



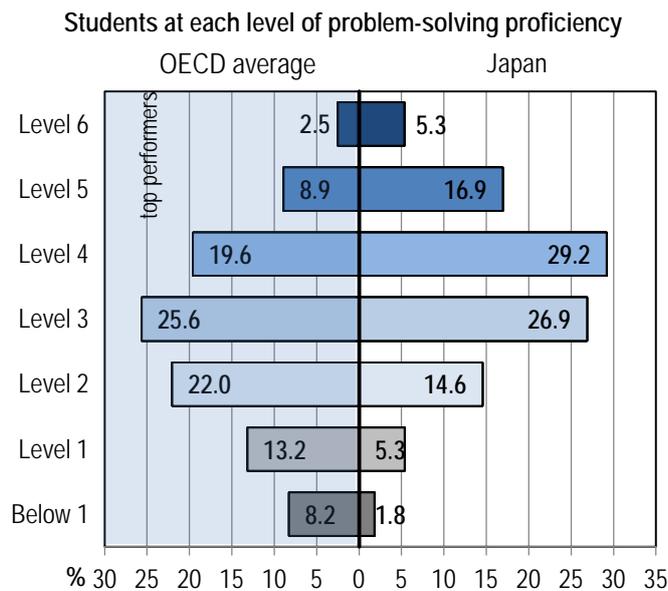
PROGRAMME FOR INTERNATIONAL  
STUDENT ASSESSMENT (PISA)  
RESULTS FROM PISA 2012 PROBLEM SOLVING

## Japan

- 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. Japan has the third highest score in problem solving – 522 points – among all countries and economies that participated in the PISA 2012 problem-solving assessment. Only Singapore and Korea score higher.
- Some 22.3% of 15-year-old students in Japan are top performers in problem solving, 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 OECD average is 11.4%). More than nine out of ten students can complete tasks at Level 2 or higher on the problem solving proficiency scale. Japan is thus close to the goal of giving each student the basic tools needed to meet the challenges that arise in daily life.
- Japanese students with low or moderate proficiency in mathematics perform significantly better in problem solving than do students in other countries with similar levels of mathematics proficiency.
- Students in Japan show stronger-than-expected performance on both interactive items and on knowledge-acquisition tasks. Other East Asian countries, such as Korea and Singapore, perform strongest on problems that require understanding, formulating or representing new knowledge, compared to other types of problems.
- Boys in Japan perform better than girls in problem solving, on average, as they do in mathematics. Nurturing girls' ability to handle complex, unfamiliar problems may ultimately lead to more women in leadership positions in the country.
- The impact of socio-economic status on problem-solving skills in Japan is weak.

**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 Japan



Source: Table V.2.1

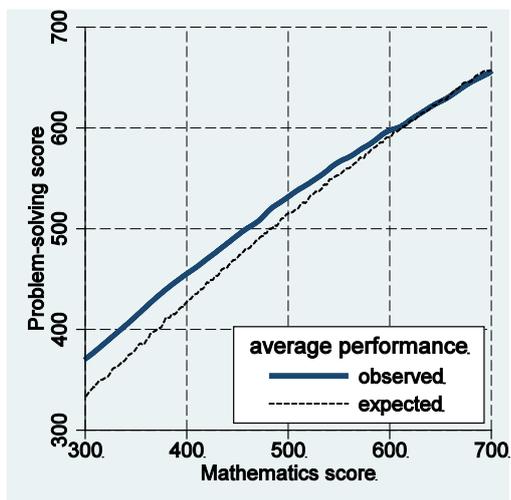
	Mean performance in problem solving	
	Mean score	Range of ranks
Singapore	562	1 – 2
Korea	561	1 – 2
Japan	552	3
Macao-China	540	4 – 6
Hong Kong-China	540	4 – 7
Shanghai-China	536	4 – 7
Chinese Taipei	534	5 – 7
Canada	526	8 – 10
Australia	523	8 – 11
Finland	523	8 – 11
England (United Kingdom)	517	9 – 16
France	511	11 – 19
Netherlands	511	11 – 21
Italy	510	12 – 21
Germany	509	12 – 21
United States	508	12 – 21
...		
<b>OECD average</b>	<b>500</b>	

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

- Students in Japan score the second highest among the 28 OECD countries that participated in the 2012 problem-solving assessment, behind students in Korea. With a mean score of 552 points, Japan ranks third among all 44 participating countries and economies.
- Average performance in Japan is not significantly different from average performance in Korea.

## Relative performance in problem solving in Japan

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.

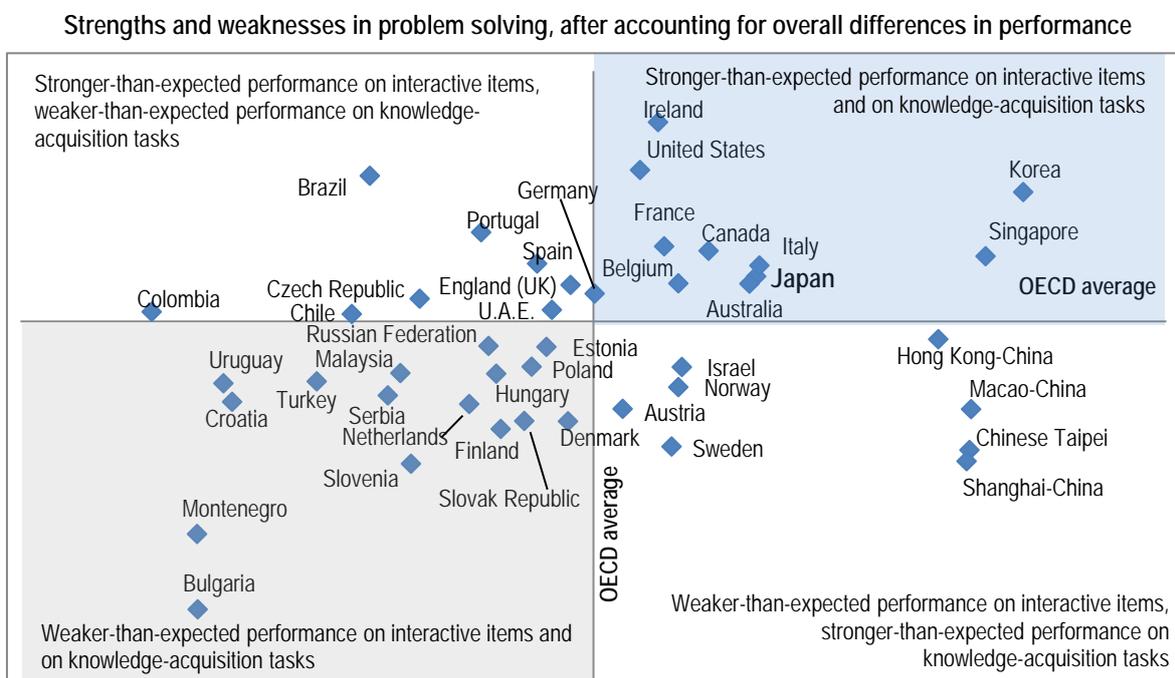
Relative performance in problem solving	
	Score dif.
Accounting for performance in all core subjects	
...among all students	<b>11</b>
Accounting for performance in mathematics only	
...among all students	<b>13</b>
...among strong and top performers in mathematics	<b>4</b>
...among moderate and low performers in mathematics	<b>21</b>

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

- Students in Japan perform better-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 low performance in mathematics.

## Strengths and weaknesses in problem solving

- Students in Japan perform close to their expected level on interactive tasks, based on the OECD average pattern of performance, and above their expected level on knowledge-acquisition tasks, which require high levels of reasoning skills and self-directed learning, after accounting for their overall performance.



Source: Figure V.3.10.

## How performance in problem solving varies within Japan

Performance in problem solving by subgroup	
	Mean score/score dif.
Boys	561
Girls	542
Difference (Boys-Girls)	<b>19</b>
Strength of the relationship between socio-economic status and performance	
Performance variation accounted for by socio-economic status (%)	
Problem solving	<b>5.2</b>
Mathematics	<b>9.8</b>
Difference (PS - M)	<b>-4.6</b>

Statistically significant differences are marked in bold.

Source: Tables V.4.7, V.4.13, V.4.19

- Japanese boys score much higher than girls in problem solving, on average (the difference between the genders is 19 points, compared to the OECD average difference in favour of boys of 7 points). While similar proportions of boys as girls are low performers, among top performers, boys outnumber girls. Boys and girls show similar strengths and weaknesses in specific problem-solving tasks.
- The impact of socio-economic status on performance is significantly weaker in problem solving than in mathematics, in Japan and across OECD countries, on average.
- Some 7.8% of the variation in Japanese students' performance in problem solving can be attributed to the fact that the assessment was computer-based – a larger-than-average impact of mode of delivery (computer-delivered/paper-based) on their problem-solving proficiency.
- The difference in problem-solving performance related to the use of computers at home is small in Japan (35 score points), compared to other countries (OECD average is 67 score points). There is no statistical difference in problem-solving performance related to the use of computers at school in Japan.

## 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](http://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 Japan, 3 014 students in 191 schools completed the assessment of problem solving.

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