In 2015, over half a million students...
- representing 28 million 15-year-olds in 72 countries/economies

... took an internationally agreed 2-hour test...
- Goes beyond testing whether students can reproduce what they were taught to assess students’ capacity to extrapolate from what they know and creatively apply their knowledge in novel situations
- Total of 390 minutes of assessment material

... and responded to questions on...
- their personal background, their schools, their well-being and their motivation

Parents, principals, teachers and system leaders provided data on:
- school policies, practices, resources and institutional factors that help explain performance differences
- 89,000 parents, 93,000 teachers and 17,500 principals responded
PISA 2015

OECD Partners
“the ability to engage with science-related issues, and with the ideas of science, as a reflective citizen”
Drag Ragworms and Common Sole into Tank 2 and Marsh Grass and Shellfish into Tank 3

This question requires students to understand a system and the role of several organisms within that system. In order to answer correctly, students must understand the goal of the fish farm, the function of each of the three tanks therein, and which organisms will best fulfill each function. Students must use information provided in the stimulus and the diagram, including a footnote under the diagram.
Trends in science performance

Student performance

OECD average

2006

2009

2012

2015
Trends in science performance

Score points

- Below Level 1
- Level 1
- Level 2
- Level 3
- Level 4
- Level 5

Mass. OECD average

2006 2009 2012 2015
Some countries combine excellence with equity.

Some countries improved performance or equity

Higher performance
Low equity

Low performance
Low equity

More equity

Percentage of performance variation explained by ESCS

Mean science performance

350
400
450
500
550

Some countries improved performance or equity

Some countries improved performance

Mean science performance

Percentage of performance variation explained by ESCS

Some countries improved equity

Mean science performance

Percentage of performance variation explained by ESCS

More equity

350
400
450
500
550

0
5
10
15
20
25

25

Brazil
Bulgaria
Chile
Mexico
Montenegro
Slovenia
Thailand
United States

Higher performance
Low equity

Low performance
Low equity

High performance
High equity

High performance
Low equity

Low performance
High equity

Some countries improved equity
Greater equity

No difference

Significant difference

USA 2006

USA 2015
Poverty is not destiny - Science performance
by international deciles of the PISA index of economic, social and cultural status (ESCS)

Figure I.6.7
Resilient students come from the bottom 25% of the ESCS index within their country/economy and perform among the top 25% across all countries/economies, after accounting for socio-economic status.
Excellence and baseline performance
The global pool of top performers: A PISA perspective

<table>
<thead>
<tr>
<th>Country</th>
<th>Share of Top Performers</th>
<th>Number of Students</th>
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</thead>
<tbody>
<tr>
<td>United States</td>
<td>8.5%</td>
<td>300k</td>
</tr>
<tr>
<td>B-S-J-G (China)</td>
<td>13.6%</td>
<td>181k</td>
</tr>
<tr>
<td>Japan</td>
<td>15.3%</td>
<td>174k</td>
</tr>
<tr>
<td>New Zealand</td>
<td>12.8%</td>
<td></td>
</tr>
<tr>
<td>United Kingdom</td>
<td>10.9%</td>
<td>68k</td>
</tr>
<tr>
<td>Korea</td>
<td>10.6%</td>
<td>60k</td>
</tr>
<tr>
<td>Brazil</td>
<td>0.7%</td>
<td></td>
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<tr>
<td>Singapore</td>
<td>24.2%</td>
<td></td>
</tr>
<tr>
<td>Finland</td>
<td>14.3%</td>
<td></td>
</tr>
<tr>
<td>Sweden</td>
<td>8.5%</td>
<td></td>
</tr>
<tr>
<td>Portugal</td>
<td>7.4%</td>
<td></td>
</tr>
<tr>
<td>Switzerland</td>
<td>9.8%</td>
<td></td>
</tr>
<tr>
<td>Belgium</td>
<td>9.0%</td>
<td></td>
</tr>
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<td>China</td>
<td>13.6%</td>
<td></td>
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<tr>
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<tr>
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<td>Netherlands</td>
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<td>Poland</td>
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<td></td>
</tr>
<tr>
<td>Australia</td>
<td>11.2%</td>
<td></td>
</tr>
<tr>
<td>Chinese Taipei</td>
<td>15.4%</td>
<td>39k</td>
</tr>
<tr>
<td>Canada</td>
<td>12.4%</td>
<td>41k</td>
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<tr>
<td>Russia</td>
<td>3.7%</td>
<td>42k</td>
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<tr>
<td>France</td>
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<td>59k</td>
</tr>
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<td>Switzerland</td>
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<td></td>
</tr>
<tr>
<td>Japan</td>
<td>15.3%</td>
<td></td>
</tr>
<tr>
<td>Germany</td>
<td>10.6%</td>
<td>79k</td>
</tr>
</tbody>
</table>

Share of top performers among 15-year-old students:

- Less than 1%
- 1 to 2.5%
- 2.5 to 5%
- 5% to 7.5%
- 7.5% to 10%
- 10% to 12.5%
- 12.5% to 15%
- More than 15%
Science and careers
Expectations of a science career by gender

Figure I.3.5

Science and engineering professionals
- Girls
- Boys

Health professionals
- Girls
- Boys

Information and communication technology (ICT) professionals
- Girls
- Boys

Science-related technicians or associate professionals
- Girls
- Boys

United States
OECD average

%
Students expecting a career in science

Percentage of students who expect to work in science-related professional and technical occupations when they are 30

- Science-related technicians and associate professionals
- Information and communication technology professionals
- Health professionals
- Science and engineering professionals

% of students with vague or missing expectations
Students expecting a career in science
by performance and enjoyment of learning

Figure I.3.17
Students’ enjoyment of learning science

Percentage of students who reported that they "agree" or "strongly agree" with the following statements

- I enjoy acquiring new knowledge in <broad science>
- I am interested in learning about <broad science>
- I generally have fun when I am learning <broad science> topics
- I am happy working on <broad science> topics
- I like reading about <broad science>

OECD average and United States
Above-average science performance:
- Japan
- Estonia
- Finland
- Macao (China)
- Viet Nam
- B-S-J-G (China)
- Korea
- Germany
- Netherlands
- Switzerland
- Belgium
- Poland

Stronger than average epistemic beliefs:
- Chinese Taipei
- Hong Kong (China)
- New Zealand
- Denmark

Above-average percentage of students expecting to work in a science-related occupation:
- Singapore
- Canada
- Slovenia
- Australia
- United Kingdom
- Ireland
- Portugal

Multiple outcomes:
- Norway
- United States
- Spain
- Israel
- United Arab Emirates
- Brazil
- Bulgaria
- Chile
- Colombia
- Costa Rica
- Dominican Republic
- Jordan
- Kosovo
- Lebanon
- Mexico
- Peru
- Qatar
- Trinidad and Tobago
- Tunisia
- Turkey
- Uruguay
Lessons from PISA

- Must haves
- Money pits
- Low hanging fruits
- Quick wins

Impact on outcomes:
- Low impact
- High impact

Feasibility:
- Low feasibility
- High feasibility
Lessons from PISA

- High impact on outcomes
  - Quick wins
  - Resources where they yield most
  - Incentive structures and accountability

- Low impact on outcomes
  - Money pits
  - Low hanging fruits

- High feasibility
  - Gateways, instructional systems

- Low feasibility
  - Commitment to universal achievement
  - Capacity at point of delivery
  - Coherence
  - A learning system
  - Must haves

Resources where they yield most
Lessons from PISA

A commitment to education and the belief that competencies can be learned and therefore all children can achieve

- Universal educational standards and personalization as the approach to engage with diversity...
- ... as opposed to a belief that students have different destinations to be met with different expectations, and selection/stratification as the approach to heterogeneity
- Clear articulation who is responsible for ensuring student success and to whom
Horizontal stratification: ability grouping

Percentage of students in schools where students are grouped by ability into different classes:

- One form of grouping for all subjects
- One form of grouping for some subjects
- No ability grouping for any subject

**Figure II.5.8**
Lessons from PISA

<table>
<thead>
<tr>
<th>High impact on outcomes</th>
<th>Low impact on outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Commitment to universal achievement</strong></td>
<td><strong>Gateways, instructional systems</strong></td>
</tr>
<tr>
<td><strong>Capacity at point of delivery</strong></td>
<td><strong>Low hanging fruits</strong></td>
</tr>
<tr>
<td><strong>Coherence</strong></td>
<td><strong>Resources where they yield most</strong></td>
</tr>
</tbody>
</table>

Money pits

Low feasibility

A learning system

Investing resources where they can make most of a difference
- Alignment of resources with key challenges (e.g. attracting the most talented teachers to the most challenging classrooms)
- Effective spending choices that prioritise high quality teachers over smaller classes

Low impact on outcomes
Spending per student from the age of 6 to 15 and science performance

Figure II.6.2
Differences in educational resources between advantaged and disadvantaged schools

Disadvantaged schools have more resources than advantaged schools.

Disadvantaged schools have fewer resources than advantaged schools.
Integrating immigrants
Figure I.7.4

Student performance in science by immigrant background

Score points
- Non-immigrant students
- Second-generation immigrant students
- First-generation immigrant students

Countries listed from left to right:
- Greece
- Costa Rica
- Jordan
- CABA (Argentina)
- Israel
- Sweden
- France
- Slovenia
- Austria
- Germany
- Netherlands
- Denmark
- Italy
- Norway
- Belgium
- Spain
- Croatia
- United States
- France
- Slovenia
- Germany
- Belgium
- Spain
- Austria
- Netherlands
- Italy
- Norway
- Denmark
- Greece

Score points range from 350 to 600.
Percentage of immigrant students and education systems' average performance in science

Figure I.7.3

[Graph showing the relationship between the percentage of immigrant students and the mean science performance across various countries.]

- OECD average
- Countries listed: Australia, Austria, Belgium, Canada, Croatia, Denmark, Estonia, France, Germany, Hong Kong (China), Hungary, Italy, Jordan, Luxembourg, Macao-China, Netherlands, New Zealand, Norway, Portugal, Russia, Singapore, Spain, Sweden, Switzerland, United Arab Emirates, United Kingdom, United States, Venezuela, Vietnam, and Qatar.

R² = 0.09

Mean science performance versus Percentage of immigrant students.
Percentage of resilient students by immigrant background

Resilient students come from the bottom 25% of the ESCS index within their country/economy and perform among the top 25% across all countries/economies, after taking socio-economic status into account.
Starting strong
Attendance at pre-primary school
by schools’ socio-economic profile

Number of years in pre-primary education among students attending socio-economically…

Disadvantaged schools

Advantaged schools

OECD average

Table II.6.51

Attendance at pre-primary school
by schools’ socio-economic profile

Number of years in pre-primary education among students attending socio-economically…

Disadvantaged schools

Advantaged schools

OECD average

Table II.6.51
Lessons from PISA

- **Low impact on outcomes**
  - **Low feasibility**
    - Capacity at point of delivery
      - Attracting, developing and retaining high quality teachers and school leaders and a work organisation in which they can use their potential
      - Instructional leadership and human resource management in schools
      - Keeping teaching an attractive profession
      - System-wide career development ...
  - **High feasibility**
    - Gateways, instructional systems
      - Money pits
    - Low hanging fruits

- **High impact on outcomes**
  - **Low feasibility**
    - Coherence
  - **High feasibility**
    - Must haves
    - Commitment to universal achievement

- **Capacity at point of delivery**
Student-teacher ratios and class size

![Graph showing student-teacher ratios and class size for various countries. High student-teacher ratios and small class sizes are indicated, whereas low student-teacher ratios and large class sizes are shown. The graph includes countries such as Denmark, Poland, and Turkey. The correlation coefficient $R^2 = 0.25$.](Image)
Lessons from PISA

- **Low impact on outcomes**
  - Low feasibility
  - Money pits
  - Hanging fruits

- **High impact on outcomes**
  - High feasibility
  - Must haves
  - Quick wins
  - Resources where they yield most
  - Incentive structures and accountability
  - Gateways, instructional systems
  - A learning system
  - Commitment to universal achievement
  - Coherence
  - Capacity at point of delivery

- **High level of metacognitive content of instruction**
  - Well established delivery chain through which curricular goals translate into instructional systems, instructional practices and student learning (intended, implemented and achieved)

- **Clear ambitious goals that are shared across the system and aligned with high stakes gateways and instructional systems**
The ‘productivity’ puzzle

Making learning time productive so that students can build their academic, social and emotional skills in a balanced way
Learning time and science performance

Figure II.6.23

- **OECD average**
- **R² = 0.21**
Learning time and science performance

Figure II.6.23

Score points in science per hour of total learning time

Intended learning time at school (hours)
Study time after school (hours)
Score points in science per hour of total learning time

Hours

Score points in science per hour of total learning time
Effective teaching

A well-structured, clear and informative lesson on a topic including teachers’ explanations, classroom debates and students’ questions pays off, as does adaptive instruction. Inquiry-based science instruction (e.g. experimentation and hands-on activities) tends to relate negatively to performance but positively to student engagement and career expectations.
Lessons from PISA

Low impact on outcomes

High impact on outcomes

Low feasibility

High feasibility

Money pits

Must haves

Commitment to universal achievement

Capacity at point of delivery

Incentive structures and accountability

Quick wins

Resources where they yield most

A learning system

Coherence

Gateways, instructional systems

Low hanging fruits

Coherence of policies and practices

- Alignment of policies across all aspects of the system
- Coherence of policies over sustained periods of time
- Consistency of implementation
- Fidelity of implementation (without excessive control)
Looking forward
Some key questions for social cohesion and sustainable development

- How well are students prepared for life, citizenship and employment in multicultural societies and in a globalised world?
- To what degree are students able to examine contemporary issues?
- Are students able to understand and appreciate multiple cultural perspectives (including their own) and manage differences and conflicts?
- To what degree are students prepared to interact with others with respect for the inviolable rights and dignity of every individual?
- To what degree do students care about the world and take action to make a difference?
PISA definition of Global Competence

**Global Competence** is the capacity to examine global and intercultural issues, to take multiple perspectives, to engage in open, appropriate and effective interactions with people from different cultures and to act for collective well-being and sustainable development.
Skills
- Examine issues
- Take perspectives
- Interact across cultures
- Act for well-being and sustainability

Knowledge
- Knowledge of global issues
- Intercultural knowledge

Values
- Valuing human dignity
- Valuing cultural diversity

Attitudes
- Openness
- Respect
- Global-mindedness

Skills
- Evaluate evidence and explain issues
- Analyse perspectives
- Adapt communication and behaviour
- Evaluate actions and consequences

Global Competence

OECD Programme for International Student Assessment
PISA
### The instruments

<table>
<thead>
<tr>
<th>Cognitive test</th>
<th>Self-reported information</th>
</tr>
</thead>
<tbody>
<tr>
<td>• A test of « global and intercultural understanding » that covers the cognitive components of global competence (e.g. critical reasoning with evidence, perspective taking)</td>
<td>• Self-reported data from students on the other components of global competence (e.g. openness, adaptability), and self-reported data from principals and teachers on activities related to global and intercultural education</td>
</tr>
</tbody>
</table>
Average school systems | High performers in PISA

Some students learn at high levels | All students learn at high levels

Uniformity | Embracing diversity

Curriculum-centred | Learner-centred

Learning a place | Learning an activity

Prescription | Informed profession

Delivered wisdom | User-generated wisdom
Thank you

Find out more about our work at www.oecd.org/pisa
– All publications
– The complete micro-level database

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Wechat: AndreasSchleicher