Excellence and equity

Andreas Schleicher
Director for Education and Skills
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
“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

OECD average

Student performance

2006 2009 2012 2015
Trends in science performance

OECD average
Science performance and equity in PISA (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

High performance
High equity

Low performance
High equity

Hong Kong (China)

Macao (China)

Italy

Ireland

Japan

Latvia

Korea

Lithuania

Spain

Slovenia

Slovak Rep.

Sweden

Switzerland

Thailand

Turkey

United Kingdom

United States

Ukraine

Uruguay

Venezuela

Vietnam

Please note: The diagram shows the relationship between science performance and equity in PISA (2006-2015) for various countries. The x-axis represents the percentage of performance variation explained by ESCS, while the y-axis represents mean science performance. Countries are plotted on the graph according to their performance and equity levels.

Some countries improved performance

Mean science performance

Percentage of performance variation explained by ESCS

High performance
Low equity

Higher performance

Low performance
Low equity

More equity

High performance
High equity

Low performance
High equity

Portugal

Norway

Romania

Colombia

Some countries improved performance

Some countries improved equity

Mean science performance

Percentage of performance variation explained by ESCS

High performance
Low equity

Higher performance
High equity

Low performance
Low equity

Brazil
Bulgaria
Chile
Mexico
Montenegro
Slovenia
Thailand
United States

Higher performance

Low performance

Low equity

High equity

Low performance

High equity
Greater equity
PISA-based test for schools
You will find more information on these flyers, or at www.pisa4you.org.
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

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%

United States (8.5%); 300k
Japan (15.3%); 174k
B-S-J-G (China) (13.6%); 181k
United Kingdom (10.9%); 68k
Vietnam (8.3%); 72k
Germany (10.6%); 79k
Korea (10.6%); 60k
Canada (12.4%); 41k
France (8.0%); 59k
Russia (3.7%); 42k
Brazil (0.7%)
Belgium (9.0%)
Finland (14.3%)
Switzerland (9.8%)
Spain (5.0%)
Singapore (24.2%)
Netherlands (11.1%)
Poland (7.3%)
Australia (11.2%)
Chinese Taipei (15.4%)
39k
Italy (4.1%)
New Zealand (12.8%)
Israel (5.9%)
Portugal (7.4%)
Sweden (8.5%)
Others

Figure I.2.18
Science and careers
Expectations of a science career by gender

Figure I.3.5

- Science and engineering professionals
  - Boys in the United States: 10%
  - Girls in the United States: 5%
  - Boys in the OECD average: 15%
  - Girls in the OECD average: 7%

- Health professionals
  - Boys in the United States: 15%
  - Girls in the United States: 10%
  - Boys in the OECD average: 20%
  - Girls in the OECD average: 15%

- Information and communication technology (ICT) professionals
  - Boys in the United States: 5%
  - Girls in the United States: 1%
  - Boys in the OECD average: 7%
  - Girls in the OECD average: 1%

- Science-related technicians or associate professionals
  - Boys in the United States: 2%
  - Girls in the United States: 1%
  - Boys in the OECD average: 3%
  - Girls in the OECD average: 1%
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

Figure I.3.2
Students expecting a career in science
by performance and enjoyment of learning

![Graph showing the relationship between score points in science and the percentage of students expecting a career in science. The graph categorizes students by performance and enjoyment of science: Low enjoyment of science, Moderate enjoyment of science, and High enjoyment of science. The graph indicates a trend where students with higher performance in science are more likely to expect a career in science, particularly those with high enjoyment of science.](Figure I.3.17)
## Students’ enjoyment of learning science

The table below shows the percentage of students who reported that they "agree" or "strongly agree" with the following statements:

<table>
<thead>
<tr>
<th>Statement</th>
<th>OECD average</th>
<th>United States</th>
</tr>
</thead>
<tbody>
<tr>
<td>I enjoy acquiring new knowledge in broad science</td>
<td>68%</td>
<td>72%</td>
</tr>
<tr>
<td>I am interested in learning about broad science</td>
<td>68%</td>
<td>72%</td>
</tr>
<tr>
<td>I generally have fun when I am learning broad science topics</td>
<td>61%</td>
<td>68%</td>
</tr>
<tr>
<td>I am happy working on broad science topics</td>
<td>61%</td>
<td>68%</td>
</tr>
<tr>
<td>I like reading about broad science</td>
<td>64%</td>
<td>67%</td>
</tr>
</tbody>
</table>

Figure I.3.9
Multiple outcomes

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
- Sweden
- Lithuania
- Croatia
- Iceland
- Georgia
- Malta

Above-average percentage of students expecting to work in a science-related occupation
- Norway
- Switzerland
- Belgium
- Poland
- Austria
- Colombia
- Costa Rica
- Dominican Republic
- Jordan
- Kosovo
- Lebanon
- Mexico
- Peru
- Qatar
- Trinidad and Tobago
- Tunisia
- Turkey
- Uruguay

- United States
- Spain
- Israel
- United Arab Emirates
- Brazil
- Bulgaria
- Chile
- Colombia
- Georgian
- Kosovo
- Lebanon
- Mexico
- Peru
- Tunisia
- Turkey
- Uruguay
Lessons from PISA

Low impact on outcomes

High impact on outcomes

Low feasibility

High feasibility

Must haves

Quick wins

Money pits

Low hanging fruits
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
Academic and social inclusion across schools

Figure II.5.12
Lessons from PISA

High impact on outcomes

- Must haves
  - Commitment to universal achievement

Low feasibility

- Capacity at point of delivery
- Coherence

Low impact on outcomes

- Money pits

Quick wins

- Resources where they yield most
  - 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

Gateways, instructional systems

- Low hanging fruits

Effective spending choices that prioritise high quality teachers over smaller classes.
Spending per student from the age of 6 to 15 and science performance

Figure II.6.2

Science performance (score points)

Average spending per student from the age of 6 to 15 (in thousands USD, PPP)
Equity in allocation of material and human resources

Based on Figure II.6.4

Principals in disadvantaged schools more concerned about the material resources

Principals in advantaged schools more concerned about the material resources

OECD average

Equity in resource allocation

PISA science score

R² = 0.31
Variation in science performance between and within schools

Between-school variation
Within-school variation

Total variation as a proportion of the OECD average 69%

OECD average 69%
OECD average 30%

Figure I.6.11
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
Student performance in science by immigrant background

Figure I.7.4

Score points

- Non-immigrant students
- Second-generation immigrant students
- First-generation immigrant students

Countries:
- Greece
- Costa Rica
- Jordan
- Israel
- Sweden
- France
- Slovenia
- Austria
- Germany
- Netherlands
- Denmark
- Italy
- Norway
- Belgium
- OECD average
- Spain
- Croatia
- United States
- Luxembourg
- Switzerland
- Qatar
- Portugal
- Russia
- United Arab Emirates
- United Kingdom
- Ireland
- Australia
- Estonia
- Hong Kong (China)
- New Zealand
- Canada
- Macao (China)
- Singapore

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

Figure I.7.3
Figure I.7.8: 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

Table II.6.51

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

Disadvantaged schools
Advantaged schools

OECD average
Lessons from PISA

- High impact on outcomes
- Low impact on outcomes

- High feasibility
- Low feasibility

- Capacity at point of delivery
  - Must have: Commitment to universal achievement
  - Quick wins: Gateways, instructional systems
  - Low hanging fruits: Money pits
  - High hanging fruits: Incentive structures and accountability

- 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...
Student-teacher ratios and class size

Figure II.6.14

High student-teacher ratios and small class sizes

Low student-teacher ratios and large class sizes
Lessons from PISA

High impact on outcomes

Quick wins
- Commitment to universal achievement
- Resources where they yield most
- Incentive structures and accountability
- A learning system

Gateways, instructional systems
- Coherence
- Capacity at point of delivery

Low hanging fruits

Low feasibility

Must haves
- Money pits
- Must haves

Must haves
- Money pits
- Must haves

Low impact on outcomes

- Clear ambitious goals that are shared across the system and aligned with high stakes gateways and instructional systems
  - Well established delivery chain through which curricular goals translate into instructional systems, instructional practices and student learning (intended, implemented and achieved)
  - High level of metacognitive content of instruction
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

$R^2 = 0.21$
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
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.
Balancing curricula
Governance, incentives, accountability, knowledge management

- Aligned incentive structures
  - For students
    - How gateways affect the strength, direction, clarity and nature of the incentives operating on students at each stage of their education
    - Degree to which students have incentives to take tough courses and study hard
    - Opportunity costs for staying in school and performing well
  - For teachers
    - Make innovations in pedagogy and/or organisation
    - Improve their own performance and the performance of their colleagues
    - Pursue professional development opportunities that lead to stronger pedagogical practices

- A balance between vertical and lateral accountability
- Effective instruments to manage and share knowledge and spread innovation – communication within the system and with stakeholders around it
- A capable centre with authority and legitimacy to act
Governance

Across the OECD, 70% of students attend schools whose principals have considerable responsibility for hiring teachers, and in half the cases also over budget allocations within the school.
Index of school autonomy
by schools’ socio-economic status

Figure II.4.7

Advantaged schools have more school autonomy

Disadvantaged schools have more school autonomy

Percentage-point difference between advantaged and disadvantaged schools

Index of school autonomy (%)
Index of school autonomy by schools’ socio-economic status

Figure II.4.7

Advantaged schools have more school autonomy

Disadvantaged schools have more school autonomy
Parental involvement in school-related activities
by schools’ socio-economic status

Figure II.3.15

Parents of students in advantaged schools are more involved in school-related activities.

Parents of students in advantaged schools are less involved in school-related activities.
Correlations between the responsibilities for school governance and science performance

Figure II.4.8

Students score lower in science when the school governing board holds more responsibility for admissions policies.
Correlations between the responsibilities for school governance and science performance by tracking achievement data over time

**Students score higher in science when the principal holds more responsibility for school admission policies, but only in countries where achievement data are tracked by an authority more extensively than the OECD average.**

**Education systems where the percentage of students whose achievement data are tracked over time by an administrative authority is:**
# School competition and science performance

Score-point difference in science when parents reported that there is at least one other school competing in the area

<table>
<thead>
<tr>
<th>Country</th>
<th>Score-point difference in science</th>
<th>After accounting for students' and schools' socio-economic profile</th>
<th>Before accounting for students' and schools' socio-economic profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hong Kong (China)</td>
<td>28</td>
<td>10</td>
<td>38</td>
</tr>
<tr>
<td>Italy</td>
<td>12</td>
<td>7</td>
<td>19</td>
</tr>
<tr>
<td>Macao (China)</td>
<td>10</td>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td>France</td>
<td>8</td>
<td>5</td>
<td>13</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>8</td>
<td>5</td>
<td>13</td>
</tr>
<tr>
<td>Mexico</td>
<td>8</td>
<td>5</td>
<td>13</td>
</tr>
<tr>
<td>Portugal</td>
<td>8</td>
<td>5</td>
<td>13</td>
</tr>
<tr>
<td>Germany</td>
<td>8</td>
<td>5</td>
<td>13</td>
</tr>
<tr>
<td>Spain</td>
<td>8</td>
<td>5</td>
<td>13</td>
</tr>
<tr>
<td>OECD average</td>
<td>8</td>
<td>5</td>
<td>13</td>
</tr>
<tr>
<td>Ireland</td>
<td>7</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>Malta</td>
<td>6</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>Korea</td>
<td>6</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>Georgia</td>
<td>6</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>Croatia</td>
<td>6</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>Chile</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Dominican Rep.</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Scotland (UK)</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
</tbody>
</table>
Public and private schools

Across OECD countries, 84% of students attend public schools, 12% government-dependent private schools and 4% independent private schools

PISA generally observes no systematic net performance differences
Science performance in public and private schools

Figure II.4.14

Students in public schools perform better

Students in private schools perform better

Score-point difference

After accounting for socio-economic status

Before accounting for socio-economic status

Science performance in public and private schools
Low expenses as a reason for choosing school by schools’ socio-economic status

Figure II.4.17

Difference between advantaged and disadvantaged schools

Percentage of parents who consider schools' low expenses "important" or "very important"

Low expenses are more important for parents whose children attend disadvantaged schools.
School low expenses as a reason for choosing school and students’ science performance

After accounting for socio-economic status

Before accounting for socio-economic status

Students whose parents consider schools' low expenses "important" or "very important perform lower

Figure II.4.17
School reputation as a reason for choosing school by schools’ socio-economic status

School reputation is more important for parents whose children attend advantaged schools.
School reputation as a reason for choosing school and students’ science performance

After accounting for socio-economic status

Before accounting for socio-economic status

Students whose parents consider school reputation "important" or "very important" perform better
Student assessments and teacher appraisals are widely used

In five out of six school systems, students are assessed at least once a year with mandatory standardised tests. 81% of students are in schools where tests and principal or senior staff observations of lessons are used to monitor teacher practice.
Frequency of mandatory standardised tests at school

Percentage of students in schools where mandatory standardised tests are used:

- Never
- 1-2 times a year
- 3-5 times a year
- Monthly
- More than once a month

Figure II.4.21
Lessons from PISA

High impact on outcomes

Must haves
Commitment to universal achievement

Quick wins
Resources where they yield most

Incentive structures and accountability

Gateways, instructional systems

Low hanging fruits

Low impact on outcomes

Capacity
at point of delivery

A learning system

Coherence

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)

Money pits

Must haves

Low feasibility

High feasibility
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

Email: Andreas.Schleicher@OECD.org
Twitter: SchleicherOECD
Wechat: AndreasSchleicher