



PROGRAMME FOR INTERNATIONAL
STUDENT ASSESSMENT (PISA)
RESULTS FROM PISA 2012 PROBLEM SOLVING

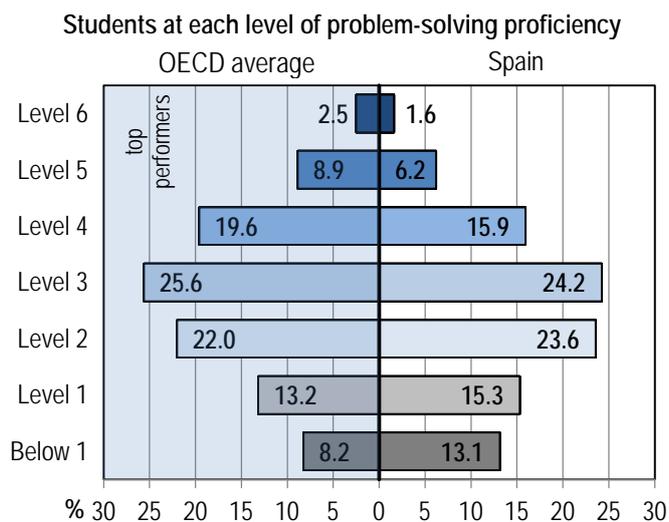
Spain

“We ought to leave behind the brick economy and focus on the knowledge economy.” So said Angel Gurría, Secretary-General of the OECD, speaking recently at the Global Forum Spain in Bilbao and highlighting one of the key challenges facing Europe, particularly Spain. PISA’s first assessment of creative problem-solving skills shows how well-prepared students are to confront – and solve – the kinds of problems that are encountered almost daily in 21st century life.

- Spanish students perform better in mathematics, reading and science than in problem solving. With a mean score of 477 points, Spain performs below the OECD average and ranks between 27 and 31 among all 44 countries and economies that participated in the problem-solving assessment.
- When asked to perform problem-solving tasks, Spanish students struggle to use all the skills that they demonstrate in other curricular domains. On average, Spanish students score 20 points lower than expected in problem solving, based on their performance in mathematics, reading and science.
- The low performance of the most vulnerable students in Spain pulls down the country’s overall performance. Only those students who are top performers in mathematics perform as well in problem solving as students in other countries do.
- In Spain, 28% of students do not reach a baseline level of proficiency in problem solving, compared with 21% across participating OECD countries. Students performing below baseline Level 2 are only able to solve very simple problems that do not require the student to think ahead and that are cast in familiar settings, such as selected the least-expensive furniture from a catalogue showing different brands and prices. In contrast, 8% of Spanish students are top performers in problem solving (the OECD average is 11%), meaning that they can systematically explore a complex problem scenario, devise multi-step solutions that take into account all constraints, and adjust their plans in light of the feedback received.
- The comparatively low problem-solving performance among Spanish students may be partly due to these students’ relative unfamiliarity with computers (the problem-solving assessment was delivered on computers), which, in turn, is related to students’ openness to engage with novel situations and devices. As PISA results show, schools can foster students’ willingness to confront – and solve – unfamiliar types of problems.

PISA 2012 defines problem-solving competence as “...an individual’s capacity to engage in cognitive processing to understand and resolve problem situations where a method of solution is not immediately obvious. It includes the willingness to engage with such situations in order to achieve one’s potential as a constructive and reflective citizen”. The problem-solving assessment focuses on students’ general reasoning skills, their ability to regulate problem-solving processes, and their willingness to do so, by confronting students with problems that do not require expert knowledge to solve – such as buying the best ticket that satisfies all constraints at an unfamiliar vending machine. In contrast, when the regular assessments of mathematics, reading and science in PISA include problem-solving tasks, solving these problems requires curricular knowledge in addition to problem-solving skills.

Performance in problem solving in SPAIN



Source: Table V.2.1

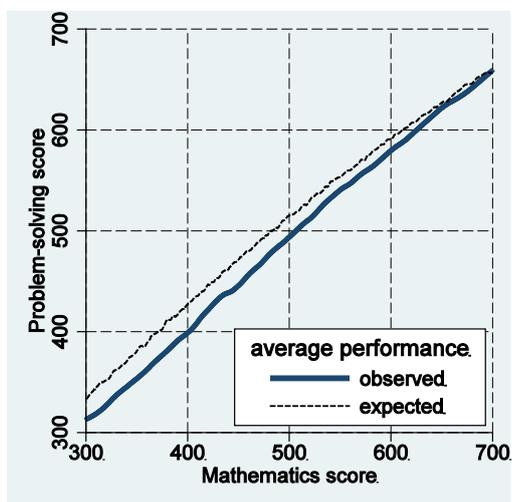
	Mean performance in problem solving	
	Mean score	Range of ranks
Singapore	562	1 – 2
Korea	561	1 – 2
Japan	552	3
...		
Shanghai-China	536	4 – 7
Canada	526	8 – 10
Australia	523	8 – 11
Finland	523	8 – 11
England (United Kingdom)	517	9 – 16
France	511	11 – 19
Italy	510	12 – 21
Germany	509	12 – 21
Portugal	494	22 – 26
Spain	477	27 – 31
OECD average	500	

This table includes only a selection of participating countries and economies. For the complete ranking, see Figure V.2.4.

- Students in Spain perform below the average of the 28 OECD countries that assessed students' problem-solving skills in 2012. With a mean score of 477 points, the rank of Spain among all 44 participating countries and economies is estimated to lie between ranks 27 and 31.
- Average performance in Spain is not significantly different from that found in the Croatia, Poland, Serbia, Slovak Republic and Slovenia.

Relative performance in problem solving in SPAIN

Relative performance at different levels of the mathematics scale



Relative performance is defined as the difference between the observed score in problem solving and the expected score, based on performance in core subjects. Stronger-than-expected performance in problem solving may indicate that the learning opportunities available to students prepare them well for handling complex, real-life problems in contexts that they do not usually encounter at school. However, if it coincides with low performance overall, it may also indicate that students' potential is not realised in the core subjects.

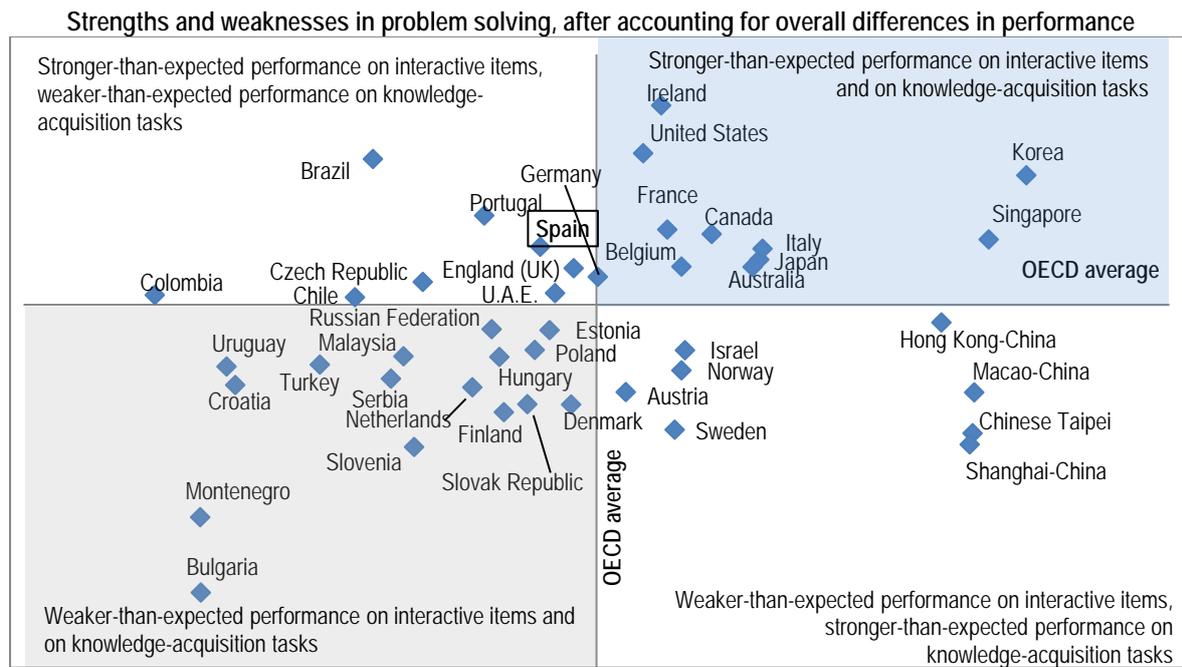
Relative performance in problem solving	
	Score dif.
Accounting for performance in all core subjects	
...among all students	-20
Accounting for performance in mathematics only	
...among all students	-20
...among strong and top performers in mathematics	-12
...among moderate and low performers in mathematics	-22

Note: Statistically significant differences are marked in bold. Source: Table V.2.6

- Students in Spain perform worse than expected in problem solving, based on their performance in mathematics, reading and science. The difference between observed and expected performance is particularly large among students with moderate and low performance in mathematics (proficiency Level 3 and below).

Strengths and weaknesses in problem solving

- Students in Spain performed in line with the OECD average on interactive items, based on their overall success. Interactive items require students to uncover useful information by exploring the problem situation and gathering feedback on the effect of their actions. In order to reach a solution, students need to be open to novelty, tolerate doubt and uncertainty, and dare to use intuitions to initiate a solution.
- Success rates on knowledge-acquisition and knowledge-utilisation tasks are also in line with the OECD average, after accounting for overall success on the test. The best-performing countries in problem-solving often do particularly well on knowledge-acquisition tasks that require advanced reasoning skills and self-directed learning.



Source: Figure V.3.10.

How performance in problem solving varies within SPAIN

Performance in problem solving by subgroup	
	Mean score/score dif.
Boys	478
Girls	476
Difference (Boys-Girls)	2
Immigrant students	443
Non-immigrant students	482
Difference (imm.- non-imm.)	-39
Strength of the relationship between socio-economic status and performance	
Performance variation accounted for by socio-economic status (%)	
Problem solving	7.9
Mathematics	15.7
Difference (PS - M)	-7.8

Statistically significant differences are marked in bold.

Source: Tables V.4.7, V.4.14, V.4.19

- In Spain, boys score at the same level as girls in problem solving, on average (the OECD average difference in favour of boys is 7 score points), but there are more boys than girls among students who perform at Level 5 or 6.
- Students with an immigrant background score significantly lower than non-immigrant students in Spain. However, they perform as expected based on their scores in mathematics, reading and science.
- The impact of socio-economic status on performance is significantly weaker in problem solving than in mathematics, both in Spain and across OECD countries, on average.
- The relationship between computer use and performance in problem solving, even after accounting for socio-demographic disparities across the two groups, is stronger in Spain than in other countries.

What is PISA?

The Programme for International Student Assessment (PISA) is a triennial survey that assesses the extent to which 15-year-old students near the end of compulsory education have acquired the knowledge and skills that are essential for full participation in modern societies. The assessment does not just ascertain whether students can reproduce knowledge; it also examines how well students can extrapolate from what they have learned and apply that knowledge in unfamiliar settings, both in and outside of school.

PISA offers insights for education policy and practice, and helps monitor trends in students' acquisition of knowledge and skills across countries and in different demographic subgroups within each country. The findings allow policy makers to gauge the knowledge and skills of students in their own countries in comparison with those in other countries, set policy targets against measurable goals achieved by other education systems, and learn from policies and practices applied elsewhere.

Key features of the PISA 2012 assessment of problem solving

In 2012, more than 40 countries and economies participated in the assessment of problem solving. **OECD countries:** Australia, Austria, Belgium, Canada, Chile, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Israel, Italy, Japan, Korea, the Netherlands, Norway, Poland, Portugal, the Slovak Republic, Slovenia, Spain, Sweden, Turkey, England (United Kingdom) and the United States. **Partner countries and economies:** Brazil, Bulgaria, Colombia, Croatia, Hong Kong-China, Macao-China, Malaysia, Montenegro, the Russian Federation, Serbia, Shanghai-China, Singapore, Chinese Taipei, the United Arab Emirates and Uruguay.

The assessment

- Problem solving was assessed on computers. The computer-based assessments lasted a total of 40 minutes, with different students taking different combinations of test items. A total of 80 minutes of problem-solving items were covered. Only basic computer familiarity and skills were required to complete the assessment.
- The use of computers made it possible to include interactive problems, in which students need to explore the (simulated) environment and gather feedback on the effect of their interventions in order to obtain all the information needed to solve a problem. Test questions were a mixture of multiple-choice questions and those requiring students to construct their own responses. Sample items can be explored online at www.oecd.org/pisa/test.
- Students assessed in problem solving also completed a two-hour assessment of mathematics, reading and science. They also answered a background questionnaire, which took 30 minutes to complete, that sought information about themselves, their homes and their school and learning experiences. In addition, countries could choose an optional questionnaire for students, asking about their familiarity with and use of information and communication technologies.

The students

- Only a subsample of all students assessed in mathematics, reading and science in 2012 also participated in the computer-based assessment of problem solving. Around 85 000 students were assessed in problem solving, representing about 19 million 15-year-olds in the schools of the 44 participating countries and economies.

In Spain, 2 709 students in 368 schools completed the problem-solving assessment.

Contacts:

Andreas Schleicher Acting Director for Education and Skills and Special Advisor on Education Policy to the Secretary-General Andreas.SCHLEICHER@oecd.org Telephone: +33 6 07 38 54 64	Pablo Zoido Analyst Directorate for Education and Skills Pablo.ZOIDO@oecd.org Telephone: +33 1 45 24 96 07
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For more information on the Programme for International Student Assessment and to access the full set of PISA 2012 results, visit: www.oecd.org/pisa