How the U.S. and Other Countries Compare: Lessons Learned International Data

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Increased likelihood of positive outcomes among adults with higher literacy skills (scoring at Level 4/5 compared with those scoring at Level 1 or below)

<table>
<thead>
<tr>
<th>Being Employed</th>
<th>High wages</th>
<th>Good to excellent health</th>
<th>Participation in volunteer activities</th>
<th>High levels of political efficacy</th>
<th>High levels of trust</th>
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<tbody>
<tr>
<td>Odds ratio</td>
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<td>United States</td>
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</table>
PISA in brief

• 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.
Mean score ... Shanghai-China performs above this line (613)

High mathematics performance

Average performance of 15-year-olds in Mathematics (PISA)

Fig I.2.13

Massachusetts

26% of American 15-year-olds do not reach PISA Level 2
(OECD average 23%, Shanghai 4%, Japan 11%, Canada 14%)
Low mathematics performance

- Iran*
- Costa Rica
- Uruguay
- Montenegro
- Bahrain*
- Georgia*
- Brazil
- Argentina
- Jordan
- Algeria
- Tunisia
- Macedonia
- Colombia
- Qatar
- Indonesia
- Botswana*
- Oman*
- Morocco*
- Honduras*
- South Africa*
- Ghana*

* Substituted from TIMSS
High mathematics performance

Average performance of 15-year-olds in mathematics

Low mathematics performance

Strong socio-economic impact on student performance

Socially equitable distribution of learning opportunities

Singapore
Hong Kong-China
Korea
Macao-China
Japan
Liechtenstein
Switzerland
Netherlands
Estonia
Finland
Canada
Viet Nam
Singapore
Hong Kong-China
Korea
Macao-China
Japan
Liechtenstein
Switzerland
Netherlands
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Canada
Viet Nam
Strong socio-economic impact on student performance

Massachusetts

Low mathematics performance

High mathematics performance

Socially equitable distribution of learning opportunities

Australia
Austria
Belgium
Canada
Chile
Czech Rep.
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Iceland
Ireland
Israel
Italy
Japan
Korea
Luxembourg
Mexico
Netherlands
New Zealand
Norway
Poland
Portugal
Slovak Rep.
Slovenia
Spain
Sweden
Switzerland
Turkey
UK
US
Singapore
Hong Kong-China
Macao-China
Massachusetts
Chinese Taipei
Korea
Japan
Estonia
Canada
Finland
Japan
Liechtenstein
China
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Singapore
Massachusetts
Strong socio-economic impact on student performance

Low mathematics performance

High mathematics performance

Socially equitable distribution of learning opportunities
Strong socio-economic impact on student performance

Low mathematics performance

Socially equitable distribution of learning opportunities

High mathematics performance

2012
High mathematics performance

Strong socio-economic impact on student performance

Socially equitable distribution of learning opportunities

Low mathematics performance
Contribution of various factors to upper secondary teacher compensation costs, per student as a percentage of GDP per capita (2004)

Salary as % of GDP/capita  Instruction time  1/teaching time  1/class size

Difference with OECD average

Percentage points

1/teaching time

Instruction time

1/class size

-10  -5  0  5  10  15

Portugal  Spain  Switzerland  Belgium  Korea  Luxembourg  Germany  Greece  Japan  Australia  United Kingdom  New Zealand  France  Netherlands  Denmark  Italy  Austria  Czech Republic  Hungary  Norway  Iceland  Ireland  Mexico  Finland  Sweden  United States  Poland  Slovak Republic
Behavioural issues equate to lower job satisfaction, class size doesn’t

Teachers' job satisfaction level following the number of students in the classroom in relation to the percentage of students with behavioural problems.
Strong socio-economic impact on student performance

Low mathematics performance

High mathematics performance

Socially equitable distribution of learning opportunities
Strong socio-economic impact on student performance

Socially equitable distribution of learning opportunities

Low mathematics performance

High mathematics performance

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Italy
Japan
Korea
Luxembourg
Mexico
Netherlands
New Zealand
Norway
Poland
Portugal
Slovak Rep.
Slovenia
Spain
Sweden
Switzerland
Turkey
UK
US

Singapore
Shanghai

2003 - 2012
It’s not just about poor kids in poor neighborhoods but about many kids in many neighborhoods.

The country where students go to class matters more than what social class students come from.
PISA mathematics performance by decile of social background

Source: PISA 2012
The percentage of students with a value of ESCS lower than -1 is presented alongside the percentage of students from disadvantaged backgrounds. The size of the bullets represents the impact of social background on student performance. The graph includes data from various countries, such as Brazil, Mexico, Portugal, Malaysia, United States, and others, indicating the variation in social background impact across different regions.
Across OECD, 13% of students are top performers (Level 5 or 6). They can develop and work with models for complex situations, and work strategically with advanced thinking and reasoning skills.
Why care about advanced skills?

Evolution of employment in occupational groups defined by PIAAC problem-solving skills

- Employment of workers with advanced problem-solving skills
- Employment of workers with poor problem-solving skills
- Employment of workers with medium-low problem-solving skills (PIAAC)

Source: PIAAC 2011
Math teaching ≠ math teaching

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

Formal math situated in a word problem, where it is *obvious* to students what mathematical knowledge and skills are needed.
Index of exposure to formal mathematics

Focus on conceptual understanding

Fig I.3.1b
Lessons from high performers

Catching up with the top performers

- High impact on outcomes
- Low impact on outcomes
- High feasibility
- Low feasibility

- Must haves
- Quick wins
- Money pits
- Low hanging fruits
Lessons from high performers

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

Mean mathematics performance vs. 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

Fig III.3.6
Greater self-efficacy among girls could shrink the gender gap in mathematics performance, particularly among the highest-performing students.

Gender gap among the highest-achieving students (90th percentile)

- Boys do better
- Girls do better

Greater self-efficacy among girls could shrink the gender gap in mathematics performance, particularly among the highest-performing students.
Percentage of girls and boys who intend to take additional mathematics, rather than language, courses after they leave school.
Lessons from high performers

- 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 ...
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...
Developing Teaching as a profession

Recruit top candidates into the profession

Improve the societal view of teaching as a profession

Retain and recognise effective teachers – path for growth

Support teachers in continued development of practice

Capacity at the point of delivery
Teachers' perceptions of the value of teaching

Percentage of lower secondary teachers who "agree" or "strongly agree" that teaching profession is a valued profession in society
Countries where teachers believe their profession is valued show higher levels of student achievement

Relationship between lower secondary teachers' views on the value of their profession in society and the country's share of top mathematics performers in PISA 2012

Share of mathematics top performers vs. Percentage of teachers who agree that teaching is valued in society

R² = 0.24  r = 0.49
Teacher skills and graduate skills (numeracy)

Middle half of the numeracy skill distribution of graduates (16-65 years)
Teacher skills and graduate skills (numeracy)

Middle half of the numeracy skill distribution of graduates (16-65 years)

Numeracy skills of teachers
### Teachers Self-Efficacy and Professional Collaboration

#### Graph Description:
- **X-axis:** Frequency of professional collaboration activities.
- **Y-axis:** Teacher self-efficacy level.

#### Activity Categories and Frequency Levels:
- **Teach jointly as a team in the same class**
- **Observe other teachers’ classes and provide feedback**
- **Engage in joint activities across different classes**
- **Take part in collaborative professional learning**

#### Frequency Levels:
- Never
- Once a year or less
- 2-4 times a year
- 5-10 times a year
- 1-3 times a month
- Once a week or more

#### Data Points:
- **Teacher self-efficacy (level)**
Percentage of lower secondary teachers who report doing the following activities at least once per month:

- Discuss individual students
- Share resources
- Team conferences
- Collaborate for common standards

Percentage of teachers

- Exchange and co-ordination
- Professional collaboration

Average versus United States
Teachers' needs for professional development

Percentage of lower secondary teachers indicating they have a high level of need for professional development in the following areas:

- Teaching students with special needs
- ICT skills for teaching
- New technologies in the workplace
- Student behaviour and classroom management
- Teaching in a multicultural or multilingual setting
- Approaches to individualised learning
- Student career guidance and counselling
- Student evaluation and assessment practice
- Teaching cross-curricular skills
- Developing competencies for future work
- Pedagogical competencies
- School management and administration
- Knowledge of the subject field(s)
- Knowledge of the curriculum

The chart shows the percentage of teachers indicating a high level of need for professional development in these areas, with United States and Average comparisons.
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
Aligning autonomy with accountability
Countries that grant schools **autonomy** over curricula and assessments tend to perform better in mathematics.

Source: PISA 2012
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)

![Bar chart showing the relationship between school autonomy and score points. Schools with more autonomy have higher score points in systems with shared math policies.]
Schools with more autonomy perform better than schools with less autonomy in systems with more accountability arrangements.

![Graph showing school autonomy for curriculum and assessment vs. system's level of posting achievement data publicly.](image)
Schools with more autonomy perform better than schools with less autonomy in systems with more collaboration.

Fig IV.1.17: School autonomy for resource allocation x System's level of teachers participating in school management. Across all participating countries and economies.
Quality assurance and school improvement

Percentage of students in schools whose principal reported that their schools have the following for quality assurance and improvement:

- Implementation of a standardised policy for mathematics
- Regular consultation with one or more experts over a period of at least six months with the aim of improving...
- Teacher mentoring
- Written feedback from students (e.g. regarding lessons, teachers or resources)
- External evaluation
- Internal evaluation/self-evaluation
- Systematic recording of data, including teacher and student attendance and graduation rates, test results...
- Written specification of student-performance standards
- Written specification of the school's curriculum and educational goals

Fig IV.4.14

[Diagram showing percentage of students in Singapore and OECD average for each quality assurance and improvement measure.]
Lessons from high performers

- 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
Align the resources with the challenges

Countries with better performance in mathematics tend to allocate educational resources more equitably

Mathematics performance (score points)

Equity in resource allocation (index points)

Source: PISA 2012
Adequate resources to address disadvantage

A shortage of qualified teachers is more of concern in disadvantaged schools.

Disadvantaged schools reported more teacher shortage.

Advantaged schools reported more teacher shortage.
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

- Commitment to universal achievement
- Gateways, instructional systems
- A learning system
- Incentive structures and accountability
- Low hanging fruits

Low impact on outcomes

- Low feasibility
- Must haves
- Capacity at point of delivery
- Coherence
- Resources where they yield most
- Quick wins
- Money pits

Resources where they yield most

A learning system

Coherence

Capacity at point of delivery

Must haves

Commitment to universal achievement

Gateways, instructional systems

Incentive structures and accountability

Low hanging fruits

Money pits

Low feasibility

High feasibility
### What it all means

<table>
<thead>
<tr>
<th>The old bureaucratic system</th>
<th>Student inclusion</th>
<th>The modern enabling system</th>
</tr>
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<tbody>
<tr>
<td><strong>Some</strong> students learn at high levels</td>
<td><strong>All</strong> students need to learn at high levels</td>
<td></td>
</tr>
<tr>
<td>Routine cognitive skills</td>
<td>Curriculum, instruction and assessment</td>
<td>Conceptual understanding, complex ways of thinking, ways of working</td>
</tr>
<tr>
<td>Standardisation and compliance</td>
<td>Teacher quality</td>
<td>High-level professional knowledge workers</td>
</tr>
<tr>
<td>‘Tayloristic’, hierarchical</td>
<td>Work organisation</td>
<td>Flat, collegial</td>
</tr>
<tr>
<td>Primarily to authorities</td>
<td>Accountability</td>
<td>Primarily to peers and stakeholders</td>
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Thank you

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and remember:
Without data, you are just another person with an opinion