



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

UNDER EMBARGO UNTIL 1 APRIL 2014, 5.00PM (SINGAPORE TIME)

Singapore

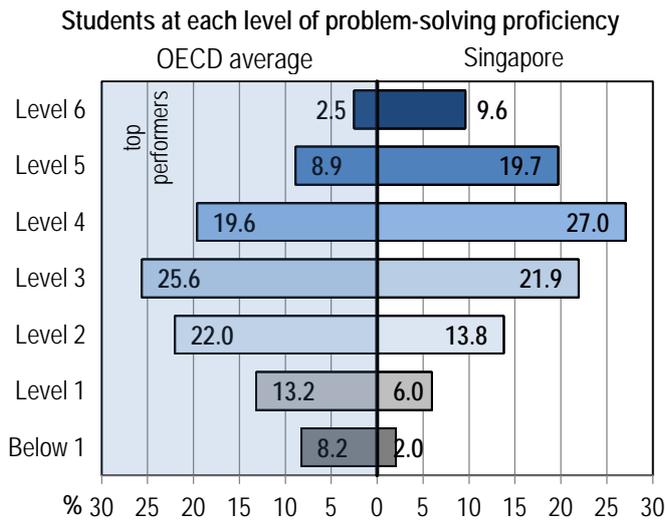
- Singapore scores highest in the PISA 2012 assessment of problem solving, with 562 points on the PISA proficiency scale. Only Korea has a similarly high score.
- Singapore also has the highest number of top-performing students in problem solving: 29% of students reach proficiency Level 5 or 6 (the OECD average is 11%).
- More than nine out of ten students in Singapore (92%) can complete tasks at the baseline level (Level 2) or higher in problem solving and a majority of 15-year-old students in Singapore can complete tasks at least at Level 4, which means that they are able to engage with moderately complex situations in a systematic way.

Singapore students are better at problem-solving tasks that require exploring and understanding, representing and formulating, and monitoring and reflecting than tasks that require planning and executing. That said, this is in the context of Singapore students being still among the highest-performing in planning and executing.

- Students in Singapore perform as expected in problem solving when taking into account their overall performance in mathematics, reading and science.
- As is true across OECD countries, on average, in Singapore, the impact of socio-economic status on performance is weaker in problem solving than in mathematics, reading and science.
- In Singapore, less than 1% of the variation in students' performance in problem solving is explained by differences in students' computer skills – far less than in other countries.

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 Singapore



Source: Table V.2.1

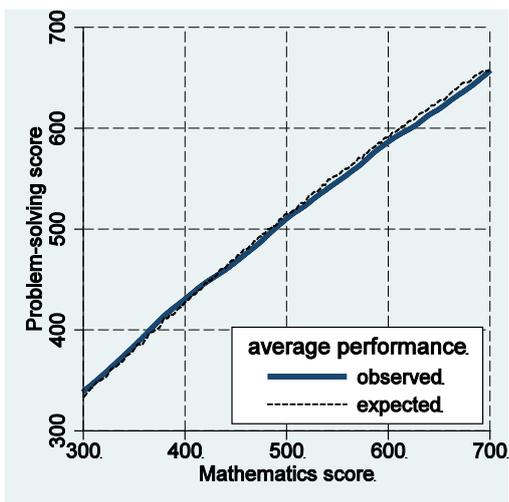
Mean performance in problem solving		
	Mean score	Range of ranks
Singapore	562	1 – 2
Korea	561	1 – 2
Japan	552	3
Macao-China	540	4 – 6
Hong Kong-China	540	4 – 7
Shanghai-China	536	4 – 7
Chinese Taipei	534	5 – 7
Canada	526	8 – 10
Australia	523	8 – 11
Finland	523	8 – 11
England (United Kingdom)	517	9 – 16
Estonia	515	11 – 15
France	511	11 – 19
...		
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 Singapore and Korea score higher in problem solving than students in all other participating countries and economies. Singapore and Korea are followed by four other East-Asian countries and economies: Japan, Macao-China, Hong Kong-China and Shanghai-China.
- Singapore also has the largest proportion of top-performing students, with 29% of students reaching Level 5 or 6 in problem solving, compared with the OECD average of 11%. Students at this level can systematically explore a complex problem scenario, devise multiple-step solutions that take into account all constraints, and adjust their plans in light of the feedback received.

Relative performance in problem solving in Singapore

Relative performance at different levels of the mathematics scale (Singapore)



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 (which is not the case in Singapore), it may also indicate that students' potential is not realised in the core subjects.

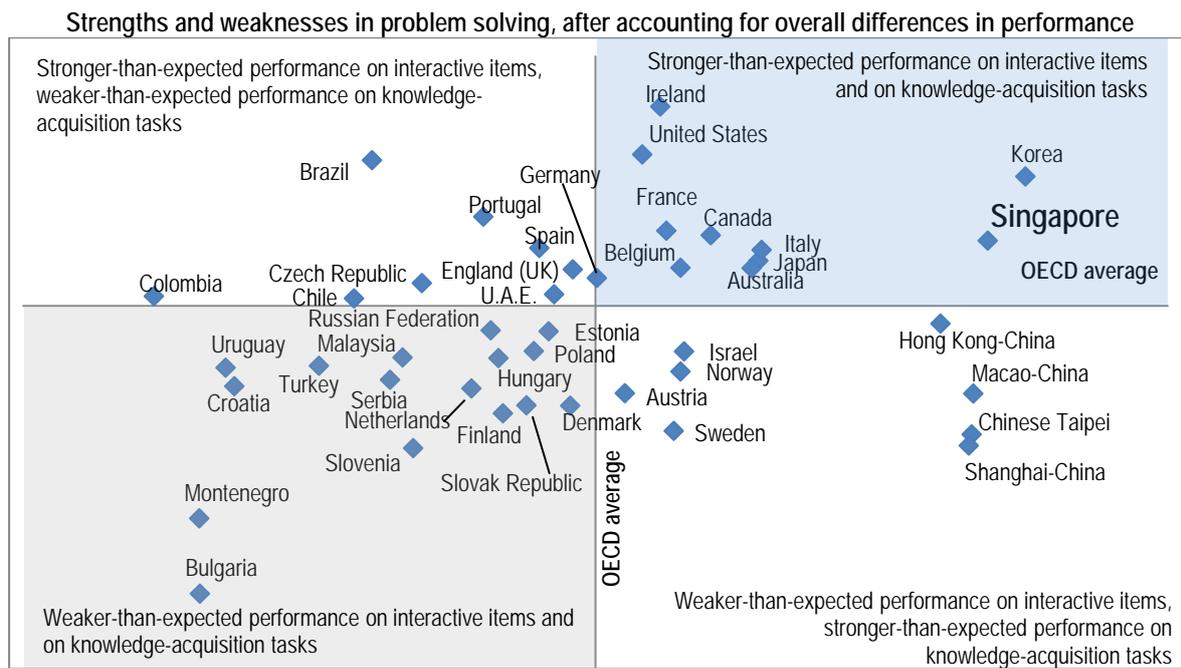
Relative performance in problem solving (Singapore)	
	Score dif.
Accounting for performance in all core subjects	
...among all students	2
Accounting for performance in one subject only:	
...mathematics	-4
...reading	26
...science	19

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

- Students in Singapore perform as expected in problem solving when taking into account their performance in mathematics, reading and science.
- When accounting for their performance in mathematics only, students in Singapore perform slightly lower in problem solving than expected, but the difference is small and can be explained by the very high mathematics performance among students in Singapore. When accounting for their performance in reading only or science only, students in Singapore perform considerably better in problem solving than expected.

Strengths and weaknesses in problem solving

- Students in Singapore perform better-than-expected on knowledge-acquisition tasks, after accounting for overall performance on the test. Most top-performing countries in problem solving tend to do particularly well on knowledge acquisition tasks, which require high levels of reasoning skills and self-directed learning.
- Students in Singapore also perform better-than-expected on interactive items, based on their overall performance on all problem-solving items. Interactive items require students to uncover useful information by exploring the problem situation and gathering feedback on the effect of their interventions. In order to reach a solution, students must be open to novelty, tolerate doubt and uncertainty, and dare to use intuition to initiate a solution.



How performance in problem solving varies within Singapore

Performance in problem solving by gender	
	Mean score/score dif.
Boys	567
Girls	558
Difference (boys – girls)	9
Strength of the relationship between socio-economic status and performance	
	Performance variation accounted for by socio-economic status (%)
Problem solving	11.1
Mathematics	14.4
Difference (problem solv. - mathematics)	-3.3

Statistically significant differences are marked in bold.

Source: Tables V.4.7, V.4.139

- In Singapore, boys perform better than girls in problem solving. The gender difference is 9 points in favour of boys, compared with 7 points on average across OECD countries; but there is a greater variation in performance among boys than among girls.
- The impact of socio-economic status on performance is weaker in problem solving than in mathematics, reading and science. This is the case in Singapore as well as across OECD countries, on average.

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 Singapore, 1 394 students in 172 schools completed the assessment of problem solving.

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