331	(3.9)	376	(3.7)	488	(3.9)	540	(4.6)	572	(4.7)	267
Chinese Taipei	549	(3.0)	105	(1.8)	550	(4.7)	548	(4.9)	3	(7.4)	366	(5.3)	407	(5.1)	478	(4.0)	625	(3.4)	680	(3.8)	710	(4.8)	345
*Croatia**	477	(3.5)	93	(2.1)	484	(4.2)	470	(3.8)	**15**	(4.0)	328	(4.1)	358	(4.2)	412	(3.5)	541	(4.5)	600	(6.1)	636	(6.8)	308
Cyprus	436	(1.3)	101	(1.1)	434	(1.8)	438	(1.8)	-4	(2.5)	269	(3.1)	305	(2.7)	367	(2.1)	505	(2.3)	565	(2.8)	601	(4.1)	332
Czech Republic*	494	(3.0)	103	(2.5)	498	(3.9)	490	(3.7)	9	(4.6)	327	(7.0)	367	(5.6)	427	(4.1)	564	(3.0)	622	(3.7)	656	(3.5)	329
Denmark*	508	(2.5)	90	(1.3)	515	(3.0)	501	(2.7)	**14**	(2.5)	359	(4.6)	391	(3.9)	447	(3.1)	570	(3.1)	624	(3.5)	653	(4.0)	294
England	502	(4.2)	103	(2.3)	509	(5.5)	495	(4.4)	**14**	(5.6)	331	(7.6)	369	(6.3)	432	(5.6)	573	(3.9)	634	(4.5)	669	(5.5)	338
Estonia*	513	(2.1)	87	(1.1)	515	(2.8)	511	(2.3)	4	(3.0)	372	(3.2)	401	(3.4)	454	(2.9)	571	(2.8)	625	(3.2)	656	(3.6)	284
Finland*	528	(2.2)	88	(1.1)	523	(3.0)	534	(2.1)	**-11**	(2.9)	379	(3.8)	415	(3.7)	471	(2.6)	588	(2.3)	639	(3.0)	669	(4.1)	290
France*	511	(2.5)	107	(2.0)	513	(3.7)	509	(2.8)	4	(4.0)	329	(5.9)	370	(4.9)	438	(3.6)	588	(3.7)	646	(3.8)	678	(4.4)	350
Germany*	517	(3.2)	105	(2.2)	522	(3.4)	511	(3.6)	**12**	(3.0)	338	(6.5)	376	(4.6)	445	(4.2)	592	(3.5)	650	(4.2)	680	(4.0)	342
Greece*	467	(3.1)	98	(1.8)	471	(4.0)	463	(3.1)	**8**	(3.7)	304	(5.6)	340	(4.6)	400	(4.1)	536	(3.6)	593	(4.3)	626	(4.4)	322
Hong Kong-China	551	(3.4)	93	(1.9)	557	(4.8)	545	(3.8)	**12**	(5.5)	385	(5.9)	425	(5.7)	492	(4.9)	616	(3.9)	666	(4.8)	696	(5.1)	311
Hungary*	477	(3.1)	100	(2.2)	479	(3.7)	475	(3.6)	4	(4.0)	307	(5.9)	344	(5.2)	410	(3.7)	547	(4.4)	605	(4.9)	638	(6.4)	331
Iceland	492	(1.9)	101	(1.2)	487	(2.6)	498	(2.5)	**-11**	(3.4)	321	(5.4)	360	(3.8)	424	(2.9)	563	(3.0)	619	(2.7)	653	(3.6)	331
Israel	462	(5.2)	114	(2.2)	470	(9.1)	453	(3.4)	**17**	(8.9)	272	(7.5)	312	(6.1)	381	(6.0)	542	(6.1)	610	(6.5)	648	(7.5)	376
Italy*	498	(2.1)	107	(1.2)	507	(2.7)	489	(2.5)	**18**	(3.0)	321	(3.1)	360	(3.1)	426	(2.6)	573	(2.7)	636	(3.1)	671	(3.0)	350
Japan	531	(3.5)	92	(2.0)	539	(4.5)	522	(3.4)	**17**	(4.2)	375	(6.1)	411	(4.7)	469	(4.3)	595	(3.9)	648	(4.6)	677	(5.1)	303
Kazakhstan	420	(2.6)	64	(1.3)	418	(3.1)	423	(2.8)	-5	(2.8)	317	(3.1)	339	(2.5)	377	(2.5)	463	(3.6)	504	(4.8)	528	(4.4)	210
Korea	540	(4.2)	98	(1.8)	545	(5.4)	535	(4.9)	10	(6.0)	373	(6.9)	412	(5.7)	476	(4.5)	609	(4.4)	662	(4.8)	693	(5.8)	320
*Latvia**	486	(3.0)	89	(1.6)	486	(3.6)	487	(3.6)	-1	(3.8)	340	(5.7)	373	(4.2)	426	(3.2)	547	(3.6)	600	(3.9)	632	(4.7)	292
Liechtenstein	540	(4.1)	107	(3.6)	553	(6.4)	526	(6.4)	**27**	(10.1)	355	(18.4)	393	(9.7)	466	(10.1)	620	(7.0)	672	(10.5)	706	(16.9)	351
*Lithuania**	471	(2.8)	91	(1.5)	470	(3.0)	471	(3.2)	-1	(2.6)	322	(3.7)	354	(4.2)	408	(3.4)	533	(3.8)	591	(4.0)	622	(4.7)	301
Luxembourg*	495	(1.1)	106	(0.9)	505	(1.6)	485	(1.5)	**20**	(2.3)	322	(4.3)	355	(3.0)	420	(1.9)	571	(1.6)	631	(2.2)	665	(3.0)	343
Macao-China	530	(1.0)	92	(0.9)	530	(1.4)	529	(1.5)	2	(2.0)	374	(3.7)	409	(2.4)	469	(2.0)	594	(2.0)	645	(2.5)	674	(3.0)	300
Mexico	413	(1.3)	73	(0.8)	418	(1.5)	408	(1.4)	**10**	(1.3)	294	(2.1)	321	(1.8)	365	(1.7)	461	(1.7)	506	(1.9)	533	(2.3)	239
Netherlands*	526	(3.6)	100	(2.5)	530	(3.8)	521	(4.0)	**10**	(2.9)	357	(7.4)	389	(5.6)	455	(5.6)	599	(4.1)	653	(3.6)	682	(4.9)	325
New Zealand	511	(2.5)	108	(1.4)	516	(3.7)	505	(3.1)	**11**	(4.7)	334	(4.7)	370	(4.0)	434	(3.5)	587	(3.3)	650	(3.6)	684	(4.1)	351
Northern Ireland	496	(3.5)	102	(2.4)	500	(5.2)	491	(5.8)	8	(8.4)	328	(8.3)	366	(6.0)	425	(4.5)	565	(4.1)	628	(6.0)	662	(6.3)	334
Norway	499	(3.1)	98	(1.6)	500	(3.2)	498	(3.7)	2	(3.1)	336	(5.8)	373	(4.1)	433	(3.6)	565	(3.1)	623	(3.9)	658	(4.3)	321
Poland*	515	(3.5)	89	(1.9)	517	(4.2)	513	(3.7)	3	(3.6)	368	(4.3)	400	(4.0)	452	(3.5)	577	(4.2)	630	(5.4)	662	(7.7)	293
Portugal*	490	(4.0)	94	(1.8)	496	(4.5)	484	(4.0)	**12**	(2.9)	333	(6.8)	369	(5.3)	425	(5.2)	557	(3.8)	612	(3.7)	642	(3.5)	308
Republic of Ireland*	507	(2.5)	91	(1.4)	515	(3.5)	498	(3.3)	**17**	(4.5)	353	(5.3)	389	(4.6)	446	(3.5)	569	(2.6)	622	(2.5)	654	(4.2)	301
*Romania**	438	(3.1)	74	(1.9)	441	(3.8)	435	(3.4)	5	(3.4)	321	(4.4)	345	(3.8)	387	(3.4)	487	(3.8)	535	(4.6)	563	(6.4)	242
Russian Federation	471	(2.9)	89	(1.6)	469	(3.8)	473	(3.0)	-4	(3.4)	324	(4.8)	357	(4.0)	411	(3.7)	531	(3.5)	586	(3.9)	618	(4.6)	294
Scotland	510	(2.7)	90	(1.9)	516	(3.3)	504	(3.2)	**12**	(3.7)	360	(7.3)	396	(5.6)	449	(3.9)	571	(3.1)	626	(4.2)	658	(6.2)	298
Serbia	445	(3.4)	92	(2.2)	448	(4.3)	443	(3.5)	6	(4.1)	297	(6.2)	328	(5.6)	383	(3.9)	506	(4.4)	566	(5.0)	599	(6.7)	302
Shanghai-China	579	(2.9)	98	(2.0)	582	(3.5)	576	(3.2)	**7**	(3.3)	412	(6.2)	448	(4.8)	514	(4.2)	647	(3.4)	700	(4.1)	732	(6.0)	320
Singapore	555	(1.4)	106	(0.9)	553	(1.9)	557	(2.0)	-5	(2.9)	377	(3.5)	414	(2.3)	482	(2.1)	629	(2.4)	688	(2.1)	721	(3.4)	344
Slovak Republic*	473	(3.3)	103	(2.1)	478	(4.1)	468	(3.7)	**9**	(4.2)	304	(5.7)	339	(5.0)	402	(4.6)	545	(4.4)	606	(4.1)	639	(5.1)	335
Slovenia*	498	(1.4)	95	(0.9)	498	(2.1)	497	(2.1)	1	(3.2)	347	(3.5)	378	(2.6)	431	(2.6)	566	(2.5)	623	(2.2)	654	(4.2)	307
Spain*	495	(2.2)	98	(0.8)	505	(2.5)	485	(2.5)	**21**	(2.3)	330	(3.3)	367	(3.4)	429	(2.8)	564	(2.6)	619	(2.3)	652	(2.5)	321
Sweden*	485	(2.4)	99	(1.3)	484	(3.3)	486	(2.5)	-2	(3.4)	320	(5.1)	357	(3.8)	418	(3.1)	553	(3.2)	612	(3.1)	646	(3.1)	325
Switzerland	529	(3.4)	101	(1.5)	535	(3.9)	523	(3.5)	**12**	(2.8)	357	(4.9)	396	(3.9)	462	(3.5)	600	(4.3)	655	(4.9)	687	(5.3)	330
Turkey	446	(4.6)	95	(3.0)	451	(5.1)	442	(5.5)	9	(5.0)	304	(4.2)	332	(3.8)	380	(3.1)	506	(7.3)	576	(9.5)	616	(10.3)	312
United Arab Emirates	428	(2.4)	90	(1.2)	424	(4.1)	431	(3.0)	-7	(5.3)	286	(3.4)	315	(2.7)	365	(2.5)	487	(3.1)	548	(3.8)	583	(4.4)	297
United Kingdom*	501	(3.5)	102	(2.0)	508	(4.6)	494	(3.8)	**14**	(4.7)	333	(6.5)	370	(5.2)	432	(4.4)	571	(3.3)	632	(4.0)	666	(4.8)	333
United States	489	(3.9)	96	(1.6)	493	(4.4)	486	(3.9)	**7**	(3.0)	336	(5.1)	367	(5.1)	422	(4.3)	556	(4.6)	615	(4.0)	649	(5.3)	313
Vietnam	497	(4.5)	81	(2.3)	500	(5.2)	494	(4.3)	**5**	(2.7)	361	(6.9)	391	(6.4)	442	(5.6)	551	(4.9)	600	(5.9)	631	(6.6)	270
Wales	483	(2.6)	93	(1.4)	489	(3.3)	477	(3.1)	**12**	(3.8)	330	(5.0)	362	(4.5)	421	(3.5)	546	(3.2)	603	(4.6)	637	(4.5)	307
OECD average	497	(0.5)	98	(0.3)	502	(0.7)	492	(0.6)	**9**	(0.7)	335	(0.9)	370	(0.7)	430	(0.6)	565	(0.6)	622	(0.7)	655	(0.8)	320

OECD countries (not italicised) *Countries not in OECD (italicised)* *EU countries
14 countries with scores below 430 omitted
Note: Values that are statistically significant are indicated in bold

B12 Significant differences in mean scores on the quantity scale

	Mean score		
	Mean	S.E.	Significance
Shanghai-China	591	(3.2)	^
Singapore	569	(1.2)	^
Hong Kong-China	566	(3.4)	^
Chinese Taipei	543	(3.1)	^
Liechtenstein	538	(4.1)	^
Korea	537	(4.1)	^
Netherlands*	532	(3.6)	^
Switzerland	531	(3.1)	^
Macao-China	531	(1.1)	^
Finland*	527	(1.9)	^
Estonia*	525	(2.2)	^
Belgium*	519	(2.0)	^
Poland*	519	(3.5)	^
Japan	518	(3.6)	^
Germany*	517	(3.1)	^
Canada	515	(2.2)	^
Austria*	510	(2.9)	^
Vietnam	509	(5.5)	^
Republic of Ireland*	505	(2.6)	^
Czech Republic*	505	(3.0)	^
Slovenia*	504	(1.2)	^
Denmark*	502	(2.4)	^
Scotland	501	(3.0)	^
Australia	500	(1.9)	^
New Zealand	499	(2.4)	^
Iceland	496	(1.9)	^
France*	496	(2.6)	^
England	495	(4.5)	^
OECD Average	**495**	**(0.5)**	^
Luxembourg*	495	(1.0)	^
United Kingdom	494	(3.8)	
Norway	492	(2.9)	^
Northern Ireland	491	(3.7)	^
Spain*	491	(2.3)	^
Italy*	491	(2.0)	^
*Latvia**	487	(2.9)	^
Slovak Republic*	486	(3.5)	^
*Lithuania**	483	(2.8)	^
Sweden*	482	(2.5)	^
Portugal*	481	(4.0)	^
*Croatia**	480	(3.7)	^
Israel	480	(5.2)	^
United States	478	(3.9)	^
Russian Federation	478	(3.0)	^
Hungary*	476	(3.4)	^
Wales	465	(2.3)	
Serbia	456	(3.7)	v
Greece*	455	(3.0)	v
*Romania**	443	(4.5)	v
*Bulgaria**	443	(4.3)	v
Turkey	442	(5.0)	v
Cyprus	439	(1.1)	v
United Arab Emirates	431	(2.7)	v
Kazakhstan	428	(3.5)	v
Chile	421	(3.3)	v
Mexico	414	(1.5)	v

14 countries with scores below 430 omitted
Simple comparison P-value = 5%

Key

^ significantly higher

NS no significant difference

v significantly lower

OECD countries (not italicised)
Countries not in OECD (italicised)
*EU countries

B13 Significant differences in mean scores on the uncertainty and data scale

	Mean score		
	Mean	S.E.	Significance
Shanghai-China	592	(3.0)	^
Singapore	559	(1.5)	^
Hong Kong-China	553	(3.0)	^
Chinese Taipei	549	(3.2)	^
Korea	538	(4.2)	^
Netherlands*	532	(3.8)	^
Japan	528	(3.5)	^
Liechtenstein	526	(3.9)	^
Macao-China	525	(1.1)	^
Switzerland	522	(3.2)	^
Vietnam	519	(4.5)	^
Finland*	519	(2.4)	^
Poland*	517	(3.5)	^
Canada	516	(1.8)	^
Estonia*	510	(2.0)	^
Germany*	509	(3.0)	^
Republic of Ireland*	509	(2.5)	^
Belgium*	508	(2.5)	^
Australia	508	(1.5)	^
New Zealand	506	(2.6)	^
Denmark*	505	(2.4)	^
Scotland	504	(2.6)	^
England	503	(3.6)	^
United Kingdom	502	(3.0)	
Austria*	499	(2.7)	^
Norway	497	(3.0)	^
Northern Ireland	496	(3.4)	^
Slovenia*	496	(1.2)	^
Iceland	496	(1.8)	^
OECD Average	**493**	**(0.5)**	^
France*	492	(2.7)	^
United States	488	(3.5)	*NS*
Czech Republic*	488	(2.8)	*NS*
Spain*	487	(2.3)	*NS*
Portugal*	486	(3.8)	*NS*
Luxembourg*	483	(1.0)	*NS*
Wales	483	(2.7)	
Sweden*	483	(2.5)	*NS*
Italy*	482	(2.0)	*NS*
*Latvia**	478	(2.8)	*NS*
Hungary*	476	(3.3)	*NS*
*Lithuania**	474	(2.7)	v
Slovak Republic*	472	(3.6)	v
*Croatia**	468	(3.5)	v
Israel	465	(4.7)	v
Russian Federation	463	(3.3)	v
Greece*	460	(2.6)	v
Serbia	448	(3.3)	v
Turkey	447	(4.6)	v
Cyprus	442	(1.1)	v
*Romania**	437	(3.3)	v
United Arab Emirates	432	(2.4)	v
*Bulgaria**	432	(3.9)	v
Chile	430	(2.9)	v
Kazakhstan	414	(2.6)	v
Mexico	413	(1.2)	v

Key

^ significantly higher

NS no significant difference

v significantly lower

OECD countries (not italicised)
Countries not in OECD (italicised)
*EU countries

14 countries with scores below 430 omitted
Simple comparison P-value = 5%

B14 Significant differences in mean scores on the change and relationships scale

	Mean score		
	Mean	S.E.	Significance
Shanghai-China	624	(3.6)	^
Singapore	580	(1.5)	^
Hong Kong-China	564	(3.6)	^
Chinese Taipei	561	(3.5)	^
Korea	559	(5.2)	^
Macao-China	542	(1.2)	^
Japan	542	(4.0)	^
Liechtenstein	542	(4.0)	^
Estonia*	530	(2.3)	^
Switzerland	530	(3.4)	^
Canada	525	(2.0)	^
Finland*	520	(2.6)	^
Netherlands*	518	(3.9)	^
Germany*	516	(3.8)	^
Belgium*	513	(2.6)	^
Vietnam	509	(5.1)	^
Poland*	509	(4.1)	^
Australia	509	(1.7)	^
Austria*	506	(3.4)	^
Republic of Ireland*	501	(2.6)	^
New Zealand	501	(2.5)	^
Czech Republic*	499	(3.5)	^
Slovenia*	499	(1.1)	^
England	498	(4.1)	^
Scotland	497	(3.1)	^
France*	497	(2.7)	^
*Latvia**	496	(3.4)	^
United Kingdom	496	(3.4)	
Denmark*	494	(2.7)	^
OECD Average	**493**	**(0.6)**	^
Russian Federation	491	(3.4)	^
United States	488	(3.5)	^
Luxembourg*	488	(1.0)	^
Iceland	487	(1.9)	^
Portugal*	486	(4.1)	^
Northern Ireland	486	(3.8)	^
Spain*	482	(2.0)	^
Hungary*	481	(3.5)	^
*Lithuania**	479	(3.2)	^
Norway	478	(3.1)	*NS*
Italy*	477	(2.1)	^
Slovak Republic*	474	(4.0)	*NS*
Wales	470	(2.5)	
Sweden*	469	(2.8)	*NS*
*Croatia**	468	(4.2)	*NS*
Israel	462	(5.3)	*NS*
Turkey	448	(5.0)	v
Greece*	446	(3.2)	v
*Romania**	446	(3.9)	v
United Arab Emirates	442	(2.6)	v
Serbia	442	(4.1)	v
Cyprus	440	(1.2)	v
*Bulgaria**	434	(4.5)	v
Kazakhstan	433	(3.2)	v
Chile	411	(3.5)	v
Mexico	405	(1.6)	v

Key

^ significantly higher

NS no significant difference

v significantly lower

OECD countries (not italicised)
Countries not in OECD (italicised)
*EU countries

14 countries with scores below 430 omitted
Simple comparison P-value = 5%

B15 Significant differences in mean scores on the space and shape scale

	Mean score		
	Mean	S.E.	Significance
Shanghai-China	649	(3.6)	^
Chinese Taipei	592	(3.8)	^
Singapore	580	(1.5)	^
Korea	573	(5.2)	^
Hong Kong-China	567	(4.0)	^
Macao-China	558	(1.4)	^
Japan	558	(3.7)	^
Switzerland	544	(3.1)	^
Liechtenstein	539	(4.5)	^
Poland*	524	(4.2)	^
Estonia*	513	(2.5)	^
Canada	510	(2.1)	^
Belgium*	509	(2.4)	^
Netherlands*	507	(3.5)	^
Germany*	507	(3.2)	^
Vietnam	507	(5.1)	^
Finland*	507	(2.1)	^
Slovenia*	503	(1.4)	^
Austria*	501	(3.1)	^
Czech Republic*	499	(3.4)	^
*Latvia**	497	(3.3)	^
Denmark*	497	(2.5)	^
Australia	497	(1.8)	^
Russian Federation	496	(3.9)	^
Portugal*	491	(4.2)	^
New Zealand	491	(2.4)	^
OECD Average	**490**	**(0.5)**	^
Slovak Republic*	490	(4.1)	^
France*	489	(2.7)	^
Iceland	489	(1.5)	^
Italy*	487	(2.5)	^
Luxembourg*	486	(1.0)	^
Scotland	482	(3.1)	^
Norway	480	(3.3)	^
Republic of Ireland*	478	(2.6)	^
England	477	(4.1)	^
Spain*	477	(2.0)	^
United Kingdom	475	(3.5)	
Hungary*	474	(3.4)	^
*Lithuania**	472	(3.1)	^
Sweden*	469	(2.5)	^
United States	463	(4.0)	^
Northern Ireland	463	(3.6)	^
*Croatia**	460	(3.9)	^
Kazakhstan	450	(3.9)	*NS*
Israel	449	(4.8)	*NS*
*Romania**	447	(4.1)	*NS*
Serbia	446	(3.9)	*NS*
Wales	444	(2.6)	
Turkey	443	(5.5)	*NS*
*Bulgaria**	442	(4.3)	*NS*
Greece*	436	(2.6)	v
Cyprus	436	(1.1)	v
United Arab Emirates	425	(2.4)	v
Chile	419	(3.2)	v
Mexico	413	(1.6)	v

Key

^ significantly higher

NS no significant difference

v significantly lower

OECD countries (not italicised)
Countries not in OECD (italicised)
*EU countries

14 countries with scores below 430 omitted
Simple comparison P-value = 5%

B16 Significant differences in mean scores on the formulate scale

	Mean score		
	Mean	S.E.	Significance
Shanghai-China	624	(4.1)	^
Singapore	582	(1.6)	^
Chinese Taipei	578	(4.0)	^
Hong Kong-China	568	(3.7)	^
Korea	562	(5.1)	^
Japan	554	(4.2)	^
Macao-China	545	(1.4)	^
Switzerland	538	(3.1)	^
Liechtenstein	535	(4.4)	^
Netherlands*	527	(3.8)	^
Finland*	519	(2.4)	^
Estonia*	517	(2.3)	^
Canada	516	(2.2)	^
Poland*	516	(4.2)	^
Belgium*	512	(2.4)	^
Germany*	511	(3.4)	^
Denmark*	502	(2.4)	^
Iceland	500	(1.7)	^
Austria*	499	(3.2)	^
Australia	498	(1.9)	^
Vietnam	497	(5.1)	^
New Zealand	496	(2.5)	^
Czech Republic*	495	(3.4)	^
Republic of Ireland*	492	(2.4)	^
Slovenia*	492	(1.5)	^
OECD Average	**492**	**(0.5)**	^
England	491	(4.4)	^
Scotland	490	(3.3)	^
United Kingdom	489	(3.7)	
Norway	489	(3.1)	^
*Latvia**	488	(3.0)	^
France*	483	(2.8)	^
Luxembourg*	482	(1.0)	^
Russian Federation	481	(3.6)	^
Slovak Republic*	480	(4.1)	^
Northern Ireland	479	(3.8)	^
Sweden*	479	(2.7)	^
Portugal*	479	(4.3)	^
*Lithuania**	477	(3.1)	^
Spain*	477	(2.2)	^
United States	476	(4.1)	^
Italy*	475	(2.2)	^
Hungary*	469	(3.6)	^
Israel	465	(4.7)	*NS*
Wales	457	(2.4)	
*Croatia**	453	(4.0)	*NS*
Turkey	449	(5.2)	*NS*
Greece*	448	(2.3)	v
Serbia	447	(3.8)	v
*Romania**	445	(4.1)	v
Kazakhstan	442	(3.8)	v
*Bulgaria**	437	(4.2)	v
Cyprus	437	(1.2)	v
United Arab Emirates	426	(2.7)	v
Chile	420	(3.2)	v
Mexico	409	(1.7)	v

Key

^ significantly higher

NS no significant difference

v significantly lower

OECD countries (not italicised)
Countries not in OECD (italicised)
*EU countries

14 countries with scores below 430 omitted
Simple comparison P-value = 5%

B17 Significant differences in mean scores on the employ scale

	Mean score		
	Mean	S.E.	Significance
Shanghai-China	613	(3.0)	^
Singapore	574	(1.2)	^
Hong Kong-China	558	(3.1)	^
Korea	553	(4.3)	^
Chinese Taipei	549	(3.1)	^
Liechtenstein	536	(3.7)	^
Macao-China	536	(1.1)	^
Japan	530	(3.5)	^
Switzerland	529	(2.9)	^
Estonia*	524	(2.1)	^
Vietnam	523	(5.1)	^
Poland*	519	(3.5)	^
Netherlands*	518	(3.4)	^
Canada	517	(1.9)	^
Germany*	516	(2.8)	^
Belgium*	516	(2.1)	^
Finland*	516	(1.8)	^
Austria*	510	(2.5)	^
Slovenia*	505	(1.2)	^
Czech Republic*	504	(2.9)	^
Republic of Ireland*	502	(2.4)	^
Australia	500	(1.7)	^
France*	496	(2.3)	^
Scotland	496	(2.8)	^
*Latvia**	495	(2.8)	^
New Zealand	495	(2.2)	^
Denmark*	495	(2.4)	^
OECD Average	**493**	**(0.5)**	^
Luxembourg*	493	(0.9)	^
England	493	(3.6)	^
United Kingdom	492	(3.1)	□
Iceland	490	(1.6)	^
Portugal*	489	(3.7)	^
Russian Federation	487	(3.1)	^
Norway	486	(2.7)	^
Northern Ireland	486	(3.1)	^
Italy*	485	(2.1)	^
Slovak Republic*	485	(3.4)	^
*Lithuania**	482	(2.7)	^
Spain*	481	(2.0)	^
Hungary*	481	(3.2)	^
United States	480	(3.5)	^
*Croatia**	478	(3.7)	^
Sweden*	474	(2.5)	^
Israel	469	(4.6)	*NS*
Wales	466	(2.2)	
Serbia	451	(3.4)	v
Greece*	449	(2.7)	v
Turkey	448	(5.0)	v
*Romania**	446	(4.1)	v
Cyprus	443	(1.1)	v
United Arab Emirates	440	(2.4)	v
*Bulgaria**	439	(4.1)	v
Kazakhstan	433	(3.2)	v
Chile	416	(3.3)	v
Mexico	413	(1.4)	v

Key

^ significantly higher

NS no significant difference

v significantly lower

OECD countries (not italicised)
Countries not in OECD(italicised)
*EU countries

14 countries with scores below 430 omitted
Simple comparison P-value = 5%

B18 Significant differences in mean scores on the interpret scale

	Mean score		
	Mean	S.E.	Significance
Shanghai-China	579	(2.9)	^
Singapore	555	(1.4)	^
Hong Kong-China	551	(3.4)	^
Chinese Taipei	549	(3.0)	^
Liechtenstein	540	(4.1)	^
Korea	540	(4.2)	^
Japan	531	(3.5)	^
Macao-China	530	(1.0)	^
Switzerland	529	(3.4)	^
Finland*	528	(2.2)	^
Netherlands*	526	(3.6)	^
Canada	521	(2.0)	^
Germany*	517	(3.2)	^
Poland*	515	(3.5)	^
Australia	514	(1.7)	^
Belgium*	513	(2.4)	^
Estonia*	513	(2.1)	^
New Zealand	511	(2.5)	^
France*	511	(2.5)	^
Scotland	510	(2.7)	^
Austria*	509	(3.3)	^
Denmark*	508	(2.5)	^
Republic of Ireland*	507	(2.5)	^
England	502	(4.2)	^
United Kingdom	501	(3.5)	□
Norway	499	(3.1)	^
Italy*	498	(2.1)	^
Slovenia*	498	(1.4)	^
Vietnam	497	(4.5)	^
OECD Average	**497**	**(0.5)**	^
Northern Ireland	496	(3.5)	^
Spain*	495	(2.2)	^
Luxembourg*	495	(1.1)	^
Czech Republic*	494	(3.0)	^
Iceland	492	(1.9)	^
Portugal*	490	(4.0)	*NS*
United States	490	(3.9)	*NS*
*Latvia**	486	(3.0)	*NS*
Sweden*	485	(2.4)	*NS*
Wales	483	(2.6)	
*Croatia**	477	(3.5)	*NS*
Hungary*	477	(3.1)	*NS*
Slovak Republic*	473	(3.3)	v
Russian Federation	471	(2.9)	v
*Lithuania**	471	(2.8)	v
Greece*	467	(3.1)	v
Israel	462	(5.2)	v
Turkey	446	(4.6)	v
Serbia	445	(3.4)	v
*Bulgaria**	441	(4.2)	v
*Romania**	438	(3.1)	v
Cyprus	436	(1.3)	v
Chile	433	(3.1)	v
United Arab Emirates	428	(2.4)	v
Kazakhstan	420	(2.6)	v
Mexico	413	(1.3)	v

Key

^ significantly higher

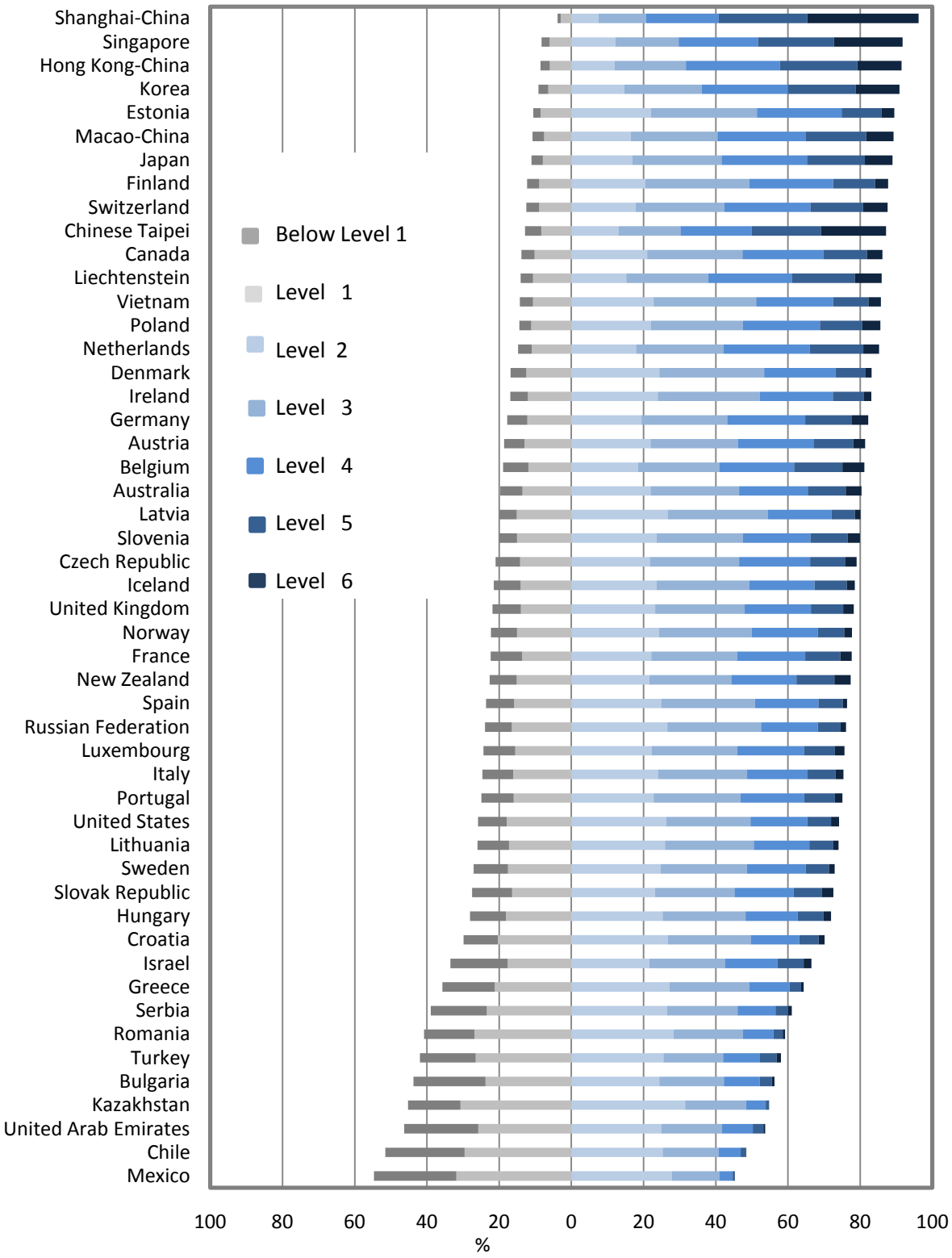
NS no significant difference

v significantly lower

OECD countries (not italicised)
Countries not in OECD (italicised)
*EU countries

14 countries with scores below 430 omitted
Simple comparison P-value = 5%

B19 Summary of the percentage of pupils at each level of proficiency on the mathematics scale



14 countries with scores below 430 omitted
Countries are ranked in descending order of the percentage of students at Levels 2, 3, 4, 5 and 6.
Source: OECD, PISA 2012 database, Table I.2.1a.

B20 Percentage of students at each level of proficiency on the mathematics scale

	Proficiency levels													
	Below Level 1		Level 1		Level 2		Level 3		Level 4		Level 5		Level 6	
	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.
Australia	6.1	(0.4)	13.5	(0.6)	21.9	(0.8)	24.6	(0.6)	19.0	(0.5)	10.5	(0.4)	4.3	(0.4)
Austria*	5.7	(0.6)	13.0	(0.7)	21.9	(0.9)	24.2	(0.8)	21.0	(0.9)	11.0	(0.7)	3.3	(0.4)
Belgium*	7.0	(0.6)	11.9	(0.6)	18.4	(0.6)	22.6	(0.7)	20.7	(0.6)	13.4	(0.5)	6.1	(0.4)
*Bulgaria**	20.0	(1.5)	23.8	(0.9)	24.4	(1.1)	17.9	(0.9)	9.9	(0.8)	3.4	(0.5)	0.7	(0.2)
Canada	3.6	(0.3)	10.2	(0.4)	21.0	(0.6)	26.4	(0.6)	22.4	(0.5)	12.1	(0.5)	4.3	(0.3)
Chile	22.0	(1.4)	29.5	(1.0)	25.3	(1.0)	15.4	(0.8)	6.2	(0.6)	1.5	(0.2)	0.1	(0.0)
Chinese Taipei	4.5	(0.5)	8.3	(0.6)	13.1	(0.6)	17.1	(0.6)	19.7	(0.8)	19.2	(0.9)	18.0	(1.0)
*Croatia**	9.5	(0.7)	20.4	(1.0)	26.7	(0.9)	22.9	(1.1)	13.5	(0.8)	5.4	(0.8)	1.6	(0.5)
Cyprus	19.0	(0.6)	23.0	(0.7)	25.5	(0.6)	19.2	(0.6)	9.6	(0.4)	3.1	(0.2)	0.6	(0.2)
Czech Republic*	6.8	(0.8)	14.2	(1.0)	21.7	(0.8)	24.8	(1.1)	19.7	(0.9)	9.6	(0.7)	3.2	(0.3)
Denmark*	4.4	(0.5)	12.5	(0.7)	24.4	(1.0)	29.0	(1.0)	19.8	(0.7)	8.3	(0.6)	1.7	(0.3)
England	8.0	(0.9)	13.7	(0.9)	22.8	(0.9)	24.5	(1.0)	18.7	(0.9)	9.3	(0.7)	3.1	(0.5)
Estonia*	2.0	(0.3)	8.6	(0.6)	22.0	(0.8)	29.4	(0.8)	23.4	(0.9)	11.0	(0.7)	3.6	(0.4)
Finland*	3.3	(0.4)	8.9	(0.5)	20.5	(0.7)	28.8	(0.8)	23.2	(0.8)	11.7	(0.6)	3.5	(0.3)
France*	8.7	(0.7)	13.6	(0.8)	22.1	(1.0)	23.8	(0.8)	18.9	(0.8)	9.8	(0.5)	3.1	(0.4)
Germany*	5.5	(0.7)	12.2	(0.8)	19.4	(0.8)	23.7	(0.8)	21.7	(0.7)	12.8	(0.7)	4.7	(0.5)
Greece*	14.5	(0.9)	21.2	(0.8)	27.2	(1.0)	22.1	(0.9)	11.2	(0.8)	3.3	(0.4)	0.6	(0.1)
Hong Kong-China	2.6	(0.4)	5.9	(0.6)	12.0	(0.8)	19.7	(1.0)	26.1	(1.1)	21.4	(1.0)	12.3	(0.9)
Hungary*	9.9	(0.8)	18.2	(1.0)	25.3	(1.2)	23.0	(1.0)	14.4	(0.9)	7.1	(0.7)	2.1	(0.5)
Iceland	7.5	(0.5)	14.0	(0.8)	23.6	(0.9)	25.7	(0.9)	18.1	(0.8)	8.9	(0.6)	2.3	(0.4)
Israel	15.9	(1.2)	17.6	(0.9)	21.6	(0.9)	21.0	(0.9)	14.6	(0.9)	7.2	(0.7)	2.2	(0.4)
Italy*	8.5	(0.4)	16.1	(0.5)	24.1	(0.5)	24.6	(0.6)	16.7	(0.5)	7.8	(0.4)	2.2	(0.2)
Japan	3.2	(0.5)	7.9	(0.7)	16.9	(0.8)	24.7	(1.0)	23.7	(0.9)	16.0	(0.9)	7.6	(0.8)
Kazakhstan	14.5	(0.9)	30.7	(1.4)	31.5	(0.9)	16.9	(1.1)	5.4	(0.8)	0.9	(0.3)	0.1	(0.0)
Korea	2.7	(0.5)	6.4	(0.6)	14.7	(0.8)	21.4	(1.0)	23.9	(1.2)	18.8	(0.9)	12.1	(1.3)
*Latvia**	4.8	(0.5)	15.1	(1.0)	26.6	(1.3)	27.8	(0.9)	17.6	(0.9)	6.5	(0.6)	1.5	(0.3)
Liechtenstein	3.5	(1.3)	10.6	(1.8)	15.2	(2.5)	22.7	(2.8)	23.2	(3.0)	17.4	(3.2)	7.4	(1.9)
*Lithuania**	8.7	(0.7)	17.3	(0.9)	25.9	(0.8)	24.6	(1.0)	15.4	(0.7)	6.6	(0.5)	1.4	(0.2)
Luxembourg*	8.8	(0.5)	15.5	(0.5)	22.3	(0.7)	23.6	(0.7)	18.5	(0.6)	8.6	(0.4)	2.6	(0.2)
Macao-China	3.2	(0.3)	7.6	(0.5)	16.4	(0.7)	24.0	(0.7)	24.4	(0.9)	16.8	(0.6)	7.6	(0.3)
Mexico	22.8	(0.7)	31.9	(0.6)	27.8	(0.5)	13.1	(0.4)	3.7	(0.2)	0.6	(0.1)	0.0	(0.0)
Netherlands*	3.8	(0.6)	11.0	(0.9)	17.9	(1.1)	24.2	(1.2)	23.8	(1.1)	14.9	(1.0)	4.4	(0.6)
New Zealand	7.5	(0.6)	15.1	(0.7)	21.6	(0.8)	22.7	(0.8)	18.1	(0.8)	10.5	(0.7)	4.5	(0.4)
Northern Ireland	8.6	(1.1)	15.5	(1.3)	23.8	(1.1)	24.3	(1.4)	17.5	(1.0)	8.1	(0.7)	2.2	(0.4)
Norway	7.2	(0.8)	15.1	(0.9)	24.3	(0.8)	25.7	(1.0)	18.3	(1.0)	7.3	(0.6)	2.1	(0.3)
Poland*	3.3	(0.4)	11.1	(0.8)	22.1	(0.9)	25.5	(0.9)	21.3	(1.1)	11.7	(0.8)	5.0	(0.8)
Portugal*	8.9	(0.8)	16.0	(1.0)	22.8	(0.9)	24.0	(0.8)	17.7	(0.9)	8.5	(0.7)	2.1	(0.3)
Republic of Ireland*	4.8	(0.5)	12.1	(0.7)	23.9	(0.7)	28.2	(0.9)	20.3	(0.8)	8.5	(0.5)	2.2	(0.2)
*Romania**	14.0	(1.2)	26.8	(1.2)	28.3	(1.1)	19.2	(1.1)	8.4	(0.8)	2.6	(0.4)	0.6	(0.3)
Russian Federation	7.5	(0.7)	16.5	(0.8)	26.6	(1.0)	26.0	(1.0)	15.7	(0.8)	6.3	(0.6)	1.5	(0.3)
Scotland	4.9	(0.6)	13.3	(1.0)	24.8	(1.1)	27.2	(1.0)	18.8	(1.0)	8.5	(0.7)	2.4	(0.4)
Serbia	15.5	(1.2)	23.4	(0.9)	26.5	(1.1)	19.5	(1.0)	10.5	(0.7)	3.5	(0.5)	1.1	(0.3)
Shanghai-China	0.8	(0.2)	2.9	(0.5)	7.5	(0.6)	13.1	(0.8)	20.2	(0.8)	24.6	(1.0)	30.8	(1.2)
Singapore	2.2	(0.2)	6.1	(0.4)	12.2	(0.7)	17.5	(0.7)	22.0	(0.6)	21.0	(0.6)	19.0	(0.5)
Slovak Republic*	11.1	(1.0)	16.4	(0.9)	23.1	(1.1)	22.1	(1.1)	16.4	(1.1)	7.8	(0.6)	3.1	(0.5)
Slovenia*	5.1	(0.5)	15.0	(0.7)	23.6	(0.9)	23.9	(1.0)	18.7	(0.8)	10.3	(0.6)	3.4	(0.4)
Spain*	7.8	(0.5)	15.8	(0.6)	24.9	(0.6)	26.0	(0.6)	17.6	(0.6)	6.7	(0.4)	1.3	(0.2)
Sweden*	9.5	(0.7)	17.5	(0.8)	24.7	(0.9)	23.9	(0.8)	16.3	(0.7)	6.5	(0.5)	1.6	(0.3)
Switzerland	3.6	(0.3)	8.9	(0.6)	17.8	(1.1)	24.5	(1.0)	23.9	(0.8)	14.6	(0.8)	6.8	(0.7)
Turkey	15.5	(1.1)	26.5	(1.3)	25.5	(1.2)	16.5	(1.0)	10.1	(1.1)	4.7	(0.8)	1.2	(0.5)
United Arab Emirates	20.5	(0.9)	25.8	(0.8)	24.9	(0.7)	16.9	(0.6)	8.5	(0.5)	2.9	(0.3)	0.5	(0.1)
United Kingdom*	7.8	(0.8)	14.0	(0.8)	23.2	(0.8)	24.8	(0.8)	18.4	(0.8)	9.0	(0.6)	2.9	(0.4)
United States	8.0	(0.7)	17.9	(1.0)	26.3	(0.8)	23.3	(0.9)	15.8	(0.9)	6.6	(0.6)	2.2	(0.3)
Vietnam	3.6	(0.8)	10.6	(1.3)	22.8	(1.3)	28.4	(1.5)	21.3	(1.2)	9.8	(1.0)	3.5	(0.7)
Wales	9.6	(0.7)	19.4	(0.7)	27.5	(0.9)	25.1	(1.0)	13.1	(0.7)	4.3	(0.5)	1.0	(0.2)
OECD average	8.0	(0.1)	15.0	(0.1)	22.5	(0.1)	23.7	(0.2)	18.2	(0.1)	9.3	(0.1)	3.3	(0.1)

OECD countries (not italicised) *Countries not in OECD (italicised)* *EU countries

14 countries with scores below 430 omitted

B21 Mean mathematics performance in PISA 2006, 2009 and 2012

	PISA 2006		PISA 2009		PISA 2012		Change between 2006 and 2012 (PISA 2012 - PISA 2006)		Change between 2009 and 2012 (PISA 2012 - PISA 2009)	
	Mean score	S.E.	Mean score	S.E.	Mean score	S.E.	Score dif.	S.E.	Score dif.	S.E.
Australia	520	(2.2)	514	(2.5)	504	(1.6)	**-16**	(3.1)	**-10**	(3.4)
Austria*	505	(3.7)	m	m	506	(2.7)	0	(4.8)	m	m
Belgium*	520	(3.0)	515	(2.3)	515	(2.1)	-6	(3.9)	-1	(3.4)
*Bulgaria**	413	(6.1)	428	(5.9)	439	(4.0)	**25**	(7.5)	11	(7.2)
Canada	527	(2.0)	527	(1.6)	518	(1.8)	**-9**	(3.1)	**-9**	(2.9)
Chile	411	(4.6)	421	(3.1)	423	(3.1)	**11**	(5.7)	2	(4.6)
Chinese Taipei	549	(4.1)	543	(3.4)	560	(3.3)	10	(5.5)	**17**	(5.0)
*Croatia**	467	(2.4)	460	(3.1)	471	(3.5)	4	(4.5)	**11**	(4.9)
Czech Republic*	510	(3.6)	493	(2.8)	499	(2.9)	**-11**	(4.8)	6	(4.3)
Denmark*	513	(2.6)	503	(2.6)	500	(2.3)	**-13**	(3.8)	-3	(3.8)
Dubai (UAE)	m	m	453	(1.1)	464	(1.2)	m	m	**11**	(2.2)
England	495	(2.5)	493	(2.9)	495	(3.9)	0	(4.7)	2	(4.9)
Estonia*	515	(2.7)	512	(2.6)	521	(2.0)	6	(3.7)	**8**	(3.6)
Finland*	548	(2.3)	541	(2.2)	519	(1.9)	**-30**	(3.3)	**-22**	(3.3)
France*	496	(3.2)	497	(3.1)	495	(2.5)	-1	(4.3)	-2	(4.2)
Germany*	504	(3.9)	513	(2.9)	514	(2.9)	10	(5.0)	1	(4.3)
Greece*	459	(3.0)	466	(3.9)	453	(2.5)	-6	(4.1)	**-13**	(4.9)
Hong Kong-China	547	(2.7)	555	(2.7)	561	(3.2)	**14**	(4.4)	7	(4.5)
Hungary*	491	(2.9)	490	(3.5)	477	(3.2)	**-14**	(4.5)	**-13**	(4.9)
Iceland	506	(1.8)	507	(1.4)	493	(1.7)	**-13**	(2.9)	**-14**	(2.7)
Israel	442	(4.3)	447	(3.3)	466	(4.7)	**25**	(6.5)	**20**	(5.9)
Italy*	462	(2.3)	483	(1.9)	485	(2.0)	**24**	(3.4)	2	(3.1)
Japan	523	(3.3)	529	(3.3)	536	(3.6)	**13**	(5.1)	7	(5.1)
Kazakhstan	m	m	405	(3.0)	432	(3.0)	m	m	**27**	(4.5)
Korea	547	(3.8)	546	(4.0)	554	(4.6)	6	(6.1)	8	(6.3)
*Latvia**	486	(3.0)	482	(3.1)	491	(2.8)	4	(4.3)	**9**	(4.4)
Liechtenstein	525	(4.2)	536	(4.1)	535	(4.0)	10	(6.0)	-1	(5.9)
*Lithuania**	486	(2.9)	477	(2.6)	479	(2.6)	-8	(4.2)	2	(4.0)
Luxembourg*	490	(1.1)	489	(1.2)	490	(1.1)	0	(2.1)	1	(2.2)
Macao-China	525	(1.3)	525	(0.9)	538	(1.0)	**13**	(2.2)	**13**	(2.0)
Mexico	406	(2.9)	419	(1.8)	413	(1.4)	**8**	(3.5)	-5	(2.7)
Netherlands*	531	(2.6)	526	(4.7)	523	(3.5)	-8	(4.6)	-3	(6.1)
New Zealand	522	(2.4)	519	(2.3)	500	(2.2)	**-22**	(3.6)	**-20**	(3.5)
Northern Ireland	494	(2.8)	492	(3.1)	487	(3.1)	-7	(4.2)	-5	(4.4)
Norway	490	(2.6)	498	(2.4)	489	(2.7)	0	(4.1)	**-9**	(3.9)
Poland*	495	(2.4)	495	(2.8)	518	(3.6)	**22**	(4.6)	**23**	(4.8)
Portugal*	466	(3.1)	487	(2.9)	487	(3.8)	**21**	(5.1)	0	(5.0)
Republic of Ireland*	501	(2.8)	487	(2.5)	501	(2.2)	0	(3.9)	**14**	(3.7)
*Romania**	415	(4.2)	427	(3.4)	445	(3.8)	**30**	(5.8)	**17**	(5.3)
Russian Federation	476	(3.9)	468	(3.3)	482	(3.0)	6	(5.1)	**14**	(4.7)
Scotland	506	(3.6)	499	(3.3)	498	(2.6)	-7	(4.5)	-1	(4.2)
Serbia	435	(3.5)	442	(2.9)	449	(3.4)	**13**	(5.1)	6	(4.7)
Shanghai-China	m	m	600	(2.8)	613	(3.3)	m	m	**13**	(4.6)
Singapore	m	m	562	(1.4)	573	(1.3)	m	m	**11**	(2.5)
Slovak Republic*	492	(2.8)	497	(3.1)	482	(3.4)	**-10**	(4.7)	**-15**	(4.9)
Slovenia*	504	(1.0)	501	(1.2)	501	(1.2)	-3	(2.2)	0	(2.3)
Spain*	480	(2.3)	483	(2.1)	484	(1.9)	4	(3.3)	1	(3.2)
Sweden*	502	(2.4)	494	(2.9)	478	(2.3)	**-24**	(3.6)	**-16**	(4.0)
Switzerland	530	(3.2)	534	(3.3)	531	(3.0)	1	(4.6)	-3	(4.7)
Turkey	424	(4.9)	445	(4.4)	448	(4.8)	**24**	(7.0)	3	(6.7)
United Arab Emirates - Ex. Dubai	m	m	411	(3.2)	423	(3.2)	m	m	12	(4.7)
United Kingdom*	495	(2.1)	492	(2.4)	494	(3.3)	-2	(4.2)	2	(4.4)
United States	474	(4.0)	487	(3.6)	481	(3.6)	7	(5.6)	-6	(5.3)
Wales	484	(2.9)	472	(3.0)	468	(2.2)	**-16**	(3.6)	-4	(3.7)

OECD countries (not italicised) *Countries not in OECD (italicised)* **EU countries*

14 countries with scores below 430 omitted

Notes: Values that are statistically significant are indicated in bold

m *indicates a missing value*

For Costa Rica and Malaysia the change between PISA 2009 and PISA 2012 represents change between 2010 and 2012 because these countries implemented the PISA 2009 assessment in 2010 as part of PISA 2009+. In the United Arab Emirates, Dubai took the PISA 2009 assessment in 2009 and the rest of the United Arab Emirates in 2010 as part of PISA+. Results are thus reported separately.

DVD Rental: a released quantity question from PISA 2012

Question 2: DVD RENTAL *PM977Q02 – 00 11 12 21 22 23 24 99*

What is the minimum number of DVDs a member needs to rent so as to cover the cost of the membership fee? Show your work.

.....

.....

.....

Number of DVDs: .....

DVD RENTAL SCORING 2

QUESTION INTENT:

Description: Calculate and compare numbers in an everyday situation

Mathematical content area: Quantity

Context: Personal

Process: Formulate

Full Credit

Code 21: 15. *[Algebraic solution with correct reasoning].*

- $3.20x = 2.50x + 10$
  $0.70x = 10$
  $x = 10 / 0.70 = 14.2$ approximately
  but whole number solution is required: 15 DVDs
- $3.20x > 2.50x + 10$ *[Same steps as previous solution but worked as an inequality].*

Code 22: 15. *[Arithmetical solution with correct reasoning].*

- For a single DVD, a member saves 0.70 zeds. Because a member has already paid 10 zeds at the beginning, they should at least save this amount for the membership to be worthwhile. 10 / 0.70 = 14.2... So 15 DVDs.

Code 23: 15. *[Solve correctly using systematic trial and error, where student chooses a number and finds the fee for members and non-members, and uses this to locate the correct number (15) for which a member pays less than a non-member].*

- 10 DVDs = 32 zeds non-members and 25 zeds + 10 zeds = 35 zeds for members.
  Therefore try a higher number than 10. 15 DVDs is 54 zeds for non-members and 37.50 + 10 = 47.50 zeds for members.
  Therefore try a smaller value: 14 DVDs = 44.80 zeds for non-members and 35

+10 = 45 zeds for members.
Therefore 15 DVDs is the answer.

Code 24: 15. With other correct reasoning.

Partial Credit

Code 11: 15. No reasoning or working.

Code 12: Correct calculation but with incorrect rounding or no rounding to take into account context.

- 14
- 14.2
- 14.3
- 14.28 …

No Credit

Code 00: Other responses.

Code 99: Missing.

Based on the chart above, are the following statements about these three penguin types true or false?

Circle "True" or "False" for each statement.

Statement	Is the statement true or false?
In 2000, the average number of chicks raised per penguin couple was larger than 0.6.	True / False
In 2006, on average, less than 80% of penguin couples raised a chick.	True / False
By about 2015 these three penguin types will be extinct.	True / False
The average number of Magellanic penguin chicks raised per penguin couple decreased between 2001 and 2004.	True / False

UNIT PENGUINS SCORING 4

QUESTION INTENT:

Description: Analyse different statements concerning a given bar chart

Mathematical content area: Uncertainty and data

Context: Scientific

Process: Interpret

Full Credit

Code 1: Four correct responses: True, True, False, True in that order.

No Credit

Code 0: Other responses.

Code 9: Missing.

Question 4: SAILING SHIPS

PM923Q04 – 0 1 9

Due to high diesel fuel costs of 0.42 zeds per litre, the owners of the ship *NewWave* are thinking about equipping their ship with a kite sail.

It is estimated that a kite sail like this has the potential to reduce the diesel consumption by about 20% overall.

Name: *NewWave*

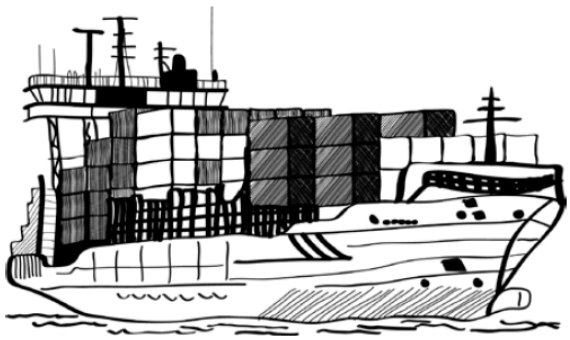
Type: freighter

Length: 117 metres

Breadth: 18 metres

Load capacity: 12 000 tons

Maximum speed: 19 knots



Diesel consumption per year without a kite sail: approximately 3 500 000 litres

The cost of equipping the *NewWave* with a kite sail is 2 500 000 zeds.

After about how many years would the diesel fuel savings cover the cost of the kite sail? Give calculations to support your answer.

.....

.....

.....

.....

.....

.....

.....

Number of years:.....

SAILING SHIPS SCORING 4

QUESTION INTENT:

Description: Solve a real world situation involving cost savings and fuel consumption

Mathematical content area: Change and relationships

Context: Scientific

Process: Formulate

Full Credit

Code 1: A solution from 8 to 9 years is provided with adequate (mathematical) calculations.

- Diesel consumption per year without a sail: 3.5 million litres, price 0.42 zed/litre, costs for diesel without a sail 1 470 000 zeds. If 20% is saved with the sail this results in a saving of 1 470 000 x 0.2 = 294 000 zeds per year. Thus: 2 500 000 / 294 000 $\approx$ 8.5, i.e.: After about 8 to 9 years, the sail becomes (financially) worthwhile.

No Credit

Code 0: Other responses.

Code 9: Missing.

Question 1: OIL SPILL

PM00RQ01 – 0 1 9

Using the map scale, estimate the area of the oil spill in square kilometres (km^2).

Answer: ..... km^2

OIL SPILL SCORING 1

QUESTION INTENT:

Description: Estimation of an irregular area on a map, using a given scale
Mathematical content area: Space and shape
Context: Scientific
Process: Employ

Full Credit

Code 1: Answers in the range from 2200 to 3300.

No Credit

Code 0: Other responses.

Code 9: Missing.

Appendix C

C1 Significant differences in mean scores on the science scale

	Mean score		
	Mean	S.E.	Significance
Shanghai-China	580	(3.0)	^
Hong Kong-China	555	(2.6)	^
Singapore	551	(1.5)	^
Japan	547	(3.6)	^
Finland*	545	(2.2)	^
Estonia*	541	(1.9)	^
Korea	538	(3.7)	^
Vietnam	528	(4.3)	^
Poland*	526	(3.1)	^
Canada	525	(1.9)	^
Liechtenstein	525	(3.5)	^
Germany*	524	(3.0)	^
Chinese Taipei	523	(2.3)	^
Netherlands*	522	(3.5)	^
Republic of Ireland*	522	(2.5)	^
Australia	521	(1.8)	^
Macao-China	521	(0.8)	^
England	516	(4.0)	^
New Zealand	516	(2.1)	^
Switzerland	515	(2.7)	^
Slovenia*	514	(1.3)	^
United Kingdom*	514	(3.4)	□
Scotland	513	(3.0)	^
Czech Republic*	508	(3.0)	^
Northern Ireland	507	(3.9)	^
Austria*	506	(2.7)	^
Belgium*	505	(2.1)	^
*Latvia**	502	(2.8)	^
OECD average	**501**	**(0.5)**	^
France*	499	(2.6)	^
Denmark*	498	(2.7)	*NS*
United States	497	(3.8)	*NS*
Spain*	496	(1.8)	*NS*
*Lithuania**	496	(2.6)	*NS*
Norway	495	(3.1)	*NS*
Hungary*	494	(2.9)	*NS*
Italy*	494	(1.9)	*NS*
*Croatia**	491	(3.1)	*NS*
Luxembourg*	491	(1.3)	*NS*
Wales	491	(3.0)	
Portugal*	489	(3.7)	*NS*
Russian Federation	486	(2.9)	*NS*
Sweden*	485	(3.0)	*NS*
Iceland	478	(2.1)	v
Slovak Republic*	471	(3.6)	v
Israel	470	(5.0)	v
Greece*	467	(3.1)	v
Turkey	463	(3.9)	v
United Arab Emirates	448	(2.8)	v
*Bulgaria**	446	(4.8)	v
Chile	445	(2.9)	v
Serbia	445	(3.4)	v
Thailand	444	(2.9)	v
*Romania**	439	(3.3)	v
Cyprus	438	(1.2)	v
Mexico	415	(1.3)	v

14 countries with scores below 430 omitted
Simple comparison P-value = 5%

Key

^ significantly higher

NS no significant difference

v significantly lower

OECD countries (not italicised)
Countries not in OECD (italicised)
*EU countries

C2 Mean score, variation and gender differences in student performance on the science scale

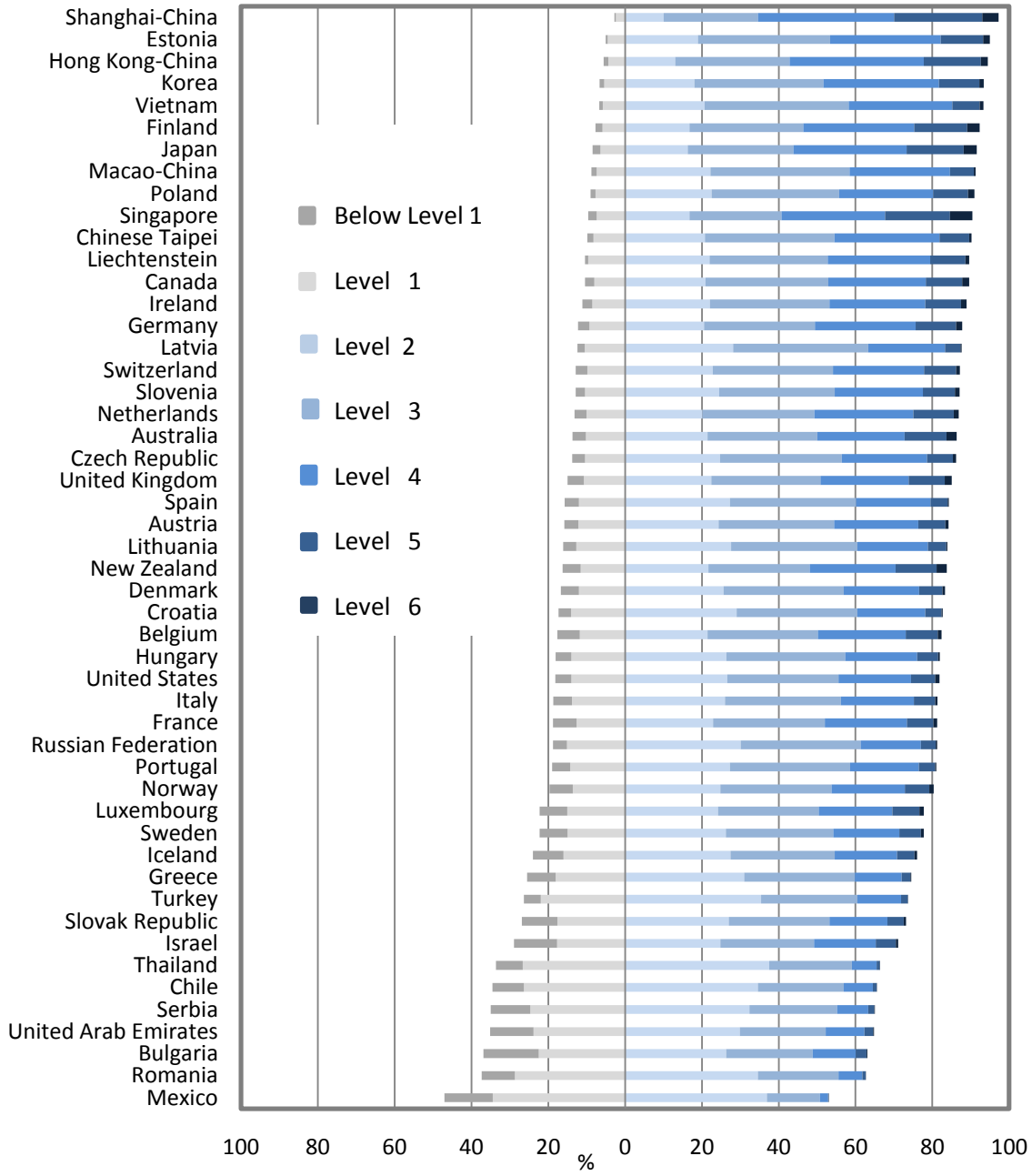
	All students				Gender differences						Percentiles												Difference between 5th and 95th percentile
	Mean score		Standard deviation		Boys		Girls		Difference (B - G)		5th		10th		25th		75th		90th		95th		
	Mean	S.E.	S.D.	S.E.	Mean score	S.E.	Mean score	S.E.	Score dif.	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	
Australia	521	(1.8)	100	(1.0)	524	(2.5)	519	(2.1)	5	(3.0)	353	(3.5)	391	(2.6)	453	(2.1)	592	(2.5)	650	(2.7)	682	(2.9)	329
Austria*	506	(2.7)	92	(1.6)	510	(3.9)	501	(3.4)	9	(5.0)	350	(4.9)	383	(5.3)	442	(3.5)	571	(3.1)	623	(3.4)	650	(3.3)	300
Belgium*	505	(2.1)	101	(1.4)	505	(2.9)	506	(2.6)	0	(3.6)	326	(5.5)	369	(4.5)	439	(3.1)	579	(2.0)	630	(2.1)	658	(2.9)	332
*Bulgaria**	446	(4.8)	102	(2.5)	437	(5.6)	457	(4.6)	**-20**	(4.5)	280	(7.5)	315	(5.3)	374	(5.6)	519	(5.1)	580	(6.1)	612	(6.2)	332
Canada	525	(1.9)	91	(0.9)	527	(2.4)	524	(2.0)	3	(2.1)	370	(3.3)	407	(2.7)	467	(2.1)	588	(2.4)	639	(2.5)	670	(3.3)	300
Chile	445	(2.9)	80	(1.5)	448	(3.7)	442	(2.9)	**7**	(3.3)	317	(4.1)	343	(3.8)	388	(3.3)	500	(3.6)	552	(3.7)	581	(3.7)	264
Chinese Taipei	523	(2.3)	83	(1.4)	524	(3.9)	523	(4.0)	1	(6.4)	379	(4.1)	411	(4.3)	469	(3.8)	582	(2.4)	626	(2.2)	652	(3.1)	273
*Croatia**	491	(3.1)	85	(1.8)	490	(3.9)	493	(3.3)	-2	(3.8)	350	(4.9)	380	(4.0)	433	(3.3)	551	(4.2)	602	(5.2)	630	(5.9)	280
Cyprus	438	(1.2)	97	(1.1)	431	(1.8)	444	(1.7)	**-13**	(2.5)	274	(3.3)	313	(2.9)	373	(2.0)	503	(2.4)	561	(2.5)	594	(3.4)	320
Czech Republic*	508	(3.0)	91	(2.1)	509	(3.7)	508	(3.5)	1	(4.0)	356	(7.2)	392	(5.5)	449	(4.0)	572	(3.2)	622	(3.7)	650	(3.1)	294
Denmark*	498	(2.7)	93	(1.7)	504	(3.5)	493	(2.5)	**10**	(2.7)	338	(5.9)	378	(4.3)	438	(3.8)	563	(3.2)	615	(4.1)	644	(3.7)	306
England	516	(4.0)	101	(2.2)	523	(5.4)	509	(4.3)	**14**	(5.5)	343	(7.0)	384	(5.9)	449	(5.6)	587	(4.1)	642	(4.2)	674	(5.6)	331
Estonia*	541	(1.9)	80	(1.1)	540	(2.5)	543	(2.3)	-2	(2.7)	409	(3.0)	439	(3.3)	487	(2.7)	597	(2.6)	645	(3.1)	672	(4.5)	263
Finland*	545	(2.2)	93	(1.2)	537	(3.0)	554	(2.3)	**-16**	(3.0)	386	(5.7)	424	(3.9)	486	(2.8)	609	(2.4)	662	(2.9)	692	(2.6)	306
France*	499	(2.6)	100	(2.2)	498	(3.8)	500	(2.4)	-2	(3.7)	323	(7.8)	366	(6.0)	433	(3.4)	570	(3.0)	622	(4.1)	651	(4.7)	328
Germany*	524	(3.0)	95	(2.0)	524	(3.1)	524	(3.5)	-1	(3.0)	361	(5.6)	397	(4.8)	461	(3.8)	592	(3.1)	642	(3.9)	671	(3.7)	310
Greece*	467	(3.1)	88	(1.5)	460	(3.8)	473	(3.0)	**-13**	(3.1)	317	(5.2)	352	(5.1)	408	(4.5)	528	(3.5)	578	(3.6)	608	(4.1)	292
Hong Kong-China	555	(2.6)	83	(1.8)	558	(3.6)	551	(3.1)	7	(4.2)	403	(7.1)	446	(5.1)	505	(3.8)	613	(3.0)	655	(3.4)	679	(3.4)	276
Hungary*	494	(2.9)	90	(1.9)	496	(3.4)	493	(3.3)	3	(3.3)	345	(6.0)	376	(4.6)	432	(4.3)	558	(3.5)	610	(4.7)	639	(4.0)	294
Iceland	478	(2.1)	99	(1.5)	477	(2.7)	480	(2.9)	-3	(3.6)	310	(5.0)	348	(3.4)	413	(2.5)	548	(3.2)	603	(3.7)	635	(5.3)	325
Israel	470	(5.0)	108	(2.1)	470	(7.9)	470	(4.0)	-1	(7.6)	286	(8.7)	328	(6.4)	396	(5.7)	548	(5.7)	608	(5.4)	640	(5.1)	354
Italy*	494	(1.9)	93	(1.1)	495	(2.2)	492	(2.4)	3	(2.5)	336	(3.2)	371	(2.8)	431	(2.5)	559	(2.0)	611	(2.5)	641	(2.6)	305
Japan	547	(3.6)	96	(2.2)	552	(4.7)	541	(3.5)	**11**	(4.3)	379	(7.0)	421	(6.4)	485	(4.5)	614	(3.6)	664	(4.3)	693	(4.7)	314
Korea	538	(3.7)	82	(1.8)	539	(4.7)	536	(4.2)	3	(5.1)	396	(6.3)	431	(4.9)	485	(4.0)	595	(4.1)	639	(4.3)	664	(5.3)	268
*Latvia**	502	(2.8)	79	(1.4)	495	(3.6)	510	(2.8)	**-15**	(3.6)	370	(5.5)	400	(4.5)	449	(3.2)	557	(3.6)	603	(3.2)	628	(4.7)	258
Liechtenstein	525	(3.5)	86	(4.1)	533	(5.8)	516	(5.7)	17	(9.1)	383	(11.1)	408	(10.0)	464	(8.4)	588	(8.2)	635	(9.3)	656	(12.2)	273
*Lithuania**	496	(2.6)	86	(1.7)	488	(3.0)	503	(2.6)	**-15**	(2.3)	352	(6.3)	383	(4.0)	438	(3.2)	555	(3.0)	605	(3.6)	634	(3.8)	283
Luxembourg*	491	(1.3)	103	(1.0)	499	(1.7)	483	(1.7)	**15**	(2.2)	318	(3.6)	355	(3.1)	419	(2.2)	566	(1.9)	624	(2.9)	655	(2.9)	337
Macao-China	521	(0.8)	79	(0.7)	520	(1.3)	521	(1.2)	-1	(1.7)	383	(3.9)	416	(2.7)	469	(1.9)	575	(1.7)	619	(1.8)	643	(2.3)	260
Mexico	415	(1.3)	71	(0.9)	418	(1.5)	412	(1.3)	**6**	(1.1)	300	(2.6)	325	(2.1)	368	(1.6)	462	(1.5)	505	(1.9)	532	(2.1)	232
Netherlands*	522	(3.5)	95	(2.2)	524	(3.7)	520	(3.9)	3	(2.9)	357	(5.9)	393	(5.4)	458	(5.0)	591	(3.9)	641	(4.1)	667	(4.0)	310
New Zealand	516	(2.1)	105	(1.4)	518	(3.2)	513	(3.3)	5	(4.9)	339	(4.5)	377	(4.5)	444	(3.0)	591	(3.1)	649	(3.0)	682	(3.9)	343
Northern Ireland	507	(3.9)	101	(2.7)	510	(6.3)	504	(5.8)	5	(9.2)	338	(7.6)	375	(7.3)	438	(5.2)	578	(5.2)	635	(6.5)	669	(7.4)	331
Norway	495	(3.1)	100	(1.9)	493	(3.2)	496	(3.7)	-4	(3.2)	325	(6.6)	365	(5.2)	429	(3.7)	564	(3.3)	620	(3.4)	651	(3.9)	326
Poland*	526	(3.1)	86	(1.5)	524	(3.7)	527	(3.2)	-3	(3.0)	382	(4.7)	415	(4.0)	467	(3.3)	584	(4.0)	637	(5.0)	668	(4.9)	286
Portugal*	489	(3.7)	89	(1.6)	488	(4.1)	490	(3.8)	-2	(2.6)	337	(6.0)	372	(5.6)	430	(4.8)	551	(3.6)	602	(3.6)	630	(4.1)	293
Republic of Ireland*	522	(2.5)	91	(1.6)	524	(3.4)	520	(3.1)	4	(4.4)	366	(5.8)	404	(4.8)	462	(3.1)	586	(2.4)	637	(2.6)	666	(3.4)	300
*Romania**	439	(3.3)	79	(2.0)	436	(3.7)	441	(3.5)	-5	(3.2)	316	(4.0)	340	(3.2)	383	(3.4)	492	(4.6)	543	(5.1)	573	(5.6)	257
Russian Federation	486	(2.9)	85	(1.3)	484	(3.5)	489	(2.9)	-6	(2.9)	347	(3.8)	377	(4.1)	428	(3.6)	544	(3.3)	596	(4.9)	627	(5.1)	280
Scotland	513	(3.0)	89	(2.0)	517	(3.3)	510	(3.6)	**7**	(3.3)	365	(6.9)	400	(4.5)	454	(3.7)	574	(3.2)	627	(4.2)	658	(5.3)	293
Serbia	445	(3.4)	87	(1.9)	443	(4.0)	447	(3.8)	-4	(3.9)	303	(5.6)	333	(5.2)	385	(4.5)	504	(3.5)	558	(3.9)	590	(5.8)	287
Shanghai-China	580	(3.0)	82	(1.8)	583	(3.5)	578	(3.1)	5	(2.7)	435	(6.2)	472	(5.4)	527	(3.7)	639	(3.2)	681	(3.2)	704	(3.3)	269
Singapore	551	(1.5)	104	(1.2)	551	(2.1)	552	(1.9)	-1	(2.6)	374	(4.0)	412	(3.2)	480	(2.6)	627	(2.6)	681	(3.4)	714	(3.2)	340
Slovak Republic*	471	(3.6)	101	(2.8)	475	(4.3)	467	(4.2)	7	(4.5)	300	(8.5)	339	(5.7)	403	(5.2)	542	(4.0)	599	(4.9)	632	(6.3)	332
Slovenia*	514	(1.3)	91	(1.2)	510	(1.9)	519	(1.9)	**-9**	(2.8)	364	(3.0)	397	(3.5)	451	(2.2)	578	(2.0)	631	(3.2)	661	(3.3)	297
Spain*	496	(1.8)	86	(0.9)	500	(2.3)	493	(1.9)	**7**	(2.1)	349	(3.9)	384	(3.1)	440	(2.3)	557	(1.8)	605	(2.0)	632	(2.0)	283
Sweden*	485	(3.0)	100	(1.5)	481	(3.9)	489	(2.8)	**-7**	(3.3)	314	(5.3)	354	(4.7)	419	(4.1)	554	(3.2)	611	(3.4)	643	(3.1)	328
Switzerland	515	(2.7)	91	(1.1)	518	(3.3)	512	(2.7)	**6**	(2.6)	358	(3.8)	394	(3.4)	455	(3.8)	579	(3.1)	630	(3.3)	658	(4.0)	300
Thailand	444	(2.9)	76	(1.7)	433	(3.3)	452	(3.4)	**-19**	(3.4)	323	(4.3)	349	(3.4)	392	(2.6)	494	(3.8)	544	(5.4)	575	(6.0)	252
Turkey	463	(3.9)	80	(1.9)	458	(4.5)	469	(4.3)	**-10**	(4.2)	339	(3.6)	363	(3.5)	407	(3.5)	518	(5.8)	573	(6.3)	602	(5.9)	263
United Arab Emirates	448	(2.8)	94	(1.1)	434	(4.1)	462	(3.7)	**-28**	(5.1)	299	(3.0)	328	(3.2)	382	(3.5)	512	(3.5)	572	(3.4)	605	(3.7)	306
United Kingdom*	514	(3.4)	100	(1.8)	521	(4.5)	508	(3.7)	**13**	(4.7)	344	(5.8)	384	(4.9)	448	(4.6)	584	(3.5)	639	(3.9)	672	(5.0)	327
United States	497	(3.8)	94	(1.5)	497	(4.1)	498	(4.0)	-2	(2.7)	344	(5.4)	377	(4.9)	431	(4.4)	563	(4.2)	619	(4.5)	652	(5.5)	308
Vietnam	528	(4.3)	77	(2.3)	529	(5.0)	528	(4.1)	1	(2.8)	398	(7.7)	428	(7.0)	478	(5.2)	580	(4.0)	625	(5.5)	652	(6.5)	254
Wales	491	(3.0)	94	(1.6)	496	(3.4)	485	(3.5)	**11**	(3.5)	334	(6.2)	370	(4.5)	428	(4.1)	556	(3.4)	609	(3.9)	639	(5.4)	305
OECD average	501	(0.5)	93	(0.3)	502	(0.6)	500	(0.5)	**1**	(0.6)	344	(0.9)	380	(0.8)	439	(0.6)	566	(0.6)	619	(0.6)	648	(0.7)	304

14 countries with scores below 430 omitted
Note: Values that are statistically significant are indicated in bold.
OECD countries (not italicised)
Countries not in OECD (italicised)
*EU countries

C3 Summary descriptions for the six levels of proficiency in science

Level	Characteristics of tasks
6	At Level 6, students can consistently identify, explain and apply scientific knowledge and *knowledge about science* in a variety of complex life situations. They can link different information sources and explanations and use evidence from those sources to justify decisions. They clearly and consistently demonstrate advanced scientific thinking and reasoning, and they demonstrate willingness to use their scientific understanding in support of solutions to unfamiliar scientific and technological situations. Students at this level can use scientific knowledge and develop arguments in support of recommendations and decisions that centre on personal, social or global situations.
5	At Level 5, students can identify the scientific components of many complex life situations, apply both scientific concepts and *knowledge about science* to these situations, and can compare, select and evaluate appropriate scientific evidence for responding to life situations. Students at this level can use well-developed inquiry abilities, link knowledge appropriately and bring critical insights to situations. They can construct explanations based on evidence and arguments based on their critical analysis.
4	At Level 4, students can work effectively with situations and issues that may involve explicit phenomena requiring them to make inferences about the role of science or technology. They can select and integrate explanations from different disciplines of science or technology and link those explanations directly to aspects of life situations. Students at this level can reflect on their actions and they can communicate decisions using scientific knowledge and evidence.
3	At Level 3, students can identify clearly described scientific issues in a range of contexts. They can select facts and knowledge to explain phenomena and apply simple models or inquiry strategies. Students at this level can interpret and use scientific concepts from different disciplines and can apply them directly. They can develop short statements using facts and make decisions based on scientific knowledge.
2	At Level 2, students have adequate scientific knowledge to provide possible explanations in familiar contexts or draw conclusions based on simple investigations. They are capable of direct reasoning and making literal interpretations of the results of scientific inquiry or technological problem solving.
1	At Level 1, students have such a limited scientific knowledge that it can only be applied to a few, familiar situations. They can present scientific explanations that are obvious and follow explicitly from given evidence.

C4 Summary of percentage of students at each level of proficiency on the science scale



14 countries with scores below 430 omitted
Countries are ranked in descending order of the percentage of students at Levels 2, 3, 4, 5 and 6.
Source: OECD, PISA 2012 database, Table I.5.1a.

C5 Percentage of students at each level of proficiency on the science scale

	All students													
	Below Level 1		Level 1		Level 2		Level 3		Level 4		Level 5		Level 6	
	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.
Australia	3.4	(0.3)	10.2	(0.4)	21.5	(0.5)	28.5	(0.7)	22.8	(0.6)	10.9	(0.5)	2.6	(0.3)
Austria*	3.6	(0.5)	12.2	(0.9)	24.3	(1.0)	30.1	(0.9)	21.9	(0.8)	7.0	(0.6)	0.8	(0.2)
Belgium*	5.8	(0.5)	11.8	(0.6)	21.5	(0.7)	28.7	(0.7)	22.9	(0.6)	8.3	(0.4)	1.0	(0.1)
*Bulgaria**	14.4	(1.3)	22.5	(1.2)	26.3	(1.1)	22.5	(1.1)	11.2	(0.8)	2.8	(0.5)	0.3	(0.1)
Canada	2.4	(0.2)	8.0	(0.4)	21.0	(0.7)	32.0	(0.5)	25.3	(0.6)	9.5	(0.5)	1.8	(0.2)
Chile	8.1	(0.8)	26.3	(1.1)	34.6	(1.1)	22.4	(1.0)	7.5	(0.6)	1.0	(0.1)	0.0	(0.0)
Chinese Taipei	1.6	(0.3)	8.2	(0.6)	20.8	(0.9)	33.7	(1.0)	27.3	(1.0)	7.8	(0.6)	0.6	(0.1)
*Croatia**	3.2	(0.4)	14.0	(0.7)	29.1	(1.0)	31.4	(1.2)	17.6	(1.2)	4.3	(0.7)	0.3	(0.2)
Cyprus	14.4	(0.5)	23.7	(0.7)	30.3	(0.9)	21.3	(0.7)	8.4	(0.4)	1.8	(0.3)	0.2	(0.1)
Czech Republic*	3.3	(0.6)	10.5	(1.0)	24.7	(1.0)	31.7	(1.2)	22.2	(1.0)	6.7	(0.5)	0.9	(0.2)
Denmark*	4.7	(0.5)	12.0	(0.7)	25.7	(0.8)	31.3	(0.9)	19.6	(0.8)	6.1	(0.7)	0.7	(0.2)
England	4.3	(0.6)	10.6	(1.0)	21.9	(1.1)	28.0	(1.1)	23.4	(1.1)	9.8	(0.8)	1.9	(0.4)
Estonia*	0.5	(0.1)	4.5	(0.4)	19.0	(0.9)	34.5	(0.9)	28.7	(1.0)	11.1	(0.7)	1.7	(0.3)
Finland*	1.8	(0.3)	5.9	(0.5)	16.8	(0.7)	29.6	(0.8)	28.8	(0.7)	13.9	(0.6)	3.2	(0.4)
France*	6.1	(0.7)	12.6	(0.7)	22.9	(1.1)	29.2	(1.1)	21.3	(0.9)	6.9	(0.7)	1.0	(0.2)
Germany*	2.9	(0.5)	9.3	(0.7)	20.5	(0.8)	28.9	(0.9)	26.2	(1.0)	10.6	(0.8)	1.6	(0.3)
Greece*	7.4	(0.7)	18.1	(1.1)	31.0	(1.1)	28.8	(1.0)	12.2	(0.8)	2.3	(0.4)	0.2	(0.1)
Hong Kong-China	1.2	(0.2)	4.4	(0.5)	13.0	(0.7)	29.8	(1.1)	34.9	(1.0)	14.9	(0.9)	1.8	(0.4)
Hungary*	4.1	(0.6)	14.0	(1.0)	26.4	(1.1)	30.9	(1.2)	18.7	(1.0)	5.5	(0.7)	0.5	(0.2)
Iceland	8.0	(0.6)	16.0	(0.7)	27.5	(0.9)	27.2	(0.9)	16.2	(0.7)	4.6	(0.6)	0.6	(0.2)
Israel	11.2	(1.1)	17.7	(0.9)	24.8	(0.9)	24.4	(1.2)	16.1	(1.1)	5.2	(0.6)	0.6	(0.2)
Italy*	4.9	(0.3)	13.8	(0.5)	26.0	(0.6)	30.1	(0.7)	19.1	(0.6)	5.5	(0.4)	0.6	(0.1)
Japan	2.0	(0.4)	6.4	(0.6)	16.3	(0.8)	27.5	(0.9)	29.5	(1.1)	14.8	(0.9)	3.4	(0.5)
Korea	1.2	(0.2)	5.5	(0.6)	18.0	(1.0)	33.6	(1.1)	30.1	(1.2)	10.6	(0.9)	1.1	(0.4)
*Latvia**	1.8	(0.4)	10.5	(0.9)	28.2	(1.2)	35.1	(1.0)	20.0	(1.0)	4.0	(0.5)	0.3	(0.1)
Liechtenstein	0.8	(0.7)	9.6	(1.9)	22.0	(3.9)	30.8	(3.8)	26.7	(2.6)	9.1	(1.5)	1.0	(1.0)
*Lithuania**	3.4	(0.5)	12.7	(0.8)	27.6	(1.0)	32.9	(1.1)	18.3	(0.9)	4.7	(0.5)	0.4	(0.1)
Luxembourg*	7.2	(0.4)	15.1	(0.7)	24.2	(0.6)	26.2	(0.6)	19.2	(0.5)	7.0	(0.5)	1.2	(0.2)
Macao-China	1.4	(0.2)	7.4	(0.5)	22.2	(0.6)	36.2	(0.8)	26.2	(0.7)	6.2	(0.3)	0.4	(0.1)
Mexico	12.6	(0.5)	34.4	(0.6)	37.0	(0.6)	13.8	(0.5)	2.1	(0.2)	0.1	(0.0)	0.0	c
Netherlands*	3.1	(0.5)	10.1	(0.8)	20.1	(1.3)	29.1	(1.3)	25.8	(1.2)	10.5	(1.0)	1.3	(0.3)
New Zealand	4.7	(0.4)	11.6	(0.8)	21.7	(0.9)	26.4	(0.9)	22.3	(0.9)	10.7	(0.6)	2.7	(0.3)
Northern Ireland	4.7	(0.7)	12.1	(1.3)	23.7	(1.5)	27.8	(1.5)	21.4	(1.3)	8.3	(0.9)	2.0	(0.5)
Norway	6.0	(0.6)	13.6	(0.7)	24.8	(0.8)	28.9	(0.9)	19.0	(0.8)	6.4	(0.6)	1.1	(0.2)
Poland*	1.3	(0.3)	7.7	(0.7)	22.5	(1.0)	33.1	(0.9)	24.5	(1.0)	9.1	(0.8)	1.7	(0.4)
Portugal*	4.7	(0.7)	14.3	(1.1)	27.3	(1.0)	31.4	(1.3)	17.8	(1.1)	4.2	(0.5)	0.3	(0.1)
Republic of Ireland*	2.6	(0.4)	8.5	(0.8)	22.0	(1.2)	31.1	(1.0)	25.0	(0.9)	9.3	(0.6)	1.5	(0.3)
*Romania**	8.7	(0.8)	28.7	(1.3)	34.6	(1.2)	21.0	(1.1)	6.2	(0.8)	0.9	(0.3)	0.0	c
Russian Federation	3.6	(0.4)	15.1	(1.0)	30.1	(1.1)	31.2	(0.9)	15.7	(1.0)	3.9	(0.5)	0.3	(0.2)
Scotland	2.7	(0.4)	9.4	(0.7)	24.9	(1.2)	32.4	(1.2)	21.8	(1.0)	7.5	(0.7)	1.3	(0.3)
Serbia	10.3	(1.0)	24.7	(1.2)	32.4	(1.2)	22.8	(1.1)	8.1	(0.6)	1.6	(0.4)	0.1	(0.1)
Shanghai-China	0.3	(0.1)	2.4	(0.4)	10.0	(0.9)	24.6	(0.9)	35.5	(1.1)	23.0	(1.1)	4.2	(0.6)
Singapore	2.2	(0.3)	7.4	(0.5)	16.7	(0.7)	24.0	(0.7)	27.0	(0.9)	16.9	(0.9)	5.8	(0.4)
Slovak Republic*	9.2	(0.9)	17.6	(1.1)	27.0	(1.3)	26.2	(1.6)	15.0	(1.0)	4.3	(0.6)	0.6	(0.2)
Slovenia*	2.4	(0.2)	10.4	(0.5)	24.5	(1.0)	30.0	(1.0)	23.0	(0.9)	8.4	(0.7)	1.2	(0.2)
Spain*	3.7	(0.3)	12.0	(0.5)	27.3	(0.6)	32.8	(0.6)	19.4	(0.5)	4.5	(0.3)	0.3	(0.1)
Sweden*	7.3	(0.6)	15.0	(0.8)	26.2	(0.8)	28.0	(0.8)	17.2	(0.8)	5.6	(0.4)	0.7	(0.1)
Switzerland	3.0	(0.3)	9.8	(0.6)	22.8	(0.8)	31.3	(0.7)	23.7	(0.9)	8.3	(0.7)	1.0	(0.2)
Thailand	7.0	(0.6)	26.6	(1.3)	37.5	(1.1)	21.6	(1.1)	6.4	(0.7)	0.9	(0.3)	0.1	(0.0)
Turkey	4.4	(0.5)	21.9	(1.3)	35.4	(1.4)	25.1	(1.3)	11.3	(1.3)	1.8	(0.3)	0.0	c
United Arab Emirates	11.3	(0.8)	23.8	(1.0)	29.9	(0.8)	22.3	(0.9)	10.1	(0.6)	2.3	(0.2)	0.3	(0.1)
United Kingdom*	4.3	(0.5)	10.7	(0.9)	22.4	(1.0)	28.4	(1.0)	23.0	(0.9)	9.3	(0.7)	1.8	(0.3)
United States	4.2	(0.5)	14.0	(1.1)	26.7	(1.1)	28.9	(1.1)	18.8	(1.1)	6.3	(0.6)	1.1	(0.2)
Vietnam	0.9	(0.3)	5.8	(0.9)	20.7	(1.4)	37.5	(1.5)	27.0	(1.5)	7.1	(0.9)	1.0	(0.3)
Wales	5.2	(0.6)	14.2	(0.8)	27.1	(1.3)	29.5	(1.3)	18.4	(0.9)	4.9	(0.6)	0.8	(0.2)
OECD average	4.8	(0.1)	13.0	(0.1)	24.5	(0.2)	28.8	(0.2)	20.5	(0.2)	7.2	(0.1)	1.2	(0.0)

14 countries with scores below 430 omitted
Note: Values that are statistically significant are indicated in bold.
c *indicates there are too few observations or no observation to provide reliable estimates*
OECD countries (not italicised)
Countries not in OECD (italicised)
*EU countries

C6 Mean science performance in PISA 2006, 2009 and 2012

	PISA 2006		PISA 2009		PISA 2012		Change between 2006 and 2012 (PISA 2012 - PISA 2006)		Change between 2009 and 2012 (PISA 2012 - PISA 2009)	
	Mean score	S.E.	Mean score	S.E.	Mean score	S.E.	Score dif.	S.E.	Score dif.	S.E.
Australia	527	(2.3)	527	(2.5)	521	(1.8)	-5	(4.5)	-6	(3.7)
Austria*	511	(3.9)	m	m	506	(2.7)	-5	(5.9)	m	m
Belgium*	510	(2.5)	507	(2.5)	505	(2.1)	-5	(4.8)	-1	(3.8)
*Bulgaria**	434	(6.1)	439	(5.9)	446	(4.8)	12	(8.5)	7	(7.8)
Canada	534	(2.0)	529	(1.6)	525	(1.9)	**-9**	(4.5)	-3	(3.2)
Chile	438	(4.3)	447	(2.9)	445	(2.9)	7	(6.3)	-3	(4.6)
Chinese Taipei	532	(3.6)	520	(2.6)	523	(2.3)	-9	(5.5)	3	(4.0)
*Croatia**	493	(2.4)	486	(2.8)	491	(3.1)	-2	(5.3)	5	(4.7)
Czech Republic*	513	(3.5)	500	(3.0)	508	(3.0)	-5	(5.8)	8	(4.7)
Denmark*	496	(3.1)	499	(2.5)	498	(2.7)	3	(5.4)	-1	(4.2)
Dubai (UAE)	m	m	466	(1.2)	474	(1.4)	m	m	**8**	(2.7)
England	516	(2.7)	515	(3.0)	516	(4.0)	0	(4.8)	1	(5.0)
Estonia*	531	(2.5)	528	(2.7)	541	(1.9)	**10**	(4.7)	**14**	(3.9)
Finland*	563	(2.0)	554	(2.3)	545	(2.2)	**-18**	(4.6)	**-9**	(3.8)
France*	495	(3.4)	498	(3.6)	499	(2.6)	4	(5.5)	1	(4.9)
Germany*	516	(3.8)	520	(2.8)	524	(3.0)	8	(6.0)	4	(4.5)
Greece*	473	(3.2)	470	(4.0)	467	(3.1)	-7	(5.7)	-3	(5.5)
Hong Kong-China	542	(2.5)	549	(2.8)	555	(2.6)	**13**	(5.0)	6	(4.3)
Hungary*	504	(2.7)	503	(3.1)	494	(2.9)	-10	(5.3)	-8	(4.8)
Iceland	491	(1.6)	496	(1.4)	478	(2.1)	**-13**	(4.4)	**-17**	(3.2)
Israel	454	(3.7)	455	(3.1)	470	(5.0)	**16**	(7.1)	**15**	(6.2)
Italy*	475	(2.0)	489	(1.8)	494	(1.9)	**18**	(4.5)	5	(3.3)
Japan	531	(3.4)	539	(3.4)	547	(3.6)	**15**	(6.1)	7	(5.4)
Korea	522	(3.4)	538	(3.4)	538	(3.7)	**16**	(6.1)	0	(5.4)
*Latvia**	490	(3.0)	494	(3.1)	502	(2.8)	**13**	(5.4)	8	(4.6)
Liechtenstein	522	(4.1)	520	(3.4)	525	(3.5)	3	(6.5)	5	(5.3)
*Lithuania**	488	(2.8)	491	(2.9)	496	(2.6)	8	(5.1)	4	(4.4)
Luxembourg*	486	(1.1)	484	(1.2)	491	(1.3)	5	(3.9)	**7**	(2.7)
Macao-China	511	(1.1)	511	(1.0)	521	(0.8)	**10**	(3.8)	**10**	(2.4)
Mexico	410	(2.7)	416	(1.8)	415	(1.3)	5	(4.6)	-1	(3.0)
Netherlands*	525	(2.7)	522	(5.4)	522	(3.5)	-3	(5.7)	0	(6.8)
New Zealand	530	(2.7)	532	(2.6)	516	(2.1)	**-15**	(4.9)	**-16**	(3.9)
Northern Ireland	508	(3.3)	511	(4.4)	507	(3.9)	-1	(5.1)	-1	(5.9)
Norway	487	(3.1)	500	(2.6)	495	(3.1)	8	(5.6)	-5	(4.5)
Poland*	498	(2.3)	508	(2.4)	526	(3.1)	**28**	(5.3)	**18**	(4.4)
Portugal*	474	(3.0)	493	(2.9)	489	(3.7)	**15**	(6.0)	-4	(5.1)
Republic of Ireland*	508	(3.2)	508	(3.3)	522	(2.5)	**14**	(5.3)	**14**	(4.5)
*Romania**	418	(4.2)	428	(3.4)	439	(3.3)	**20**	(6.4)	**11**	(5.1)
Russian Federation	479	(3.7)	478	(3.3)	486	(2.9)	7	(5.8)	8	(4.8)
Scotland	515	(4.0)	514	(3.5)	513	(3.0)	-1	(5.0)	-1	(4.6)
Serbia	436	(3.0)	443	(2.4)	445	(3.4)	9	(5.8)	2	(4.6)
Shanghai-China	m	m	575	(2.3)	580	(3.0)	m	m	6	(4.3)
Singapore	m	m	542	(1.4)	551	(1.5)	m	m	**10**	(2.9)
Slovak Republic*	488	(2.6)	490	(3.0)	471	(3.6)	**-17**	(5.7)	**-19**	(5.1)
Slovenia*	519	(1.1)	512	(1.1)	514	(1.3)	-5	(3.9)	2	(2.6)
Spain*	488	(2.6)	488	(2.1)	496	(1.8)	8	(4.7)	**8**	(3.4)
Sweden*	503	(2.4)	495	(2.7)	485	(3.0)	**-19**	(5.2)	**-10**	(4.5)
Switzerland	512	(3.2)	517	(2.8)	515	(2.7)	4	(5.4)	-1	(4.4)
Thailand	421	(2.1)	425	(3.0)	444	(2.9)	**23**	(5.1)	**19**	(4.6)
Turkey	424	(3.8)	454	(3.6)	463	(3.9)	**40**	(6.5)	10	(5.7)
United Arab Emirates	m	m	429	(3.3)	439	(3.8)	m	m	10	(5.4)
United Kingdom*	515	(2.3)	514	(2.5)	514	(3.4)	-1	(5.4)	0	(4.7)
United States	489	(4.2)	502	(3.6)	497	(3.8)	9	(6.7)	-5	(5.6)
Wales	505	(3.5)	496	(3.5)	491	(3.0)	**-14**	(4.6)	-5	(4.6)

14 countries with scores below 430 omitted
Notes: Values that are statistically significant are indicated in bold.
m *indicates a missing value*
For Costa Rica and Malaysia the change between PISA 2009 and PISA 2012 represents change between 2010 and 2012 because these countries implemented the PISA 2009 assessment in 2010 as part of PISA 2009+.
In the United Arab Emirates, Dubai took the PISA 2009 assessment in 2009 and the rest of the United Arab Emirates in 2010 as part of PISA+. Results are thus reported separately.
OECD countries (not italicised)
Countries not in OECD (italicised)
*EU countries

Appendix D

D1 Significant differences in mean scores on the reading scale

	Mean score		
	Mean	S.E.	Significance
Shanghai-China	570	(2.9)	^
Hong Kong-China	545	(2.8)	^
Singapore	542	(1.4)	^
Japan	538	(3.7)	^
Korea	536	(3.9)	^
Finland*	524	(2.4)	^
Republic of Ireland*	523	(2.6)	^
Canada	523	(1.9)	^
Chinese Taipei	523	(3.0)	^
Poland*	518	(3.1)	^
Estonia*	516	(2.0)	^
Liechtenstein	516	(4.1)	^
New Zealand	512	(2.4)	^
Australia	512	(1.6)	^
Netherlands*	511	(3.5)	^
Belgium*	509	(2.2)	^
Switzerland	509	(2.6)	^
Macao-China	509	(0.9)	^
Vietnam	508	(4.4)	^
Germany*	508	(2.8)	^
Scotland	506	(3.0)	^
France*	505	(2.8)	^
Norway	504	(3.2)	^
England	500	(4.2)	^
United Kingdom*	499	(3.5)	
Northern Ireland	498	(3.9)	^
United States	498	(3.7)	^
OECD average	**496**	**(0.5)**	^
Denmark*	496	(2.6)	^
Czech Republic*	493	(2.9)	^
Italy*	490	(2.0)	^
Austria*	490	(2.8)	^
*Latvia**	489	(2.4)	^
Hungary*	488	(3.2)	^
Spain*	488	(1.9)	^
Luxembourg*	488	(1.5)	^
Portugal*	488	(3.8)	*NS*
Israel	486	(5.0)	*NS*
*Croatia**	485	(3.3)	*NS*
Sweden*	483	(3.0)	*NS*
Iceland	483	(1.8)	*NS*
Slovenia*	481	(1.2)	*NS*
Wales	480	(2.7)	
*Lithuania**	477	(2.5)	*NS*
Greece*	477	(3.3)	*NS*
Turkey	475	(4.2)	*NS*
Russian Federation	475	(3.0)	*NS*
Slovak Republic*	463	(4.2)	v
Cyprus	449	(1.2)	v
Serbia	446	(3.4)	v
United Arab Emirates	442	(2.5)	v
Chile	441	(2.9)	v
Thailand	441	(3.1)	v
Costa Rica	441	(3.5)	v
*Romania**	438	(4.0)	v
*Bulgaria**	436	(6.0)	v
Mexico	424	(1.5)	v

13 countries with scores below 430 omitted
Simple comparison P-value = 5%

Key

^ significantly higher

NS no significant difference

v significantly lower

OECD countries (not italicised)
Countries not in OECD (italicised)
*EU countries

D2 Mean score, variation and gender differences in student performance on the reading scale

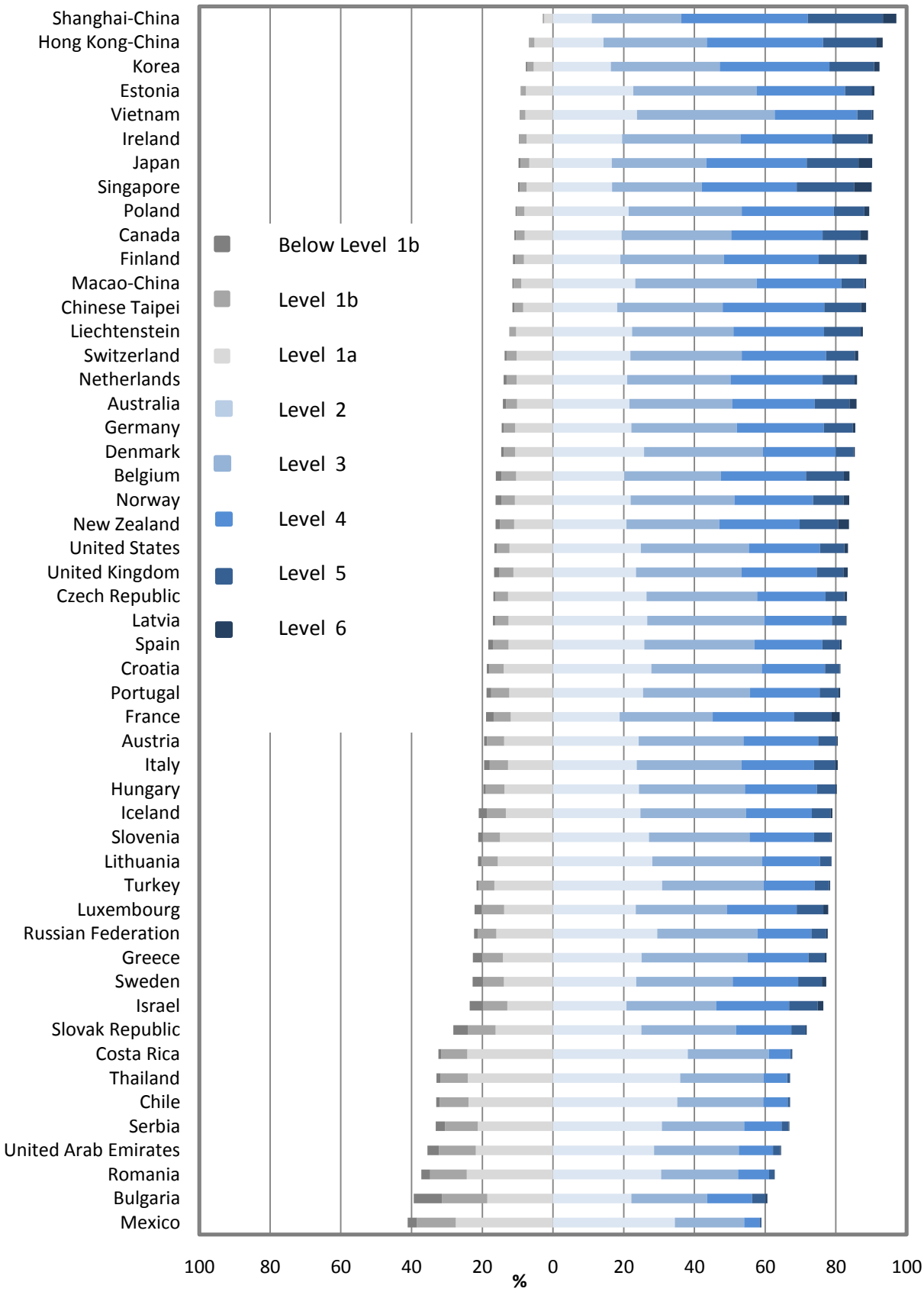
	All students				Gender differences						Percentiles												Difference between 5th and 95th percentile
	Mean score		Standard deviation		Boys		Girls		Difference (B - G)		5th		10th		25th		75th		90th		95th		
	Mean	S.E.	S.D.	S.E.	Mean score	S.E.	Mean score	S.E.	Score dif.	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	
Australia	512	(1.6)	97	(1.0)	495	(2.3)	530	(2.0)	**-34**	(2.9)	347	(3.0)	386	(2.4)	448	(2.2)	579	(1.9)	634	(2.3)	664	(3.1)	318
Austria*	490	(2.8)	92	(1.8)	471	(4.0)	508	(3.4)	**-37**	(5.0)	329	(6.3)	365	(5.1)	427	(3.9)	557	(3.0)	603	(2.5)	629	(3.7)	300
Belgium*	509	(2.2)	103	(1.7)	493	(2.9)	525	(2.6)	**-32**	(3.4)	324	(6.5)	372	(4.3)	444	(3.2)	583	(2.7)	635	(2.3)	663	(2.6)	339
*Bulgaria**	436	(6.0)	119	(2.8)	403	(6.3)	472	(5.6)	**-70**	(5.2)	233	(9.2)	275	(8.0)	353	(8.2)	523	(6.0)	585	(6.1)	619	(6.3)	386
Canada	523	(1.9)	92	(0.9)	506	(2.3)	541	(2.1)	**-35**	(2.1)	363	(3.3)	403	(2.8)	464	(2.3)	587	(2.2)	638	(2.6)	667	(2.7)	305
Chile	441	(2.9)	78	(1.4)	430	(3.8)	452	(2.9)	**-23**	(3.3)	310	(4.6)	339	(4.2)	388	(3.8)	496	(3.3)	541	(3.3)	567	(3.4)	258
Chinese Taipei	523	(3.0)	91	(1.8)	507	(4.3)	539	(4.3)	**-32**	(6.4)	361	(5.5)	399	(5.2)	467	(4.4)	587	(2.8)	633	(3.6)	659	(4.7)	298
Costa Rica	441	(3.5)	74	(1.6)	427	(3.9)	452	(3.5)	**-25**	(2.6)	315	(5.4)	344	(5.4)	391	(4.3)	490	(4.2)	536	(5.0)	563	(4.9)	247
*Croatia**	485	(3.3)	86	(2.1)	461	(4.1)	509	(3.3)	**-48**	(4.0)	337	(5.9)	370	(5.1)	427	(4.4)	546	(3.8)	593	(4.9)	622	(5.1)	284
Cyprus	449	(1.2)	111	(1.3)	418	(1.9)	481	(1.9)	**-64**	(3.0)	249	(4.0)	297	(3.3)	378	(2.4)	528	(2.1)	583	(2.6)	616	(3.3)	366
Czech Republic*	493	(2.9)	89	(1.9)	474	(3.3)	513	(3.4)	**-39**	(3.7)	344	(6.0)	378	(4.7)	434	(3.7)	554	(3.6)	604	(3.8)	634	(4.3)	290
Denmark*	496	(2.6)	86	(2.2)	481	(3.3)	512	(2.6)	**-31**	(2.8)	347	(6.9)	385	(5.1)	442	(3.5)	555	(2.4)	602	(2.8)	629	(4.4)	281
England	500	(4.2)	98	(2.6)	487	(5.4)	512	(4.5)	**-24**	(5.4)	328	(8.5)	371	(8.3)	438	(5.8)	568	(3.8)	621	(4.5)	652	(5.2)	324
Estonia*	516	(2.0)	80	(1.2)	494	(2.4)	538	(2.3)	**-44**	(2.4)	381	(4.4)	412	(3.4)	463	(3.0)	571	(2.4)	618	(2.8)	645	(4.3)	263
Finland*	524	(2.4)	95	(1.3)	494	(3.1)	556	(2.4)	**-62**	(3.1)	360	(5.7)	399	(4.3)	463	(3.5)	590	(2.3)	639	(2.5)	669	(3.5)	309
France*	505	(2.8)	109	(2.3)	483	(3.8)	527	(3.0)	**-44**	(4.2)	312	(7.7)	358	(5.4)	435	(4.3)	584	(3.6)	639	(3.9)	669	(5.0)	357
Germany*	508	(2.8)	91	(1.7)	486	(2.9)	530	(3.1)	**-44**	(2.5)	346	(5.2)	384	(4.8)	447	(3.6)	574	(3.1)	621	(3.2)	646	(3.3)	300
Greece*	477	(3.3)	99	(2.1)	452	(4.1)	502	(3.1)	**-50**	(3.7)	302	(8.8)	346	(6.0)	416	(4.5)	545	(3.4)	597	(3.9)	626	(4.5)	325
Hong Kong-China	545	(2.8)	85	(1.8)	533	(3.8)	558	(3.3)	**-25**	(4.7)	391	(6.4)	430	(5.4)	493	(4.4)	604	(3.0)	648	(3.4)	672	(4.1)	281
Hungary*	488	(3.2)	92	(1.9)	468	(3.9)	508	(3.3)	**-40**	(3.6)	327	(6.0)	363	(5.2)	427	(4.6)	555	(3.3)	603	(3.9)	630	(4.7)	303
Iceland	483	(1.8)	98	(1.4)	457	(2.4)	508	(2.5)	**-51**	(3.3)	308	(5.7)	352	(4.1)	422	(2.9)	551	(2.9)	602	(2.4)	631	(3.2)	323
Israel	486	(5.0)	114	(2.5)	463	(8.2)	507	(3.9)	**-44**	(7.9)	282	(9.5)	329	(7.5)	414	(6.8)	568	(4.5)	624	(4.5)	656	(4.8)	374
Italy*	490	(2.0)	97	(0.9)	471	(2.5)	510	(2.3)	**-39**	(2.6)	317	(3.5)	359	(2.9)	427	(2.6)	559	(2.1)	609	(2.2)	636	(2.1)	319
Japan	538	(3.7)	99	(2.3)	527	(4.7)	551	(3.6)	**-24**	(4.1)	364	(7.7)	409	(6.5)	475	(4.8)	607	(3.8)	658	(4.4)	689	(5.1)	325
Korea	536	(3.9)	87	(2.0)	525	(5.0)	548	(4.5)	**-23**	(5.4)	382	(8.6)	424	(6.2)	483	(4.3)	596	(4.1)	640	(4.0)	665	(4.8)	282
*Latvia**	489	(2.4)	85	(1.7)	462	(3.3)	516	(2.7)	**-55**	(4.0)	341	(5.9)	375	(5.6)	434	(3.0)	548	(2.9)	593	(2.8)	619	(4.1)	278
Liechtenstein	516	(4.1)	88	(4.2)	504	(6.2)	529	(5.8)	**-24**	(8.7)	360	(9.7)	391	(9.5)	452	(7.8)	584	(6.9)	630	(10.6)	649	(13.7)	288
*Lithuania**	477	(2.5)	86	(1.5)	450	(2.8)	505	(2.6)	**-55**	(2.3)	331	(5.1)	363	(4.0)	419	(3.9)	538	(2.8)	585	(3.1)	612	(3.6)	281
Luxembourg*	488	(1.5)	105	(1.0)	473	(1.9)	503	(1.8)	**-30**	(2.0)	304	(3.8)	347	(2.7)	418	(2.4)	564	(2.2)	620	(2.3)	651	(2.4)	347
Macao-China	509	(0.9)	82	(0.7)	492	(1.4)	527	(1.1)	**-36**	(1.7)	366	(3.3)	400	(2.4)	457	(1.8)	566	(1.4)	611	(1.6)	637	(2.1)	270
Mexico	424	(1.5)	80	(1.0)	411	(1.7)	435	(1.6)	**-24**	(1.4)	288	(3.0)	319	(2.5)	370	(1.9)	479	(1.8)	525	(1.9)	552	(2.0)	264
Netherlands*	511	(3.5)	93	(3.0)	498	(4.0)	525	(3.5)	**-26**	(3.1)	349	(8.3)	386	(6.6)	451	(5.1)	579	(3.7)	625	(3.6)	650	(3.8)	300
New Zealand	512	(2.4)	106	(1.6)	495	(3.3)	530	(3.5)	**-34**	(5.0)	332	(4.7)	374	(4.9)	443	(3.2)	586	(3.1)	645	(4.0)	679	(4.9)	347
Northern Ireland	498	(3.9)	95	(2.7)	484	(5.4)	512	(5.2)	**-27**	(7.6)	333	(9.6)	373	(7.1)	436	(5.0)	565	(5.7)	618	(5.3)	646	(5.9)	313
Norway	504	(3.2)	100	(1.9)	481	(3.3)	528	(3.9)	**-46**	(3.3)	330	(8.1)	375	(4.8)	442	(4.0)	573	(3.4)	627	(3.9)	658	(4.2)	328
Poland*	518	(3.1)	87	(1.6)	497	(3.7)	539	(3.1)	**-42**	(2.9)	366	(5.9)	404	(4.6)	461	(3.2)	579	(3.6)	626	(4.8)	655	(6.2)	289
Portugal*	488	(3.8)	94	(1.9)	468	(4.2)	508	(3.7)	**-39**	(2.7)	320	(6.9)	362	(6.0)	429	(4.9)	554	(3.5)	604	(3.5)	631	(3.8)	311
Republic of Ireland*	523	(2.6)	86	(1.7)	509	(3.5)	538	(3.0)	**-29**	(4.2)	373	(7.1)	410	(5.7)	469	(3.6)	582	(2.7)	631	(3.2)	659	(3.2)	286
*Romania**	438	(4.0)	90	(2.0)	417	(4.5)	457	(4.2)	**-40**	(4.1)	290	(5.3)	322	(4.4)	375	(4.4)	501	(5.5)	555	(5.3)	586	(6.3)	296
Russian Federation	475	(3.0)	91	(1.5)	455	(3.5)	495	(3.2)	**-40**	(3.0)	323	(4.8)	359	(4.5)	415	(4.0)	537	(3.9)	592	(4.2)	623	(5.1)	300
Scotland	506	(3.0)	87	(1.8)	493	(3.2)	520	(3.5)	**-27**	(3.4)	357	(7.2)	394	(5.1)	450	(3.9)	565	(3.6)	614	(3.8)	645	(4.8)	288
Serbia	446	(3.4)	93	(2.0)	423	(3.9)	469	(3.8)	**-46**	(3.8)	290	(6.0)	325	(5.5)	384	(4.4)	509	(4.1)	566	(4.6)	596	(5.6)	307
Shanghai-China	570	(2.9)	80	(1.8)	557	(3.3)	581	(2.8)	**-24**	(2.5)	431	(5.1)	463	(4.6)	518	(3.6)	626	(2.8)	667	(3.5)	690	(4.7)	259
Singapore	542	(1.4)	101	(1.2)	527	(1.9)	559	(1.9)	**-32**	(2.6)	369	(3.6)	408	(2.9)	475	(2.1)	614	(2.1)	668	(3.2)	698	(3.7)	329
Slovak Republic*	463	(4.2)	104	(3.3)	444	(4.6)	483	(5.1)	**-39**	(4.6)	274	(10.4)	321	(8.4)	396	(6.8)	538	(4.1)	591	(5.2)	620	(5.5)	346
Slovenia*	481	(1.2)	92	(0.9)	454	(1.7)	510	(1.8)	**-56**	(2.7)	324	(2.9)	362	(2.5)	420	(1.9)	548	(2.1)	598	(2.5)	626	(3.7)	301
Spain*	488	(1.9)	92	(1.1)	474	(2.3)	503	(1.9)	**-29**	(2.0)	327	(4.6)	367	(3.6)	430	(2.6)	552	(2.1)	601	(2.3)	630	(2.1)	303
Sweden*	483	(3.0)	107	(1.8)	458	(4.0)	509	(2.8)	**-51**	(3.6)	297	(6.5)	343	(5.4)	416	(4.3)	558	(3.3)	614	(4.2)	647	(4.2)	350
Switzerland	509	(2.6)	90	(1.1)	491	(3.1)	527	(2.5)	**-36**	(2.6)	352	(4.6)	388	(3.9)	451	(3.3)	573	(2.8)	622	(3.2)	648	(3.9)	296
Thailand	441	(3.1)	78	(1.8)	410	(3.6)	465	(3.3)	**-55**	(3.2)	310	(5.0)	341	(4.4)	389	(3.5)	494	(3.7)	541	(4.4)	569	(6.2)	259
Turkey	475	(4.2)	86	(2.4)	453	(4.6)	499	(4.3)	**-46**	(4.0)	335	(5.3)	365	(4.6)	417	(4.0)	534	(5.6)	588	(6.8)	620	(7.9)	285
United Arab Emirates	442	(2.5)	95	(1.1)	413	(3.9)	469	(3.2)	**-55**	(4.8)	281	(3.9)	316	(3.7)	376	(3.1)	508	(2.8)	562	(3.1)	595	(3.4)	314
United Kingdom*	499	(3.5)	97	(2.3)	487	(4.5)	512	(3.8)	**-25**	(4.6)	330	(7.4)	372	(7.0)	438	(4.8)	567	(3.4)	619	(3.8)	650	(4.3)	320
United States	498	(3.7)	92	(1.6)	482	(4.1)	513	(3.8)	**-31**	(2.6)	342	(7.2)	378	(4.8)	436	(4.5)	561	(3.9)	614	(4.0)	646	(4.7)	303
Vietnam	508	(4.4)	74	(2.6)	492	(5.0)	523	(4.0)	**-31**	(2.6)	379	(9.6)	411	(8.2)	462	(5.4)	559	(3.9)	599	(5.0)	623	(5.3)	245
Wales	480	(2.7)	90	(1.7)	466	(3.2)	493	(3.2)	**-27**	(3.5)	325	(6.3)	365	(4.7)	421	(3.7)	541	(3.2)	593	(3.9)	624	(4.6)	299
OECD average	496	(0.5)	94	(0.3)	478	(0.6)	515	(0.5)	**-38**	(0.6)	332	(1.1)	372	(0.9)	435	(0.7)	563	(0.6)	613	(0.6)	642	(0.7)	310

13 countries with scores below 430 omitted
Note: Values that are statistically significant are indicated in bold.
OECD countries (not italicised)
Countries not in OECD (italicised)
*EU countries

D3 Summary descriptions for the six levels of proficiency in reading

Level	Characteristics of tasks
6	Tasks at this level typically require the reader to make multiple inferences, comparisons and contrasts that are both detailed and precise. They require demonstration of a full and detailed understanding of one or more texts and may involve integrating information from more than one text. Tasks may require the reader to deal with unfamiliar ideas, in the presence of prominent competing information, and to generate abstract categories for interpretations. *Reflect and evaluate* tasks may require the reader to hypothesise about or critically evaluate a complex text on an unfamiliar topic, taking into account multiple criteria or perspectives, and applying sophisticated understandings from beyond the text. There is limited data about *access and retrieve* tasks at this level, but it appears that a salient condition is precision of analysis and fine attention to detail that is inconspicuous in the texts.
5	Tasks at this level that involve retrieving information require the reader to locate and organise several pieces of deeply embedded information, inferring which information in the text is relevant. Reflective tasks require critical evaluation or hypothesis, drawing on specialised knowledge. Both interpretative and reflective tasks require a full and detailed understanding of a text whose content or form is unfamiliar. For all aspects of reading, tasks at this level typically involve dealing with concepts that are contrary to expectations.
4	Tasks at this level that involve retrieving information require the reader to locate and organise several pieces of embedded information. Some tasks at this level require interpreting the meaning of nuances of language in a section of text by taking into account the text as a whole. Other interpretative tasks require understanding and applying categories in an unfamiliar context. Reflective tasks at this level require readers to use formal or public knowledge to hypothesise about or critically evaluate a text. Readers must demonstrate an accurate understanding of long or complex texts whose content or form may be unfamiliar.
3	Tasks at this level require the reader to locate, and in some cases recognise the relationship between, several pieces of information that must meet multiple conditions. Interpretative tasks at this level require the reader to integrate several parts of a text in order to identify a main idea, understand a relationship or construe the meaning of a word or phrase. They need to take into account many features in comparing, contrasting or categorising. Often the required information is not prominent or there is much competing information; or there are other text obstacles, such as ideas that are contrary to expectation or negatively worded. Reflective tasks at this level may require connections, comparisons, and explanations, or they may require the reader to evaluate a feature of the text. Some reflective tasks require readers to demonstrate a fine understanding of the text in relation to familiar, everyday knowledge. Other tasks do not require detailed text comprehension but require the reader to draw on less common knowledge.
2	Some tasks at this level require the reader to locate one or more pieces of information, which may need to be inferred and may need to meet several conditions. Others require recognising the main idea in a text, understanding relationships, or construing meaning within a limited part of the text when the information is not prominent and the reader must make low level inferences. Tasks at this level may involve comparisons or contrasts based on a single feature in the text. Typical reflective tasks at this level require readers to make a comparison or several connections between the text and outside knowledge, by drawing on personal experience and attitudes.
1a	Tasks at this level require the reader to locate one or more independent pieces of explicitly stated information; to recognise the main theme or author's purpose in a text about a familiar topic, or to make a simple connection between information in the text and common, everyday knowledge. Typically the required information in the text is prominent and there is little, if any, competing information. The reader is explicitly directed to consider relevant factors in the task and in the text.
1b	Tasks at this level require the reader to locate a single piece of explicitly stated information in a prominent position in a short, syntactically simple text with a familiar context and text type, such as a narrative or a simple list. The text typically provides support to the reader, such as repetition of information, pictures or familiar symbols. There is minimal competing information. In tasks requiring interpretation the reader may need to make simple connections between adjacent pieces of information.

D4 Summary of percentage of students at each level of proficiency on the reading scale



13 countries with scores below 430 omitted

Countries are ranked in descending order of the percentage of students at Levels 2, 3, 4, 5 and 6.

Source: OECD, PISA 2012 database, Table I.4.1a.

D5 Percentage of students at each level of proficiency on the reading scale

	Proficiency levels															
	Below Level 1b		Level 1b		Level 1a		Level 2		Level 3		Level 4		Level 5		Level 6	
	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.
Australia	0.9	(0.1)	3.1	(0.2)	10.2	(0.4)	21.6	(0.5)	29.1	(0.5)	23.3	(0.5)	9.8	(0.5)	1.9	(0.2)
Austria*	0.8	(0.2)	4.8	(0.6)	13.8	(0.8)	24.2	(0.9)	29.6	(0.9)	21.2	(0.9)	5.2	(0.6)	0.3	(0.1)
Belgium*	1.6	(0.3)	4.1	(0.4)	10.5	(0.6)	20.2	(0.6)	27.3	(0.7)	24.0	(0.6)	10.7	(0.5)	1.6	(0.2)
*Bulgaria**	8.0	(1.1)	12.8	(1.2)	18.6	(1.1)	22.2	(1.2)	21.4	(1.1)	12.7	(1.0)	3.8	(0.6)	0.5	(0.2)
Canada	0.5	(0.1)	2.4	(0.2)	8.0	(0.4)	19.4	(0.6)	31.0	(0.7)	25.8	(0.6)	10.8	(0.5)	2.1	(0.2)
Chile	1.0	(0.2)	8.1	(0.8)	23.9	(1.1)	35.1	(1.1)	24.3	(1.1)	6.9	(0.6)	0.6	(0.1)	0.0	(0.0)
Chinese Taipei	0.6	(0.1)	2.5	(0.3)	8.4	(0.7)	18.1	(0.8)	29.9	(0.9)	28.7	(1.0)	10.4	(0.7)	1.4	(0.3)
Costa Rica	0.8	(0.2)	7.3	(1.0)	24.3	(1.2)	38.1	(1.4)	22.9	(1.4)	6.0	(0.8)	0.6	(0.2)	0.0	c
*Croatia**	0.7	(0.2)	4.0	(0.6)	13.9	(1.0)	27.8	(1.1)	31.2	(1.2)	17.8	(1.1)	4.2	(0.7)	0.2	(0.1)
Cyprus	6.1	(0.3)	9.7	(0.4)	17.0	(0.6)	25.1	(0.8)	24.9	(0.7)	13.2	(0.6)	3.5	(0.3)	0.5	(0.1)
Czech Republic*	0.6	(0.3)	3.5	(0.6)	12.7	(0.9)	26.4	(1.3)	31.3	(1.2)	19.4	(1.1)	5.3	(0.5)	0.8	(0.2)
Denmark*	0.8	(0.3)	3.1	(0.4)	10.7	(0.8)	25.8	(0.9)	33.6	(0.8)	20.5	(0.9)	5.1	(0.6)	0.4	(0.1)
England	1.6	(0.3)	4.0	(0.6)	11.1	(0.9)	23.1	(1.2)	29.5	(1.2)	21.5	(1.3)	7.8	(0.7)	1.3	(0.3)
Estonia*	0.2	(0.1)	1.3	(0.3)	7.7	(0.6)	22.7	(0.9)	35.0	(1.1)	24.9	(1.1)	7.5	(0.7)	0.9	(0.2)
Finland*	0.7	(0.2)	2.4	(0.4)	8.2	(0.6)	19.1	(0.8)	29.3	(0.7)	26.8	(0.8)	11.3	(0.6)	2.2	(0.3)
France*	2.1	(0.4)	4.9	(0.4)	11.9	(0.7)	18.9	(0.8)	26.3	(0.8)	23.0	(0.7)	10.6	(0.6)	2.3	(0.4)
Germany*	0.5	(0.2)	3.3	(0.4)	10.7	(0.7)	22.1	(0.9)	29.9	(0.9)	24.6	(0.9)	8.3	(0.6)	0.7	(0.2)
Greece*	2.6	(0.4)	5.9	(0.6)	14.2	(0.8)	25.1	(1.1)	30.0	(1.0)	17.2	(1.2)	4.6	(0.6)	0.5	(0.1)
Hong Kong-China	0.2	(0.1)	1.3	(0.2)	5.3	(0.6)	14.3	(0.8)	29.2	(1.2)	32.9	(1.4)	14.9	(1.0)	1.9	(0.4)
Hungary*	0.7	(0.2)	5.2	(0.6)	13.8	(0.9)	24.3	(1.2)	29.9	(1.0)	20.4	(1.0)	5.3	(0.7)	0.4	(0.1)
Iceland	2.3	(0.3)	5.4	(0.5)	13.3	(0.6)	24.7	(0.9)	29.9	(1.1)	18.6	(1.1)	5.2	(0.4)	0.6	(0.2)
Israel	3.8	(0.6)	6.9	(0.7)	12.9	(1.0)	20.8	(0.9)	25.3	(0.8)	20.6	(1.0)	8.1	(0.8)	1.5	(0.3)
Italy*	1.6	(0.2)	5.2	(0.3)	12.7	(0.5)	23.7	(0.6)	29.7	(0.5)	20.5	(0.6)	6.1	(0.3)	0.6	(0.1)
Japan	0.6	(0.2)	2.4	(0.4)	6.7	(0.7)	16.6	(0.9)	26.7	(1.0)	28.4	(1.1)	14.6	(1.0)	3.9	(0.6)
Korea	0.4	(0.1)	1.7	(0.4)	5.5	(0.6)	16.4	(0.9)	30.8	(1.0)	31.0	(1.1)	12.6	(1.0)	1.6	(0.3)
*Latvia**	0.7	(0.2)	3.7	(0.5)	12.6	(1.0)	26.7	(1.3)	33.1	(1.1)	19.1	(0.9)	3.9	(0.6)	0.3	(0.1)
Liechtenstein	0.0	c	1.9	(1.0)	10.5	(1.8)	22.4	(3.4)	28.6	(4.5)	25.7	(2.4)	10.4	(2.4)	0.6	c
*Lithuania**	1.0	(0.2)	4.6	(0.5)	15.6	(1.1)	28.1	(1.1)	31.1	(0.9)	16.3	(0.8)	3.1	(0.3)	0.2	(0.1)
Luxembourg*	2.0	(0.2)	6.3	(0.3)	13.8	(0.8)	23.4	(0.7)	25.8	(0.6)	19.7	(0.6)	7.5	(0.3)	1.4	(0.2)
Macao-China	0.3	(0.1)	2.1	(0.2)	9.0	(0.4)	23.3	(0.6)	34.3	(0.7)	24.0	(0.6)	6.4	(0.5)	0.6	(0.2)
Mexico	2.6	(0.2)	11.0	(0.5)	27.5	(0.7)	34.5	(0.6)	19.6	(0.5)	4.5	(0.3)	0.4	(0.1)	0.0	(0.0)
Netherlands*	0.9	(0.5)	2.8	(0.5)	10.3	(0.9)	21.0	(1.3)	29.2	(1.3)	26.1	(1.4)	9.0	(0.7)	0.8	(0.2)
New Zealand	1.3	(0.3)	4.0	(0.5)	11.0	(0.7)	20.8	(0.8)	26.3	(1.1)	22.7	(1.1)	10.9	(0.6)	3.0	(0.4)
Northern Ireland	1.1	(0.3)	4.1	(0.7)	11.5	(1.3)	24.4	(1.4)	29.8	(1.5)	20.8	(1.3)	7.1	(0.8)	1.2	(0.3)
Norway	1.7	(0.3)	3.7	(0.4)	10.8	(0.7)	21.9	(1.0)	29.4	(1.4)	22.3	(1.2)	8.5	(0.6)	1.7	(0.3)
Poland*	0.3	(0.1)	2.1	(0.4)	8.1	(0.7)	21.4	(0.9)	32.0	(0.9)	26.0	(1.0)	8.6	(0.8)	1.4	(0.4)
Portugal*	1.3	(0.3)	5.1	(0.5)	12.3	(1.0)	25.5	(1.2)	30.2	(1.5)	19.7	(1.1)	5.3	(0.6)	0.5	(0.1)
Republic of Ireland*	0.3	(0.1)	1.9	(0.4)	7.5	(0.7)	19.6	(1.2)	33.4	(1.2)	26.0	(0.9)	10.1	(0.7)	1.3	(0.3)
*Romania**	2.5	(0.4)	10.3	(0.8)	24.4	(1.3)	30.6	(1.1)	21.8	(1.2)	8.7	(0.9)	1.5	(0.4)	0.1	c
Russian Federation	1.1	(0.2)	5.2	(0.5)	16.0	(1.0)	29.5	(1.1)	28.3	(1.0)	15.3	(0.9)	4.2	(0.5)	0.5	(0.1)
Scotland	0.5	(0.2)	2.7	(0.5)	9.3	(0.9)	23.9	(1.2)	33.8	(1.3)	22.0	(1.0)	6.9	(0.6)	0.9	(0.3)
Serbia	2.6	(0.4)	9.3	(0.7)	21.3	(1.1)	30.8	(1.2)	23.3	(1.1)	10.5	(0.8)	2.0	(0.4)	0.2	(0.1)
Shanghai-China	0.1	(0.1)	0.3	(0.1)	2.5	(0.3)	11.0	(0.9)	25.3	(0.8)	35.7	(1.1)	21.3	(1.0)	3.8	(0.7)
Singapore	0.5	(0.1)	1.9	(0.3)	7.5	(0.4)	16.7	(0.7)	25.4	(0.7)	26.8	(0.8)	16.2	(0.7)	5.0	(0.4)
Slovak Republic*	4.1	(0.8)	7.9	(0.8)	16.2	(1.1)	25.0	(1.1)	26.8	(1.4)	15.7	(1.0)	4.1	(0.6)	0.3	(0.2)
Slovenia*	1.2	(0.1)	4.9	(0.4)	15.0	(0.7)	27.2	(0.8)	28.4	(0.9)	18.2	(0.6)	4.7	(0.5)	0.3	(0.1)
Spain*	1.3	(0.2)	4.4	(0.4)	12.6	(0.5)	25.8	(0.8)	31.2	(0.7)	19.2	(0.6)	5.0	(0.3)	0.5	(0.1)
Sweden*	2.9	(0.4)	6.0	(0.6)	13.9	(0.7)	23.5	(0.9)	27.3	(0.7)	18.6	(0.9)	6.7	(0.5)	1.2	(0.2)
Switzerland	0.5	(0.1)	2.9	(0.3)	10.3	(0.6)	21.9	(0.9)	31.5	(0.7)	23.8	(0.8)	8.2	(0.6)	1.0	(0.2)
Thailand	1.2	(0.3)	7.7	(0.8)	24.1	(1.0)	36.0	(1.1)	23.5	(1.1)	6.7	(0.8)	0.8	(0.2)	0.1	(0.0)
Turkey	0.6	(0.2)	4.5	(0.6)	16.6	(1.1)	30.8	(1.4)	28.7	(1.3)	14.5	(1.4)	4.1	(0.8)	0.3	(0.1)
United Arab Emirates	3.3	(0.3)	10.4	(0.6)	21.8	(0.7)	28.6	(0.7)	24.0	(0.8)	9.7	(0.6)	2.1	(0.3)	0.2	(0.1)
United Kingdom*	1.5	(0.3)	4.0	(0.5)	11.2	(0.8)	23.5	(1.0)	29.9	(1.1)	21.3	(1.1)	7.5	(0.6)	1.3	(0.2)
United States	0.8	(0.2)	3.6	(0.5)	12.3	(0.9)	24.9	(1.0)	30.5	(0.9)	20.1	(1.1)	6.9	(0.6)	1.0	(0.2)
Vietnam	0.1	(0.1)	1.5	(0.5)	7.8	(1.1)	23.7	(1.4)	39.0	(1.5)	23.4	(1.5)	4.2	(0.7)	0.4	(0.2)
Wales	1.0	(0.2)	4.9	(0.5)	14.7	(0.9)	28.5	(1.3)	29.8	(0.9)	16.3	(0.8)	4.2	(0.5)	0.5	(0.1)
OECD average	1.3	(0.1)	4.4	(0.1)	12.3	(0.1)	23.5	(0.2)	29.1	(0.2)	21.0	(0.2)	7.3	(0.1)	1.1	(0.0)

13 countries with scores below 430 omitted
Note: Values that are statistically significant are indicated in bold.
c *indicates there are too few observations or no observation to provide reliable estimates*
OECD countries (not italicised)
Countries not in OECD (italicised)
*EU countries

D6 Mean reading performance in PISA 2006, 2009 and 2012

	PISA 2006		PISA 2009		PISA 2012		Change between 2006 and 2012 (PISA 2012 - PISA 2006)		Change between 2009 and 2012 (PISA 2012 - PISA 2009)	
	Mean score	S.E.	Mean score	S.E.	Mean score	S.E.	Score dif.	S.E.	Score dif.	S.E.
Australia	513	(2.1)	515	(2.3)	512	(1.6)	-1	(6.2)	-3	(3.8)
Austria*	490	(4.1)	m	m	490	(2.8)	-1	(7.4)	m	m
Belgium*	501	(3.0)	506	(2.3)	509	(2.2)	8	(6.7)	3	(4.1)
*Bulgaria**	402	(6.9)	429	(6.7)	436	(6.0)	**34**	(10.7)	7	(9.4)
Canada	527	(2.4)	524	(1.5)	523	(1.9)	-4	(6.4)	-1	(3.6)
Chile	442	(5.0)	449	(3.1)	441	(2.9)	-1	(8.0)	-8	(5.0)
Chinese Taipei	496	(3.4)	495	(2.6)	523	(3.0)	**27**	(7.2)	**28**	(4.8)
Costa Rica	m	m	443	(3.2)	441	(3.5)	m	m	-2	(5.4)
*Croatia**	477	(2.8)	476	(2.9)	485	(3.3)	7	(7.1)	9	(5.1)
Czech Republic*	483	(4.2)	478	(2.9)	493	(2.9)	10	(7.5)	**15**	(4.8)
Denmark*	494	(3.2)	495	(2.1)	496	(2.6)	2	(6.9)	1	(4.3)
Dubai (UAE)	m	m	459	(1.1)	468	(1.3)	m	m	**9**	(3.1)
England	496	(2.7)	495	(2.8)	500	(4.2)	4	(4.9)	5	(5.0)
Estonia*	501	(2.9)	501	(2.6)	516	(2.0)	**16**	(6.6)	**15**	(4.2)
Finland*	547	(2.1)	536	(2.3)	524	(2.4)	**-23**	(6.4)	**-12**	(4.2)
France*	488	(4.1)	496	(3.4)	505	(2.8)	**18**	(7.5)	10	(5.2)
Germany*	495	(4.4)	497	(2.7)	508	(2.8)	13	(7.6)	**10**	(4.7)
Greece*	460	(4.0)	483	(4.3)	477	(3.3)	**17**	(7.6)	-6	(6.0)
Hong Kong-China	536	(2.4)	533	(2.1)	545	(2.8)	9	(6.7)	**11**	(4.4)
Hungary*	482	(3.3)	494	(3.2)	488	(3.2)	6	(7.2)	-6	(5.2)
Iceland	484	(1.9)	500	(1.4)	483	(1.8)	-2	(6.2)	**-18**	(3.5)
Israel	439	(4.6)	474	(3.6)	486	(5.0)	**47**	(8.8)	12	(6.7)
Italy*	469	(2.4)	486	(1.6)	490	(2.0)	**21**	(6.4)	4	(3.6)
Japan	498	(3.6)	520	(3.5)	538	(3.7)	**40**	(7.6)	**18**	(5.7)
Korea	556	(3.8)	539	(3.5)	536	(3.9)	**-20**	(7.8)	-3	(5.9)
*Latvia**	479	(3.7)	484	(3.0)	489	(2.4)	9	(7.1)	5	(4.6)
Liechtenstein	510	(3.9)	499	(2.8)	516	(4.1)	5	(8.0)	**16**	(5.6)
*Lithuania**	470	(3.0)	468	(2.4)	477	(2.5)	7	(6.8)	**9**	(4.3)
Luxembourg*	479	(1.3)	472	(1.3)	488	(1.5)	8	(5.9)	**16**	(3.3)
Macao-China	492	(1.1)	487	(0.9)	509	(0.9)	**17**	(5.8)	**22**	(2.9)
Mexico	410	(3.1)	425	(2.0)	424	(1.5)	**13**	(6.5)	-2	(3.6)
Netherlands*	507	(2.9)	508	(5.1)	511	(3.5)	4	(7.2)	3	(6.7)
New Zealand	521	(3.0)	521	(2.4)	512	(2.4)	-9	(6.8)	**-9**	(4.2)
Northern Ireland	495	(3.5)	499	(4.1)	498	(3.9)	2	(5.3)	-2	(5.7)
Norway	484	(3.2)	503	(2.6)	504	(3.2)	**20**	(7.2)	1	(4.9)
Poland*	508	(2.8)	500	(2.6)	518	(3.1)	11	(7.0)	**18**	(4.8)
Portugal*	472	(3.6)	489	(3.1)	488	(3.8)	**15**	(7.6)	-2	(5.5)
Republic of Ireland*	517	(3.5)	496	(3.0)	523	(2.6)	6	(7.1)	**28**	(4.7)
*Romania**	396	(4.7)	424	(4.1)	438	(4.0)	**42**	(8.3)	**13**	(6.3)
Russian Federation	440	(4.3)	459	(3.3)	475	(3.0)	**35**	(7.7)	**16**	(5.2)
Scotland	499	(4.0)	500	(3.2)	506	(3.0)	7	(5.0)	6	(4.4)
Serbia	401	(3.5)	442	(2.4)	446	(3.4)	**45**	(7.4)	4	(5.0)
Shanghai-China	m	m	556	(2.4)	570	(2.9)	m	m	**14**	(4.5)
Singapore	m	m	526	(1.1)	542	(1.4)	m	m	**16**	(3.1)
Slovak Republic*	466	(3.1)	477	(2.5)	463	(4.2)	-4	(7.6)	**-15**	(5.5)
Slovenia*	494	(1.0)	483	(1.0)	481	(1.2)	**-13**	(5.8)	-2	(3.1)
Spain*	461	(2.2)	481	(2.0)	488	(1.9)	**27**	(6.3)	7	(3.8)
Sweden*	507	(3.4)	497	(2.9)	483	(3.0)	**-24**	(7.2)	**-14**	(4.9)
Switzerland	499	(3.1)	501	(2.4)	509	(2.6)	10	(6.9)	9	(4.4)
Thailand	417	(2.6)	421	(2.6)	441	(3.1)	**24**	(6.9)	**20**	(4.8)
Turkey	447	(4.2)	464	(3.5)	475	(4.2)	**28**	(8.2)	11	(6.1)
United Arab Emirates	m	m	423	(3.7)	432	(3.3)	m	m	9	(5.6)
United Kingdom*	495	(2.3)	494	(2.3)	499	(3.5)	4	(7.0)	5	(4.9)
United States	c	c	500	(3.7)	498	(3.7)	c	c	-2	(5.8)
Wales	481	(3.7)	476	(3.4)	480	(2.7)	-1	(4.6)	4	(4.3)

13 countries with scores below 430 omitted
Notes: Values that are statistically significant are indicated in bold.
m indicates a missing value
c indicates there are too few observations or no observation to provide reliable estimates
For Costa Rica and Malaysia the change between PISA 2009 and PISA 2012 represents change between 2010 and 2012 because these countries implemented the PISA 2009 assessment in 2010 as part of PISA 2009+.
In the United Arab Emirates, Dubai took the PISA 2009 assessment in 2009 and the rest of the United Arab Emirates in 2010 as part of PISA+. Results are thus reported separately.
OECD countries (not italicised) *Countries not in OECD (italicised)*
*EU countries

Appendix E

PISA index of economic, social and cultural status and performance in mathematics, by national quarters of the index

	PISA index of economic, social and cultural status (ESCS)										Performance on the mathematics scale, by national quarters of this index								Score point difference in mathematics associated with one unit increase in the ESCS		Increased likelihood of students in the bottom quarter of the ESCS index scoring in the bottom quarter of the mathematics performance distribution		Strength of the relationship between mathematics performance and the ESCS	
	All students		Bottom quarter		Second quarter		Third quarter		Top quarter		Bottom quarter		Second quarter		Third quarter		Top quarter						Percentage of explained variance in mathematics performance	
	Mean index	S.E.	Mean index	S.E.	Mean index	S.E.	Mean index	S.E.	Mean index	S.E.	Mean score	S.E.	Mean score	S.E.	Mean score	S.E.	Mean score	S.E.	Effect	S.E.	Ratio	S.E.	%	S.E.
Iceland	0.78	(0.01)	-0.34	(0.02)	0.57	(0.02)	1.19	(0.02)	1.71	(0.01)	464	(2.9)	481	(3.2)	508	(3.4)	526	(3.7)	**31**	(2.1)	**1.75**	(0.11)	**7.7**	(1.0)
Norway	0.46	(0.02)	-0.56	(0.02)	0.27	(0.02)	0.79	(0.02)	1.35	(0.02)	459	(4.1)	479	(3.7)	504	(3.9)	522	(3.7)	**32**	(2.4)	**1.83**	(0.12)	**7.4**	(1.0)
Denmark*	0.43	(0.02)	-0.70	(0.03)	0.16	(0.04)	0.81	(0.03)	1.44	(0.02)	460	(3.4)	489	(3.4)	513	(2.9)	545	(3.4)	**39**	(1.7)	**2.36**	(0.16)	**16.5**	(1.4)
Canada	0.41	(0.02)	-0.75	(0.02)	0.16	(0.02)	0.79	(0.02)	1.44	(0.01)	486	(2.3)	509	(2.5)	529	(2.5)	558	(2.9)	**31**	(1.2)	**1.84**	(0.08)	**9.4**	(0.7)
Finland*	0.36	(0.02)	-0.68	(0.02)	0.13	(0.02)	0.73	(0.02)	1.28	(0.01)	488	(3.1)	509	(2.5)	529	(3.2)	555	(2.6)	**33**	(1.8)	**1.89**	(0.10)	**9.4**	(0.9)
United Arab Emirates	0.32	(0.02)	-0.82	(0.03)	0.19	(0.02)	0.67	(0.01)	1.26	(0.01)	391	(3.2)	427	(2.4)	454	(3.6)	466	(4.2)	**33**	(1.9)	**2.09**	(0.10)	**9.8**	(1.0)
Liechtenstein	0.30	(0.05)	-0.89	(0.08)	0.01	(0.06)	0.66	(0.07)	1.42	(0.06)	490	(9.4)	552	(11.4)	543	(12.0)	563	(11.5)	**28**	(5.8)	**2.44**	(0.46)	**7.6**	(3.1)
Northern Ireland	0.29	(0.02)	-0.76	(0.02)	-0.08	(0.03)	0.61	(0.04)	1.38	(0.02)	444	(4.6)	471	(5.4)	502	(4.6)	541	(5.4)	**45**	(3.0)	**2.17**	(0.17)	**16.7**	(1.9)
England	0.29	(0.02)	-0.76	(0.03)	0.02	(0.04)	0.62	(0.03)	1.27	(0.02)	460	(5.0)	478	(5.4)	511	(4.6)	546	(4.5)	**41**	(2.8)	**1.88**	(0.14)	**12.4**	(1.4)
Sweden*	0.28	(0.02)	-0.82	(0.02)	0.02	(0.02)	0.65	(0.02)	1.25	(0.01)	442	(2.9)	470	(3.9)	495	(3.4)	518	(3.9)	**36**	(1.9)	**1.94**	(0.11)	**10.6**	(1.1)
United Kingdom*	0.27	(0.02)	-0.78	(0.02)	0.00	(0.03)	0.61	(0.02)	1.26	(0.02)	458	(4.2)	477	(4.1)	508	(4.2)	545	(3.9)	**41**	(2.4)	**1.86**	(0.11)	**12.5**	(1.2)
Australia	0.25	(0.01)	-0.84	(0.02)	0.05	(0.02)	0.61	(0.01)	1.18	(0.01)	462	(2.2)	492	(2.0)	521	(2.9)	550	(2.6)	**42**	(1.3)	**2.12**	(0.09)	**12.3**	(0.8)
Netherlands*	0.23	(0.02)	-0.82	(0.03)	0.02	(0.03)	0.58	(0.02)	1.15	(0.02)	484	(5.2)	513	(3.9)	537	(4.8)	565	(5.1)	**40**	(3.1)	**1.99**	(0.14)	**11.5**	(1.7)
Germany*	0.19	(0.02)	-0.99	(0.03)	-0.16	(0.03)	0.52	(0.04)	1.42	(0.02)	467	(5.1)	502	(3.9)	540	(3.8)	569	(4.3)	**43**	(2.0)	**2.40**	(0.16)	**16.9**	(1.4)
Wales	0.19	(0.02)	-0.82	(0.02)	-0.12	(0.03)	0.50	(0.02)	1.19	(0.02)	436	(3.5)	461	(3.0)	473	(3.7)	512	(3.4)	**35**	(2.2)	**1.80**	(0.13)	**10.4**	(1.3)
United States	0.17	(0.04)	-1.14	(0.05)	-0.11	(0.04)	0.60	(0.04)	1.35	(0.04)	442	(3.9)	462	(4.5)	494	(5.4)	532	(4.7)	**35**	(1.7)	**2.05**	(0.16)	**14.8**	(1.3)
Switzerland	0.17	(0.02)	-1.00	(0.02)	-0.12	(0.03)	0.52	(0.03)	1.29	(0.02)	488	(4.0)	519	(4.0)	543	(3.9)	575	(4.6)	**38**	(1.8)	**2.07**	(0.12)	**12.8**	(1.2)
Israel	0.17	(0.03)	-0.98	(0.04)	-0.03	(0.04)	0.58	(0.03)	1.12	(0.02)	409	(5.3)	452	(5.5)	491	(6.3)	524	(5.6)	**51**	(2.6)	**2.49**	(0.18)	**17.2**	(1.5)
Belgium*	0.15	(0.02)	-1.05	(0.03)	-0.19	(0.03)	0.55	(0.02)	1.27	(0.02)	469	(4.0)	497	(3.2)	534	(2.9)	567	(2.9)	**43**	(1.9)	**2.21**	(0.12)	**15.0**	(1.3)
Scotland	0.13	(0.02)	-0.96	(0.02)	-0.18	(0.03)	0.49	(0.03)	1.18	(0.02)	463	(4.0)	487	(4.2)	504	(3.5)	546	(4.6)	**37**	(2.4)	**1.95**	(0.14)	**12.9**	(1.4)
Republic of Ireland*	0.13	(0.02)	-0.97	(0.02)	-0.19	(0.03)	0.48	(0.03)	1.20	(0.02)	462	(4.4)	489	(3.2)	512	(2.9)	545	(3.3)	**38**	(1.8)	**2.11**	(0.12)	**14.6**	(1.2)
*Estonia**	0.11	(0.01)	-0.92	(0.02)	-0.23	(0.02)	0.44	(0.02)	1.16	(0.01)	496	(3.0)	508	(3.2)	523	(3.6)	558	(2.9)	**29**	(1.7)	**1.62**	(0.11)	**8.6**	(0.9)
Cyprus	0.09	(0.01)	-1.06	(0.02)	-0.28	(0.01)	0.43	(0.02)	1.25	(0.02)	398	(2.5)	428	(2.6)	448	(2.8)	492	(2.8)	**38**	(1.6)	**2.01**	(0.14)	**14.1**	(1.1)
Austria*	0.08	(0.02)	-0.97	(0.03)	-0.25	(0.02)	0.33	(0.03)	1.19	(0.03)	458	(4.2)	495	(4.2)	519	(3.8)	552	(4.2)	**43**	(2.2)	**2.34**	(0.16)	**15.8**	(1.5)
Luxembourg*	0.07	(0.01)	-1.42	(0.02)	-0.26	(0.02)	0.57	(0.02)	1.41	(0.01)	438	(2.9)	470	(2.7)	508	(2.6)	546	(2.7)	**37**	(1.2)	**2.38**	(0.14)	**18.3**	(1.1)
Slovenia*	0.07	(0.01)	-1.03	(0.01)	-0.31	(0.02)	0.39	(0.02)	1.22	(0.02)	458	(2.6)	486	(3.1)	511	(3.1)	552	(3.2)	**42**	(1.5)	**2.04**	(0.12)	**15.6**	(1.0)
New Zealand	0.04	(0.02)	-1.05	(0.02)	-0.22	(0.03)	0.39	(0.02)	1.04	(0.02)	445	(3.2)	493	(4.0)	514	(4.0)	559	(3.6)	**52**	(1.9)	**2.61**	(0.19)	**18.4**	(1.3)
Korea	0.01	(0.03)	-0.97	(0.03)	-0.23	(0.03)	0.33	(0.03)	0.92	(0.02)	516	(4.9)	538	(4.8)	567	(6.3)	595	(6.6)	**42**	(3.3)	**1.77**	(0.11)	**10.1**	(1.4)
OECD average	0.00	(0.00)	-1.15	(0.00)	-0.32	(0.00)	0.34	(0.01)	1.15	(0.00)	452	(0.7)	482	(0.6)	506	(0.7)	542	(0.8)	**39**	(0.4)	**2.15**	(0.02)	**14.6**	(0.2)
France*	-0.04	(0.02)	-1.10	(0.02)	-0.30	(0.02)	0.29	(0.02)	0.95	(0.01)	442	(3.5)	476	(3.1)	511	(4.2)	561	(4.0)	**57**	(2.2)	**2.57**	(0.16)	**22.5**	(1.3)
Italy*	-0.05	(0.01)	-1.29	(0.01)	-0.41	(0.02)	0.25	(0.02)	1.24	(0.02)	447	(2.4)	475	(2.6)	498	(2.6)	522	(2.8)	**30**	(1.2)	**1.92**	(0.08)	**10.1**	(0.6)
Greece*	-0.06	(0.03)	-1.34	(0.03)	-0.46	(0.03)	0.32	(0.04)	1.22	(0.02)	413	(3.8)	439	(3.9)	459	(3.5)	502	(3.7)	**34**	(1.8)	**2.06**	(0.17)	**15.5**	(1.5)
Czech Republic*	-0.07	(0.02)	-0.98	(0.02)	-0.37	(0.02)	0.16	(0.02)	0.93	(0.02)	450	(4.4)	486	(4.5)	508	(4.3)	552	(4.0)	**51**	(2.7)	**2.27**	(0.18)	**16.2**	(1.5)
Japan	-0.07	(0.02)	-0.99	(0.02)	-0.35	(0.02)	0.20	(0.02)	0.85	(0.02)	500	(5.2)	528	(4.1)	551	(4.3)	575	(5.9)	**41**	(3.9)	**1.96**	(0.13)	**9.8**	(1.6)
Russian Federation	-0.11	(0.02)	-1.10	(0.03)	-0.37	(0.03)	0.22	(0.03)	0.82	(0.02)	445	(4.8)	468	(4.3)	496	(3.6)	521	(5.1)	**38**	(3.2)	**1.96**	(0.16)	**11.4**	(1.7)
*Lithuania**	-0.13	(0.02)	-1.34	(0.02)	-0.48	(0.03)	0.30	(0.03)	1.00	(0.02)	439	(3.7)	465	(3.6)	492	(4.2)	522	(3.5)	**36**	(1.8)	**2.16**	(0.12)	**13.8**	(1.2)
Slovak Republic*	-0.18	(0.03)	-1.25	(0.04)	-0.57	(0.02)	0.02	(0.04)	1.06	(0.03)	416	(6.6)	473	(3.8)	496	(4.4)	545	(6.2)	**54**	(2.9)	**2.99**	(0.22)	**24.6**	(2.1)
Spain*	-0.19	(0.03)	-1.50	(0.02)	-0.60	(0.03)	0.17	(0.03)	1.16	(0.03)	442	(2.8)	471	(2.4)	495	(2.8)	533	(2.5)	**34**	(1.1)	**2.20**	(0.11)	**15.8**	(1.0)

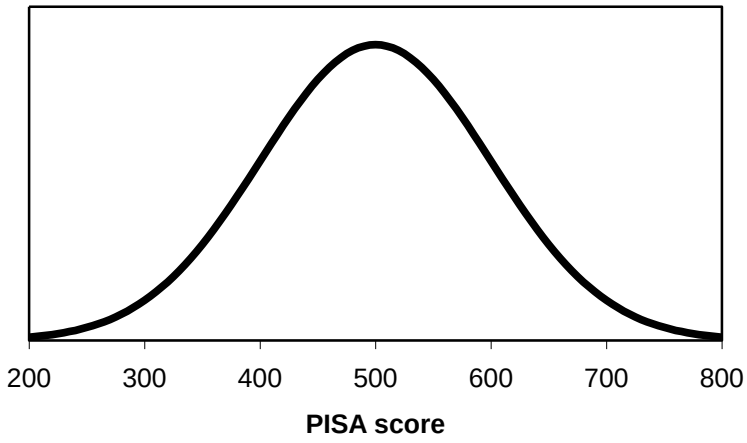
	PISA index of economic, social and cultural status (ESCS)										Performance on the mathematics scale, by national quarters of this index								Score point difference in mathematics associated with one unit increase in the ESCS		Increased likelihood of students in the bottom quarter of the ESCS index scoring in the bottom quarter of the mathematics performance distribution		Strength of the relationship between mathematics performance and the ESCS	
	All students		Bottom quarter		Second quarter		Third quarter		Top quarter		Bottom quarter		Second quarter		Third quarter		Top quarter						Percentage of explained variance in mathematics performance	
	Mean index	S.E.	Mean index	S.E.	Mean index	S.E.	Mean index	S.E.	Mean index	S.E.	Mean score	S.E.	Mean score	S.E.	Mean score	S.E.	Mean score	S.E.	Effect	S.E.	Ratio	S.E.	%	S.E.
Poland*	-0.21	(0.03)	-1.22	(0.02)	-0.69	(0.02)	-0.01	(0.05)	1.08	(0.03)	473	(3.6)	501	(4.0)	526	(5.2)	571	(6.3)	**41**	(2.4)	**2.19**	(0.17)	**16.6**	(1.7)
Hungary*	-0.25	(0.03)	-1.46	(0.04)	-0.65	(0.03)	0.09	(0.04)	1.01	(0.03)	422	(4.8)	464	(3.7)	487	(4.6)	539	(6.6)	**47**	(2.8)	**2.74**	(0.22)	**23.1**	(2.3)
*Latvia**	-0.26	(0.03)	-1.39	(0.03)	-0.64	(0.04)	0.11	(0.04)	0.90	(0.02)	453	(4.4)	472	(3.4)	508	(4.7)	532	(4.7)	**35**	(2.1)	**2.07**	(0.18)	**14.7**	(1.7)
Singapore	-0.26	(0.01)	-1.46	(0.02)	-0.54	(0.02)	0.09	(0.02)	0.88	(0.02)	523	(2.9)	557	(3.1)	589	(3.1)	627	(2.8)	**44**	(1.4)	**2.17**	(0.12)	**14.4**	(0.9)
*Bulgaria**	-0.28	(0.04)	-1.59	(0.06)	-0.67	(0.03)	0.10	(0.04)	1.06	(0.03)	384	(5.1)	424	(4.1)	449	(6.1)	501	(5.9)	**42**	(2.7)	**2.52**	(0.18)	**22.3**	(2.3)
Serbia	-0.30	(0.02)	-1.37	(0.02)	-0.70	(0.03)	-0.05	(0.03)	0.95	(0.03)	416	(4.4)	436	(3.7)	450	(4.7)	495	(5.0)	**34**	(2.4)	**1.73**	(0.12)	**11.7**	(1.4)
Kazakhstan	-0.32	(0.02)	-1.31	(0.02)	-0.57	(0.03)	0.02	(0.03)	0.60	(0.02)	405	(4.0)	427	(3.5)	437	(3.7)	458	(5.2)	**27**	(2.8)	**1.81**	(0.16)	**8.0**	(1.7)
*Croatia**	-0.34	(0.02)	-1.35	(0.02)	-0.70	(0.02)	-0.14	(0.03)	0.84	(0.02)	438	(3.6)	459	(3.8)	472	(4.8)	517	(5.9)	**36**	(2.6)	**1.78**	(0.13)	**12.0**	(1.4)
Shanghai-China	-0.36	(0.04)	-1.63	(0.05)	-0.70	(0.04)	0.06	(0.04)	0.83	(0.03)	562	(6.3)	602	(4.7)	628	(3.8)	660	(5.3)	**41**	(2.7)	**2.21**	(0.15)	**15.1**	(1.9)
Chinese Taipei	-0.40	(0.02)	-1.47	(0.03)	-0.70	(0.03)	-0.11	(0.03)	0.68	(0.03)	497	(5.1)	546	(4.5)	572	(4.1)	626	(5.3)	**58**	(2.5)	**2.46**	(0.14)	**17.9**	(1.4)
*Romania**	-0.47	(0.04)	-1.58	(0.05)	-0.80	(0.03)	-0.26	(0.04)	0.76	(0.05)	407	(4.5)	428	(3.8)	444	(4.0)	501	(7.7)	**38**	(2.9)	**2.09**	(0.15)	**19.3**	(2.4)
Portugal*	-0.48	(0.05)	-1.85	(0.03)	-1.06	(0.04)	-0.23	(0.07)	1.21	(0.07)	441	(4.5)	474	(4.9)	495	(4.8)	548	(5.2)	**35**	(1.6)	**2.31**	(0.14)	**19.6**	(1.8)
Chile	-0.58	(0.04)	-1.97	(0.05)	-1.02	(0.04)	-0.27	(0.05)	0.95	(0.03)	378	(4.0)	409	(3.9)	429	(3.6)	477	(5.4)	**34**	(1.6)	**2.37**	(0.16)	**23.1**	(1.9)
Hong Kong-China	-0.79	(0.05)	-2.00	(0.03)	-1.20	(0.05)	-0.46	(0.07)	0.50	(0.06)	532	(4.8)	554	(3.8)	567	(4.5)	600	(5.8)	**27**	(2.6)	**1.70**	(0.12)	**7.5**	(1.5)
Macao-China	-0.89	(0.01)	-1.91	(0.01)	-1.23	(0.01)	-0.68	(0.01)	0.28	(0.02)	521	(2.6)	535	(2.5)	543	(2.3)	558	(2.5)	**17**	(1.5)	**1.36**	(0.07)	**2.6**	(0.4)
Mexico	-1.11	(0.02)	-2.66	(0.02)	-1.65	(0.03)	-0.74	(0.03)	0.61	(0.03)	385	(1.9)	407	(1.9)	417	(1.9)	447	(2.4)	**19**	(0.8)	**1.85**	(0.07)	**10.4**	(0.8)
Turkey	-1.46	(0.04)	-2.74	(0.03)	-1.96	(0.03)	-1.21	(0.05)	0.07	(0.06)	412	(4.5)	436	(4.2)	447	(6.0)	498	(8.3)	**32**	(2.4)	**1.84**	(0.11)	**14.5**	(1.8)
Vietnam	-1.81	(0.05)	-3.08	(0.03)	-2.27	(0.03)	-1.63	(0.05)	-0.26	(0.09)	473	(6.1)	499	(5.0)	519	(5.7)	555	(8.2)	**29**	(2.6)	**2.00**	(0.16)	**14.6**	(2.3)

14 countries with mathematics mean scores below 430 omitted
Note: Values that are statistically significant are indicated in bold
OECD countries (not italicised) *Countries not in OECD (italicised)* *EU countries

Appendix F

Notes on PISA International Scale Scores

PISA defines an international scale for each subject in such a way that, for each subject when it is first run as a major focus[6], the 'OECD population' has a Normal distribution with a mean of 500 and standard deviation of 100. This is illustrated in the 'bell-shaped' curve below.



How the OECD population is defined is rather complex:

1. The sample of pupils within each OECD country is selected;
2. Their results are weighted in such a way that each country in the study (i.e. UK as a whole, not Wales) has an equal weight;
3. Pupils' scores are adjusted to have the above distribution within this hypothetical population.

Thus the important unit is the country, not the student – Russia and Hong Kong have the same weights in the scale, despite differences in size.

PISA scores are thus defined on a scale which does not relate directly to any other test measure. In particular, there is no easy or valid way to relate them to 'months of progress' or any measure of individual development.

[6] This means that the mean of 500 for OECD countries relates to the year 2000 for Reading, 2003 for Mathematics and 2006 for Science.

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