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INVESTOR IN PEOPLE

PROGRAMME FOR INTERNATIONAL STUDENT ASSESSMENT (PISA 2006): RESULTS FOR ENGLAND

INTRODUCTION

The Programme for International Student Assessment (PISA) is a survey of educational achievement organised by the Organisation for Economic Co-operation and Development (OECD).

PISA assesses the knowledge and skills of students aged fifteen as they near the end of their schooling and is carried out on a three-year cycle, with each cycle focusing on one of the three areas of 'literacy' in which knowledge and skills are assessed: reading, mathematics and science. 57 countries participated in the third cycle in 2006, including all 30 OECD members and 25 of the 27 EU members (the two exceptions being Cyprus and Malta). Note: 19 countries are members of both the OECD and the EU.

The full NFER report for England, "*Achievement of 15-year-olds in England : PISA 2006 National Report*" can be found at www.nfer.ac.uk/pisa

The full OECD international report, "*PISA 2006: Science Competencies for Tomorrow's World*" can be found at www.pisa.oecd.org

THE CONCEPT OF 'LITERACY' IN PISA

Scientific literacy was the main focus of PISA 2006 with mathematical and reading literacy as the two minor domains. In PISA the term 'literacy' is defined so as to measure the extent to which students have acquired the ability to put their knowledge to functional use in different situations in adult life. What PISA does not do is to attempt to measure student success in their mastery of school subjects taught to a nationally defined curriculum.

For further detail about the conceptual framework underlying the PISA assessment see '*Assessing Scientific, Reading and Mathematical Literacy: A Framework for PISA 2006*, (OECD, 2006)'

SAMPLE AND DATA

In England, Wales and Northern Ireland, the survey was carried out on behalf of the respective governments by the National Foundation for Educational Research (NFER). Students sat the two-hour assessment in November 2006 under test conditions, following the standardised procedures implemented by all countries. A proportion of the questions used in the 2-hour test were ones used in previous rounds. This continuity between rounds provides a measure of change.

In Scotland, the PISA survey was carried out earlier in 2006.

Students also completed a questionnaire to provide information on their economic and social backgrounds, study habits, and attitudes to science and to science learning. Head-teachers in the participating schools completed a school questionnaire to provide information on the school's size, intake, resources and organisation, as well as science activities

available in the school.

Age, rather than year group, is used to define participation in the survey because of the variance of grade levels and in policies on grade promotion around the world. The fifteen year olds who took part in the UK were mainly in Year 11 in England, Wales and Scotland, and Year 12 in Northern Ireland.

The PISA study has strict sampling requirements regarding both the participation rate which is acceptable and the replacement of schools which decline to take part. 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 of 88% for the UK combined sample fell short of the participation requirement by just 1% (England 89%, Scotland 85%, Wales 84% and N. Ireland 74%). This was a great improvement on the PISA surveys in 2000 and 2003. An NFER analysis of the characteristics of responding and non-responding schools in England, Wales and Northern Ireland showed no significant differences and it was accepted by the PISA sampling referee that there was no evidence of possible bias in the sample as a result of school non-participation.

In England, the weighted student response of 88% of sampled students (a total of 4935 students) easily met the required target of 80%. The student response was similarly high in Wales (89%) and Northern Ireland (85%) and just below the target in Scotland (79%). The United Kingdom as a whole therefore achieved a satisfactory weighted student response rate.

HOW PROFICIENCY IS RATED IN PISA

The mean score for each scale was set to 500 among OECD countries, with each country contributing equally to the average. The reading literacy scale was set to 500 in its first year in 2000. Similarly the mathematics scale was set to 500 in 2003. As PISA 2006 was the first survey in which science was the major domain, the science scale has been newly set to a mean of 500. As with any repeated measurement that uses samples it should be expected that the mean varies slightly from year to year without necessarily indicating any real change in the global level of skills. This year the OECD average for reading is 492 and that for mathematics is 498. 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	559-663	633-708	above 708
Mathematics	below 358	358-420	420-482	482-545	545-607	607-669	above 669
Reading	below 335	335-407	407-480	480-553	553-626	above 626	

The method by which these scales are derived is explained further in '*PISA 2003 Technical Report, (OECD, 2005)*'.

PISA uses proficiency levels to describe the types of skills that students at each particular level are likely to demonstrate and 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 were 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.

Students 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 students proficient at Level 3 are also considered to be proficient at Levels 1 and 2. In science and mathematics there are six levels, while in reading there are five levels. The proficiency level of a student is the highest level at which they answer more than half of the questions correctly.

Every cycle of PISA focuses on a different subject. No one student is presented with all PISA questions. Instead, statistical methods are used to estimate the likelihood that the student would be able to answer questions correctly which they have not actually been presented with. For further information see “*PISA 2006 Technical Report*” OECD (forthcoming)

FINDINGS

NOTE: In the following text and tables, the comparison group comprises those countries who meet at least one of the following criteria (and non-OECD member names are shown in italics):

- OECD member
- EU member (shown with an asterisk after name)
- Achieved a mean score of at least 430

Outcomes for England are derived from the international analysis carried out at ‘sub-national’ level (i.e. for the constituent countries within the UK) by the NFER as well as from additional analysis conducted using the international dataset.

Science

England’s students achieved a mean score of 516 in science, significantly above the OECD mean of 500. Seven of the other participating countries achieved a mean score significantly higher than England (see Table 1). Although not in the top group, this places England among the higher achievers relative to all other participating countries. Internationally, thirteen countries performed at a level not significantly different from that of England, while the remaining thirty-six countries performed significantly less well (see Tables 2 and 3).

As the following Tables show, only two of the countries that significantly outperformed England are EU members (Finland and Estonia). While eight EU countries did not perform significantly differently from England, 14 performed less well. Similarly, among OECD countries, only Finland, Canada, Japan and New Zealand outperformed England, ten performed similarly, and fifteen performed less well.

Table 1: Countries with a significantly higher mean score than England in science

Finland* 563, *Hong Kong-China* 542, Canada 534, *Chinese Taipei* 532, *Estonia** 531, Japan 531 and New Zealand 530

Table 2: Countries with a mean score not significantly different to England in science

Australia 527, Netherlands* 525, *Liechtenstein* 522, Korea 522, *Slovenia** 519, Germany* 516, **ENGLAND 516**, Czech Republic* 513, Switzerland 512, *Macao-China* 511, Austria* 511, Belgium* 510, Ireland* 508 and Hungary* 504

Table 3: Countries with a significantly lower mean score than England in science

Sweden* 503, Poland* 498, Denmark* 496, France* 495, *Croatia* 493, Iceland 491, *Latvia** 490, USA 489, Slovak Republic* 488, Spain* 488, *Lithuania** 488, Norway 487, Luxembourg* 486, *Russian Fed.* 479, Italy* 475, Portugal* 474, Greece* 473, *Israel* 454, *Chile* 438, *Serbia*, 436, *Bulgaria** 434, Turkey 424, *Romania** 418 and Mexico 410

Distribution of performance in science

The scientific literacy assessment framework for PISA measures three competencies (the ability to identify scientific issues, to explain phenomena scientifically and to use scientific evidence). In some countries, students showed notably stronger or weaker performance in some of these areas, relative to their mean performance. In England, however, there was less variation with students achieving relatively consistently across the three competencies.

England's highest score was attained on the *explaining phenomena scientifically* scale, with a mean of 518. On the *identifying scientific issues* scale, England scored a mean of 515 and on the *using scientific evidence* scored a mean of 514. On all three scales, the differences from the overall mean for science (516) are small, indicating that on average students in England performed in a consistent way. In some other countries there was more variation between the mean scores for the three sub-scales and significant differences between them can be found for countries with high, average and low mean scores on the overall scientific literacy scale.

England's score at the 5th percentile was 336 while its score at the 95th percentile was 686, a difference of 350 scale points. This was exceeded by only two other comparison group countries (Israel and New Zealand). The average difference across the OECD countries was 311 scale points.

In all PISA countries there were some students at the lowest level of achievement (level 1), while in most of the 57 participating countries, at least some students achieved the highest level (level 6). The proportion of students doing so varied across countries and there was no straightforward relationship between overall mean score and variation in achievement.

In England, 4.9 per cent of students scored below PISA level 1, compared with an OECD average of 5.2 per cent. In the lower two levels combined, England has 16.7 per cent compared with an OECD average of 19.2 per cent. Although this compares well with the OECD average, it compares less well with the highest scoring countries. In Finland, for example, only 4.1 per cent of students were in level 1 and below and in Hong Kong only 8.7 per cent. In all, 20 countries had a lower proportion of students at level 1 and below than England. However, at the top end of the scale, 3.0 per cent of England's students achieved PISA level 6, one of the three highest proportions at this level, behind only New Zealand and Finland (4.0 and 3.9 per cent respectively). Combining the top two levels moves England down to 8th position, with 14.0 per cent in the top two levels, compared with Finland's 20.9 per cent and New Zealand's 17.6 per cent. Although this is still a respectable result, it does emphasise the relatively wide gap in England between the highest and lowest achievers.

Gender differences in science

Of the 57 participating countries, 21 had a statistically significant difference in gender performance with 9 favouring males and 12 favouring females. In England, males (521) significantly outperformed females (510). This overall difference in the science scores of females and males is largely attributable to differential performance on the *Explaining phenomena scientifically* competency scale. On this sub-scale males scored a mean of 529, some 22 points higher than the female mean of 507. Only Chile (35 points) and Luxembourg (24 points) had larger differences, whilst the OECD mean difference on this scale was 15 points.

For the other two competency scales (*Identifying scientific issues* and *Using scientific evidence*), there were no significant differences in England between the performance of males and females. On the *Using scientific evidence* scale, this finding is in line with the majority of the comparison group. Although the OECD average showed a small, significant difference in favour of females, only eight comparison group countries showed differential performance on this scale with all but one favouring females. However, on the *Identifying scientific issues* scale, where the OECD mean difference was 17 scale points, almost all comparison group countries showed statistically significant differences, and all favouring females. England was one of only four countries (the others were Israel, Chinese Taipei, and Chile) with no significant gender difference on this scale.

Mathematics

Mathematics was a minor domain in the PISA 2006 survey, which means that only a sub-set of questions from the 2003 mathematics test items were used and not all students were assessed in this subject. The results reported are estimates for the whole population, based on the performance of those who were presented with mathematics test items. These estimates also use information about students who did not take the mathematics test items and extrapolate their probable performance in mathematics based on specific characteristics such as their socio-economic background and their actual performance on the science test items. The scores therefore give a snapshot of performance in mathematics rather than the fuller more rigorous assessment which is available for science. (see '*PISA 2006 Technical Report*' (OECD forthcoming) for more information).

England's students achieved a mean score of 495 in mathematical literacy which was slightly below the OECD mean of 498 (the difference is not statistically significant). Of the other participating countries, eighteen achieved a mean score significantly higher than England (see Table 4). This places England in a middling position relative to other countries. Internationally, twelve countries performed at a level not significantly different from that of England, while the remaining twenty-six countries performed significantly less well (see Tables 5 and 6).

As the Tables below show, seven of the countries that significantly outperformed England are EU members. While ten EU countries did not perform significantly differently from England, only seven performed less well. Among OECD countries, twelve outperformed England, ten performed similarly, and only seven performed less well.

Table 4: Countries with a significantly higher mean score than England in mathematics

Chinese Taipei 549, Finland* 548, *Hong Kong-China* 547, Korea 547, Netherlands* 531, Switzerland 530, Canada 527, *Macao-China* 525, *Liechtenstein* 525, Japan 523, New Zealand 522, Belgium* 520, Australia 520, *Estonia** 515, Denmark* 513, Czech Republic* 510, Iceland 506 and *Slovenia** 504

Table 5: Countries with a mean score not significantly different to England in mathematics

Austria* 505, Germany* 504, Sweden* 502, Ireland* 501, France* 496, Poland* 495, **ENGLAND 495**, Slovak Republic* 492, Hungary* 491, Luxembourg* 490, Norway 490, *Lithuania** 486 and *Latvia* 486

Table 6: Countries with a significantly lower mean score than England in mathematics

Spain* 480, *Azerbaijan* 476, *Russian Fed.* 476, USA 474, *Croatia* 467, Portugal* 466, Italy* 462, Greece* 459, *Israel* 442, *Serbia* 435, Turkey* 424, *Romania** 415, *Bulgaria** 413 and Mexico 406

Distribution of performance in mathematics

England's mean score at the 5th percentile was 350 while its mean score at the 95th percentile was 643, a difference of 293 scale points. This was smaller than the OECD average difference of 299 scale points. About two thirds of the OECD countries had a larger difference than England between the highest and lowest percentiles.

In England, 6.0 per cent of students scored below PISA level 1, which was slightly less than the OECD average of 7.7 per cent. In the lower two levels combined, England has 19.9 per cent compared with an OECD average of 21.3 per cent. At the top end of the distribution, England had 2.5 per cent at level 6, slightly below the OECD average of 3.3 per cent. This pattern is repeated for the top two levels combined, with England at 11.2 per cent compared with an OECD average of 13.3 per cent.

Gender differences in mathematics

Of the 57 participating countries, 36 had a statistically significant difference in gender performance, in 35 countries favouring males and in Qatar favouring females. In England, there was a significant difference favouring males. The difference of 17 scale points between females and males was higher than the OECD average of 11 scale points. This was one of the highest differences within the 44 comparison countries with only three countries (Austria, Japan and Germany) having a higher figure. There was no direct relationship between a country's overall performance and the pattern of gender differences in attainment.

Reading

Reading was a minor domain in the PISA 2006 survey, which means that not all students were assessed in this subject. The results reported are estimates for the whole population, based on the performance of those who were presented with reading test items. These estimates also use information about students who did not take the reading test items and extrapolate their probable performance in reading based on specific characteristics such as their socio-economic background and their actual performance on the science test items. The scores therefore give a snapshot of performance in reading rather than the fuller more rigorous assessment which is available for science. (see 'PISA 2006 Technical Report' (OECD forthcoming) for more information).

England's students achieved a mean score of 496 in reading which was slightly above the OECD mean of 492 (the difference is not statistically significant). Of the seven countries with mean scores significantly above England (see Table 7), only one (Hong Kong) is not an OECD country, and two (Finland and Ireland) are EU countries. It is interesting that three of the countries are English-speaking (Ireland, Australia and New Zealand), one has a substantial number of English speakers (Canada) and one has had a significant amount of influence from the UK on its education system in the past (Hong Kong).

Internationally, eighteen countries performed at a level not significantly different from that of England and the remaining thirty countries performed significantly less well (see Tables 8 and 9). Note that USA reading attainment is omitted from the international report due to problems in the administration of the assessment.

As the following Tables show, seven of the countries that significantly outperformed England are EU members. Twelve EU countries did not perform significantly differently from England and eleven performed less well. Among OECD countries, thirteen performed similarly to England and nine performed less well. This indicates that among those countries participating in PISA, England did better in reading literacy than it did in mathematical literacy but not as well as it did in science literacy.

Table 7: Countries with a significantly higher mean score than England in reading

Korea 556, Finland* 547, *Hong Kong-China* 536, Canada 527, New Zealand 521, Ireland* 517 and Australia 513

Table 8: Countries with a mean score not significantly different to England in reading

Liechtenstein 510, Poland* 508, Sweden* 507, Netherlands* 507, Belgium* 501, *Estonia** 501, Switzerland 499, Japan 498, *Chinese-Taipei* 496, **ENGLAND 496**, Germany* 495, Denmark* 494, *Slovenia** 494, *Macao-China* 492, Austria* 490, France* 488, Norway 484, Czech Republic* 483 and Hungary* 482

Table 9: Countries with a significantly lower mean score than England in reading

Iceland 484, *Latvia** 479, Luxembourg* 479, *Croatia* 477, Portugal* 472, *Lithuania** 470, Italy* 469, Slovak Republic* 466, Spain* 461, Greece* 460, Turkey* 447, *Chile* 442, *Russian Fed.* 440, *Israel* 439, Mexico 410, *Bulgaria** 402 and *Romania** 396

Distribution of performance in reading

England's score at the 5th percentile was 317 while its score at the 95th percentile was 654, a difference of 337 scale points. This was larger than the OECD average difference of 324 scale points and only 14 countries had a wider distribution than England. These included the OECD countries Czech Republic, Belgium, Germany, Austria, Italy, Slovak Republic, New Zealand, Norway, France and Greece. OECD partner countries with a higher scale point difference than England were Israel, Bulgaria and Chile.

In England, 6.8 per cent of students scored below PISA level 1, which was slightly less than the OECD average of 7.4 per cent. In the lower two levels combined, England has 18.9 per cent compared with an OECD average of 20.1 per cent. At the top end of the distribution, England had 9.2 per cent at level 6, slightly above the OECD average of 8.6 per cent. This pattern is repeated for the top two levels combined, with England at 29.8 per cent compared with an OECD average of 29.3 per cent.

Although the numbers scoring at each level compare well with the OECD average, they are nevertheless not a reason for complacency when compared with some other countries. The three highest attaining countries have low numbers at level 1 or below: 5.8 per cent in Korea, 4.8 per cent in Finland and 7.1 per cent in Hong Kong, compared with England's figure of 19.0 per cent. England has a relatively long tail of underachievement when compared with the highest scoring countries.

Gender differences in reading

Of the 56 participating countries which were reported, all had a statistically significant difference in gender performance, favouring females. In England, there was a difference of 29 scale points between females and males. This was lower than the OECD average of 38 scale points difference and was in fact one of the lowest among the comparison countries, with only Chile, Chinese Taipei, the Netherlands and Macao-China having a smaller difference. The largest difference among OECD countries was a 57-point difference in Greece, while the largest among the partner countries included in the comparison group was a 58-point difference in Bulgaria.

PISA in the United Kingdom

For **science**, performance was relatively consistent across the UK, with few significant differences in terms of overall achievement. The one exception was that England's mean score (516) was significantly higher than that of Wales (505), with Scotland (515) and N. Ireland (508) falling in-between the two.

On the three competency subscales also, few differences emerged, indicating that students across the UK are fairly well matched in terms of their science skills. Exceptions were that both England and Scotland scored significantly higher than Wales on *Identifying scientific issues* (which includes skills such as recognising issues that can be investigated scientifically, and recognising the key features of a scientific investigation), while Scotland also scored significantly higher than Wales on *Using scientific evidence* (skills such as interpreting scientific evidence, making and communicating conclusions, identifying assumptions, evidence and reasoning behind conclusions, and reflecting on the societal implications of science and technological developments).

The difference between the OECD mean score at the 5th percentile and the OECD mean score at the 95th percentile was 311 scale points, with the comparable differences for all participating countries ranging from 257 to 367 scale points. The highest difference of 367 was found in Northern Ireland, although all four parts of the UK had a wide distribution compared with other PISA countries (England 350, Wales 334 and Scotland 330).

In terms of gender differences, the OECD average showed a slight advantage for males and this was mirrored in England and Wales (11 and 10 scale points respectively), where males significantly outperformed females. There were no statistically significant gender differences on the overall science scale in Northern Ireland (2 scale points) or Scotland (4 scale points).

In both England and Wales, the largest gender difference was due to differential performance on the *Explaining phenomena scientifically* scale. This was also true for most participating countries: typically, males outperformed females on this scale. In both Wales and England, there were no significant gender

differences on the other competency scales. Northern Ireland had no significant gender differences on any of the three competencies, while Scotland had differences on two competencies which cancelled each other overall: males did better at *Explaining phenomena scientifically* while females did better at *Identifying scientific issues*.

The highest attainment for **mathematics** was in Scotland (506), followed by England (495) and Northern Ireland (494). The mean score for Northern Ireland was significantly lower than that for Scotland. The lowest attainment was in Wales (484), and the mean score for Wales was significantly lower than that for Scotland and England.

The lowest achieving students were in Northern Ireland where the 5th percentile score (341) was slightly lower than the OECD average (346). England (350) and Wales (351) had similar scores and they were slightly higher than the OECD average. Scotland (367) had the highest scores at the 5th percentile in the UK. The greatest proportions of the highest achieving students were in Northern Ireland and Scotland where the scores at the 95th percentile (647) were the same. This was followed by England (643). The lowest were in Wales (621), where the score of students in the 95th percentile was 26 points lower than that in Northern Ireland and Scotland, and 22 points lower than England. Looking at the range of performance, as shown by the number of score points difference between the highest and lowest achievers, the largest gap was in Northern Ireland and the smallest in Wales.

The differences between males and females were statistically significant in England, Scotland and Wales but not in Northern Ireland. The difference in score points between males and females was similar in England, Scotland and Wales (17, 16 and 16 scale points respectively) and this was above the OECD average (11). Northern Ireland (7) stood out as having a relatively small difference between males and females. It was the 16th lowest in gender difference out of the 44 comparison countries. The gender gap in England, Wales and Scotland was high in the international comparison. Within the 44 comparison countries, England had one of the largest gender differences, just after Austria, Japan and Germany. There were only five countries with a larger gender difference than Wales and Scotland.

The highest attainment for **reading** was in Scotland (499), followed by England and Northern Ireland (496 for both). However, the differences between these three countries were not significant. The lowest attainment was in Wales (481), and the mean score for Wales was significantly lower than the other three parts of the UK.

The lowest achieving students in Northern Ireland and Wales scored 331 and 312 respectively at the 5th percentile. In England, the 5th percentile score was the same as the OECD average (317) whilst it was even higher in Scotland (334). Scores at the 95th percentile were highest in Northern Ireland (659), followed by England (654), Scotland (650) and Wales (635). Looking at the range of performance, as shown by the number of score points difference between the highest and lowest achievers, the largest gap was in Northern Ireland and the smallest in Scotland.

In all cases, females had higher mean scores and the difference was statistically significant. This was in fact the case in every country in the PISA survey. The differences in each part of the UK were of a similar size, ranging from 26 scale points in Scotland to 33 in Northern Ireland.

NOTES FOR EDITORS

Previous PISA Studies

The first PISA study was undertaken in 32 countries in 2000 (supplemented with a further 11 countries in 2002). 41 countries participated in the second cycle in 2003.

In the 2000 study the UK mean score of 523 on reading literacy (the main domain) saw it ranked 8th whilst it scored 529 on mathematical literacy (ranked 9th) and 532 on science literacy (ranked 5th).

In the 2003 study the UK failed to achieve the minimum response rate required to ensure comparability across countries (due to a shortfall in England). A subsequent bias analysis found no evidence for any significant bias of school-level performance results but did suggest that there was potential non-response bias at student level. The PISA Consortium decided that it was not possible reliably to assess the magnitude, or even the direction, of this bias and to correct for it. It concluded that it was not possible to say with confidence that the UK's sample results reliably reflected those for the national population with the level of accuracy required for PISA. The OECD supported this view and determined that the scores for England, and therefore the UK, could not be reliably compared with those for other countries or with the performance scores for the UK from PISA 2000. The mean performance of the responding sample of England pupils was 507, 506 and 519 in mathematics, reading and science respectively.

The Development of the 2006 Survey

The Australian Council for Educational Research (ACER) led the international consortium that designed and implemented the survey on behalf of the OECD. The 2006 survey built on the experiences of the two previous rounds. By using standardised survey procedures and tests, it aimed to collect data from around the world that could be compared despite differences in language and culture. The framework and specification for the survey were agreed internationally and both the consortium and participants submitted items for inclusion in the survey. After the questions had been reviewed by an expert panel, countries were invited to comment on their difficulty, cultural appropriateness, and curricular and non-curricular relevance.

The results of a field trial carried out in every country in 2005 were used to finalise the contents and format of the main study instruments. Strict international quality standards were 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.

The use of 5th and 95th percentiles

The 5th percentile is the score at which 5 per cent of students score lower, while the 95th percentile is the score at which 5 per cent score higher. This is a better measure for comparing countries than using the lowest and highest students. Such a comparison may be affected by a small number of students in a country with very high or very low scores. Comparison of the 5th and the 95th percentiles gives a much better indication of the typical spread of attainment.