PISA 2012
Strong performers and successful reformers in education

Andreas Schleicher
Brazil, 6 December 2013
• Over half a million students...
  – representing 28 million 15-year-olds in 65 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
  – Mathematics, reading, science, problem-solving, financial literacy
  – Total of 390 minutes of assessment material

... and responded to questions on...
  – their personal background, their schools and their engagement with learning and school

• Parents, principals and system leaders provided data on...
  – school policies, practices, resources and institutional factors that help explain performance differences.
What do 15-year-olds know...
...and what can they do with what they know?

No country improved learning outcomes faster than Brazil...
...but Brazil still has a long way to go
Change in performance between PISA 2003 and 2012

- **PISA 2003 performance below the OECD average**
  - Brazil
  - Mexico
  - Tunisia
  - Turkey
  - Portugal
  - Poland
  - Russian Fed.
  - United States
  - Latvia
  - Spain
  - Norway
  - Luxembourg
  - Ireland
  - Austria
  - Switzerland

- **PISA 2003 performance above the OECD average**
  - Germany
  - Hong Kong-China
  - Macao-China
  - Korea
  - Austria
  - Switzerland
  - Japan
  - Liechtenstein
  - Germany
  - Sweden
  - France
  - Canada
  - Netherlands
  - Belgium
  - Australia
  - New Zealand
  - Finland

**Fig I.2.18**

- **Average annual mathematics score change**
  - Improving performance
  - Deteriorating performance

- **Average mathematics performance in PISA 2003**
The Brazilian miracle

- No country improved enrolment faster
  - 15-year-olds enrolled
    - 2003: 65%
    - 2012: 78%

- No country saw steeper performance gains since 2003
  - 35 score points on the mathematics scale observed
  - 44 score points adjusting for the ‘drag’ from newly enrolled students

- With that pace Brazil will catch up with the United States in 18 years and the OECD average in 21 years.
Performance of countries in a level playing field

How the world would look if students around the world were living in similar social and economic conditions
US would rank lower in a level playing field:
- Ranks 3rd in wealth per person (explains 12%)
- Ranks 5th in spending per student
- Has average share of disadvantaged students
- Ranks 6th in parental attainment
- Has 6th largest share of immigrant students (explains 4%)
The dream of social mobility

In some countries it is close to a reality
A resilient student is situated in the bottom quarter of the PISA index of economic, social and cultural status (ESCS) in the country of assessment and performs in the top quarter of students among all countries, after accounting for socio-economic status.

Socio-economically disadvantaged students not only score lower in mathematics, they also report lower levels of engagement, drive, motivation and self-beliefs. Resilient students break this link and share many characteristics of advantaged high-achievers.
Social background and school performance - Brazil

- Private school
- Public school in rural area
- Public school in urban area

Score

PISA index of social, economic and cultural status
Differences in mathematics performance between private and public schools shrink considerably after accounting for socio-economic status

Score-point difference

Performance advantage of public schools

Performance advantage of private schools

Fig IV.1.19
Educational resources are more problematic in disadvantaged schools in most countries

Difference between socio-economically disadvantaged and socio-economically advantaged schools

Disadvantaged and public schools reported better educational resources

Advantaged and private schools reported better educational resources
Math teaching ≠ math teaching

PISA = reason mathematically and understand, formulate, employ and interpret mathematical concepts, facts and procedures
Focus on conceptual understanding

Index of exposure to formal mathematics
Students' exposure to applied mathematics

Index of exposure to applied mathematics

Fig I.3.1c
Relationship between mathematics performance and students' exposure to applied mathematics

Mean score in mathematics

Index of exposure to applied mathematics

- Never
- Rarely
- Sometimes
- Frequently

OECD countries
All participating countries and economies

Fig I.3.2
Lessons from high performers

Catching up with the top-performers

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

High impact on outcomes

Low feasibility → High feasibility

Low impact on outcomes
Lessons from high performers

High impact on outcomes

- Quick wins
  - Resources where they yield most
  - Gateways, instructional systems
  - Incentive structures and accountability

Low impact on outcomes

- Money pits
  - Low hanging fruits

Must haves

- Commitment to universal achievement
- Capacity at point of delivery
- Coherence

High feasibility

- A learning system
- Resources where they yield most
- Gateways, instructional systems
- Incentive structures and accountability

Low feasibility

- Money pits
- Low hanging fruits
- Quick wins
- Quick wins
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 heterogeneity in the student body...
  ...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
Countries where students have stronger beliefs in their abilities perform better in mathematics

Fig III.4.5

Mean mathematics performance

Mean index of mathematics self-efficacy

R² = 0.36
Perceived self-responsibility for failure in mathematics

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

- Sometimes I am just unlucky
- The teacher did not get students interested in the material
- Sometimes the course material is too hard
- This week I made bad guesses on the quiz
- My teacher did not explain the concepts well this week
- I’m not very good at solving mathematics problems
The parent factor

Students whose parents have high educational expectations for them tend to report more perseverance, greater intrinsic motivation to learn mathematics, and more confidence in their own ability to solve mathematics problems than students of similar background and academic performance, whose parents hold less ambitious expectations for them.
Parents’ expectations for their child have a strong influence on students’ behaviour towards school.

Percentage-point change in arriving late for school that is associated with parents expecting the child to complete a university degree.

Fig III.6.11
Parents’ high expectations can nurture students’ enjoyment in learning mathematics.

Change in the index of intrinsic motivation to learn mathematics that is associated with parents expecting the child to complete a university degree.

Mean index change

- Belgium (Flemish)
- Korea
- Italy
- Hong Kong-China
- Chile
- Portugal
- Hungary
- Croatia
- Macao-China
- Mexico
- Germany

Fig III.6.11
Lessons from high performers

- High impact on outcomes
  - Must haves
    - Commitment to universal achievement
  - Quick wins

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

Incentive structures and accountability

Capacity at point of delivery

Coherence

- 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 ...
Grade repetition is negatively related to equity

Variation in mathematics performance explained by socio-economic status (%)

Greater equity

Less equity

Percentage of students who have repeated at least one grade

Adjusted by per capita GDP

R²=0.05

R²=0.07

Fig IV.1.4
Grade repetition is an expensive policy

USD, PPPs

- Total cost per repeater (one grade year)
- Total annual cost, relative to total expenditure on primary and secondary education (%)
Lessons from high performers

Capacity at the 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
Teacher shortage

Mean index

Luxembourg
Jordan
Thailand
Turkey
Shanghai-China
Israel
Colombia
Peru
Chile
Netherlands
Mexico
Germany
Viet Nam
Russian Fed.
Uruguay
Norway
Kazakhstan
Indonesia
Belgium
Italy
Malaysia
Brazil
Australia
Iceland
U.A.E.
Singapore
New Zealand
Korea
Switzerland
Estonia
Costa Rica
OECD average
Sweden
Argentina
Austria
Qatar
Ireland
France
Denmark
United Kingdom
Hong Kong-China
Albania
Japan
Canada
Slovak Republic
Latvia
Greece
United States
Czech Republic
Croatia
Finland
Montenegro
Romania
Hungary
Lithuania
Slovenia
Spain
Sweden
Poland

Mean index

Top quarter of this index

Bottom quarter of this index

Fig IV.3.5
Adequacy of educational resources

Fig IV.3.8
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
Countries that grant schools autonomy over curricula and assessments tend to perform better in mathematics.
Schools with more autonomy perform better than schools with less autonomy in systems with more collaboration.

School autonomy for resource allocation $\times$ System's level of teachers participating in school management

Across all participating countries and economies.

![Bar chart showing score points with less school autonomy vs. more school autonomy for resource allocation and system's level of teachers participating in school management. Teachers participate in management and teachers don't participate in management are compared.]
Schools with more autonomy perform better than schools with less autonomy in systems with more accountability arrangements.

School autonomy for curriculum and assessment x system's level of posting achievement data publicly.
Schools with more autonomy perform better than schools with less autonomy in systems with standardised math policies.

School autonomy for curriculum and assessment $\times$ system’s extent of implementing a standardised math policy (e.g. curriculum and instructional materials)

![Graph showing the relationship between school autonomy and score points in systems with standardised math policies.](image-url)
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
Money makes a difference...

...but only up to a point
Spending per student from the age of 6 to 15 and mathematics performance in PISA 2012

**Fig IV.1.8**

- **Cumulative expenditure per student less than USD 50 000**
- **Cumulative expenditure per student USD 50 000 or more**

Mathematics performance (score points) vs. Average spending per student from the age of 6 to 15 (USD, PPPs)

- Countries plotted: 
  - Austria
  - Belgium
  - Brazil
  - Bulgaria
  - Chile
  - Colombia
  - Croatia
  - Czech Republic
  - Denmark
  - Estonia
  - Finland
  - France
  - Germany
  - Greece
  - Hungary
  - Iceland
  - India
  - Ireland
  - Israel
  - Italy
  - Japan
  - Korea
  - Latvia
  - Lithuania
  - Luxembourg
  - Malaysia
  - Mexico
  - Montenegro
  - Morocco
  - Netherlands
  - New Zealand
  - Norway
  - Poland
  - Portugal
  - Republic of Korea
  - Singapore
  - Slovak Republic
  - Slovenia
  - Spain
  - Sweden
  - Switzerland
  - Thailand
  - Turkey
  - United Kingdom
  - United States

Correlation coefficients:
- \( R^2 = 0.01 \)
- \( R^2 = 0.37 \)
Countries with better performance in mathematics tend to allocate educational resources more equitably

Mathematics performance (score points) vs. Equity in resource allocation (index points)

Adjusted by per capita GDP

R² = 0.19

Countries: Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, Colombia, Costa Rica, Croatia, Denmark, Estonia, Finland, France, Germany, Ghana, Greece, Hungary, Iceland, Indonesia, Ireland, Israel, Italy, Japan, Jordan, Korea, Latvia, Luxembourg, Malaysia, Mexico, Montenegro, Morocco, Norway, Peru, Poland, Portugal, Qatar, Romania, Rwanda, Singapore, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Arab Emirates, United Kingdom, United States, Uruguay, Vietnam, Venezuela, Zambia, Zimbabwe.
Difference in mathematics performance, by attendance at pre-primary school

Students who attended pre-primary school perform better
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)
Lessons from high performers

- High impact on outcomes
  - Must haves
    - Commitment to universal achievement
  - Quick wins
    - Resources where they yield most
    - Gateways, instructional systems
    - A learning system
    - Incentive structures and accountability
  - Low hanging fruits
  - Money pits

- Low impact on outcomes
  - Low feasibility
    - Capacity at point of delivery
    - Coherence
  - High feasibility
    - Resources where they yield most
    - Gateways, instructional systems
    - A learning system
    - Incentive structures and accountability

Capacity at point of delivery
Commitment to universal achievement
Money pits
Lessons from high performers

What it all means

The old bureaucratic system

Student inclusion

 Routine cognitive skills, rote learning

Curriculum, instruction and assessment

 Few years more than secondary

Teacher quality

 ‘Tayloristic’, hierarchical

Work organisation

Primarily to authorities

Accountability

The modern enabling system

All students need to learn at high levels

Learning to learn, complex ways of thinking, ways of working

High-level professional knowledge workers

Flat, collegial

Primarily to peers and stakeholders
Find out more about PISA at www.pisa.oecd.org
  • All national and international publications
  • The complete micro-level database

Email: Andreas.Schleicher@OECD.org
Twitter: SchleicherEDU

and remember:
Without data, you are just another person with an opinion
Do you have an idea on how to use this data to improve education in your country?

Would you like to work with us to develop that idea?

Apply to the Thomas J. Alexander fellowship programme!

http://www.oecd.org/edu/thomasjalexanderfellowship.htm