Problem Solving in PISA: The Results of 15-year-olds on the Computer-based Assessment of Problem Solving

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The Educational Research Centre (ERC) has released a new report examining the results for Ireland on a computer-based assessment of problem-solving, the latest set of results to be released from the OECD's PISA study. PISA is an international survey of the achievements of 15-year-old students in mathematical, reading and scientific literacy, carried out every three years, the first of which was in 2000. Of the 65 countries that participated in the 2012 cycle of PISA, 44 (including Ireland and 27 other OECD countries) also took part in a 40-minute computer-based assessment of problem-solving. This assessment was aimed at measuring general problem-solving competencies and, while there is some overlap with mathematical competencies, it was not specifically designed as an assessment of mathematical problem solving. The results of this assessment are presented in a new volume also released by the OECD today (*PISA 2012 Results: Creative Problem Solving – Students' Skill in Tackling Real-life Problems*).

Key findings from the computer-based assessment of problem solving:

How well did students in Ireland perform in problem solving?

- The average performance of students in Ireland on problem-solving (498) is not statistically significantly different from the OECD average (500).
- Ireland's performance is ranked 17th out of the 28 participating OECD countries and 22nd out of all 44 participating countries.
- About 20% of students in Ireland perform below Level 2 (the baseline level of proficiency in PISA) which is similar to the OECD average (21%). About 9% of students in Ireland are performing at the highest levels of proficiency in PISA (Levels 5 & 6), which is just slightly below the corresponding OECD average (11%).
- In Ireland, male and female students do not differ significantly in terms of their problem-solving performance (500 for males and 496 for females). Both male and female students in Ireland have similar average scores to the corresponding OECD average scores (503 for males and 497 for females).

How does performance differ across different types of problem-solving tasks?

- Students in Ireland are as likely as students on average across OECD countries to be successful on knowledge-acquisition tasks (i.e. items involving the processes of 'exploring and understanding' and 'representing and formulating'). Students in Ireland are significantly less likely to be successful on knowledge-utilisation tasks (i.e. items involving the processes of 'planning and executing' tasks) compared to the OECD average, while they are significantly more likely to be successful on tasks involving 'monitoring and reflecting'.

How does performance on problem solving compare to performance in mathematics, reading and science?

- Students in Ireland perform less well than expected on the computer-based assessment of problem solving when their performance on the print assessments of mathematics, reading and

science are accounted for, indicating that the mode of delivery of the assessment (i.e. that it was delivered on a computer) may have had an effect on performance.

- Students in Ireland may have been disadvantaged relative to students in other countries due to less familiarity with using computers (at home and at school) for school-related tasks. Students in Ireland reported using ICTs in school in general, in mathematics lessons and at home for school-related tasks less often than the average across OECD countries.

How does performance differ between schools?

- In Ireland, schools differ more in terms of their average problem-solving performance than their print mathematics, reading or science performance, indicating that the influence of school is greater for problem-solving than for other domains.
- In Ireland, the relationship between average socio-economic status and problem-solving performance almost disappears when performance in mathematics is accounted for. This suggests that socio-economic disparities in problem-solving performance reflect a general academic disadvantage at school level rather than a specific disadvantage in problem solving.

How do different groups of students in Ireland perform on the computer-based assessment of problem solving?

- Students with an immigrant background in Ireland (10% of students) perform significantly less well on the assessment of problem solving than native students (by about 13 points). When compared to other students with similar mathematics, reading and science performance, immigrant students in Ireland perform less well in problem solving (-11 points), suggesting that these students have a specific difficultly with the skills uniquely measured by the computer-based assessment of problem solving. However, it is not clear to what extent this difficulty relates to problem-solving proficiency, language proficiency, the mode of delivery of the assessment or some combination of these.
- Students in Transition Year (24% of participating students) perform significantly above their expected level (by 5 points), given their performance in print mathematics, reading and science, perhaps due to greater engagement with computers or greater opportunity to develop problem-solving skills in Transition Year.

What is the relationship between student motivation and disposition towards problem solving and performance?

- Students in Ireland have significantly higher levels of reported perseverance with problems compared to the 28-country OECD average, but do not differ in terms of openness to problem solving. In Ireland, the relationship between openness to problem solving and performance is stronger among higher-achieving students than lower-achieving students. A similar pattern is evident for perseverance.

Background Note:

The OECD's Programme for International Student Assessment (PISA) is an international survey of the achievements of 15-year-old students in mathematical, reading and scientific literacy, carried out every three years beginning in 2000. In the most recent cycle of PISA, which took place in 2012, 65

countries, including all 34 OECD member countries, participated. All countries took part in the paper-based assessments of mathematics, reading and science, while subsets of countries also participated in computer-based assessments of mathematics, digital reading and problem solving. Ireland participated in all six assessments and results for five of these (the print assessments of mathematics, reading and science; and the computer-based assessments of mathematics and digital reading) were published in December 2013. The main findings for Ireland were:

- The performance of students in Ireland on the print assessments of mathematics, reading and science (502, 523 and 522, respectively) was above the corresponding OECD averages (494, 497 and 501, respectively).
- Ireland's performance on the computer-based assessment of digital reading was also above the OECD average in 2012 (520 and 497, respectively) while performance on the computer-based assessment of mathematics was not significantly different from the OECD average (493 and 497, respectively).
- The performance of students in Ireland on print mathematics and reading is statistically significantly higher in 2012 than in 2009, but does not differ significantly from the performance of Irish students in earlier PISA cycles. On the other hand, the average science score of students in Ireland in 2012 was significantly higher than in all previous cycles that can be compared for science. The average digital reading score of students in Ireland also increased significantly between 2009 and 2012.

Further Information:

- Sample tasks from PISA, including items from the computer-based assessment of problem solving: http://www.oecd.org/pisa/pisaproducts/pisa-test-questions.htm
- Summary results for Ireland on problem solving: www.erc.ie/p12psreport
- OECD's reports on PISA 2012 results, including Volume 5, the report on problem solving: http://www.oecd.org/pisa/keyfindings/pisa-2012-results.htm
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