# Lessons from TIMSS and PIRLS

Researching education, improving learning

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www.iea.nl

# Content

- About IEA
- TIMSS and PIRLS studies
- TIMSS 2015 overview
- TIMSS 2019
- Study results
- Background factors
- Quality assessment – use of international studies
- Summary

# IEA today

- 69 member institutions all over the world
- High professional competence both in the IEA Data Processing and Research Center and the international study centers
- Studies are well regarded and participation in trend studies is high
- Country diversity is very high
- Only international actor on the primary school level with TIMSS and PIRLS

# IEA's mission

- Provide **international benchmarks** to identify relative strengths and weaknesses in education systems
- Provide **high-quality data** to the understanding of key factors that influence teaching and learning
- Provide **high-quality data** as a resource for identifying areas of concern and action, and for preparing and evaluating educational reforms
- **Develop and improve the capacity of education systems** to engage in national strategies for educational monitoring and improvement
- Contribute to the development of a **worldwide community of researchers** in educational evaluation

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# IEA studies

- IEA studies focus on the output of educational systems—that is, the educational achievements and attitudes of students after a fixed period of schooling, usually the fourth and eighth grades
- Studies are designed to understand the linkages between:
  - intended curriculum (what policy requires)
  - implemented curriculum (what is taught in schools)
  - achieved curriculum (what students learn)
- Studies cover a broad variety of skills and competencies: Reading literacy, mathematics and science, information and communication literacy, civic and citizenship

TIMSS 2015 PIRLS 2016 ICILS 2018 ICCS 2016 IEA

# Characteristics of IEA studies

- Grade based and classroom based assessments, main target populations in Grade 4 and Grade 8
- Curriculum based, assess content domains and cognitive domains (knowing, applying and reasoning)
- Combination of multiple choice and open ended questions
- Step wise introduction of computer-based assessments
- Background surveys for pupils, teachers, principals and parents
- Links teaching, learning environments, home background and learning outcomes
- Multiple matrix sampling – gives very precise results at the national level, but does not give individual results
- Trend studies – 4 and 5 year cycles

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Question
-naire

Question
-naire

Question
-naire

Test
booklet

Question
-naire

Achieve
-ment

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# What is PIRLS and TIMSS?

# PIRLS – Progress in International reading Literacy Study

- Assesses reading literacy after 4 years of schooling
- Measures abilities in two overarching purposes for reading
  - Reading for literary experience
  - Reading to acquire and use information
- Reports results on two scales:
  - Retrieving and straightforward inferencing
  - Interpreting, integrating, and evaluating
- PIRLS also collects background data on national curriculum policies in reading; how the education system is organized to facilitate learning; students' home environment for learning; school climate and resources; and how instruction actually occurs in classrooms

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# Additional PIRLS initiatives

- **PIRLS Literacy**
  - The PIRLS Literacy assessment is equivalent to PIRLS in scope
  - Purpose to extend the effective measurement of reading literacy at the lower end of the achievement scale.
  - Participants in the PIRLS Literacy assessment can have their results reported on the PIRLS achievement scale
- **ePIRLS**
  - ePIRLS is a computer-based reading assessment of students' ability to acquire and use information when reading online
  - The assessment encompasses an engaging, simulated internet environment with authentic school-like assignments about science and social studies topics
  - The ePIRLS online reading achievement scale enables countries to examine their fourth-graders' online reading performance relative to their performance on the PIRLS reading achievement scales.

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# Main findings from PIRLS 2011

- In general, fourth grade students demonstrated high achievement in reading.
- In nearly all of the countries and benchmarking participants, girls outperformed boys
- many top-performing countries had a relative strength in the interpreting, integrating, and evaluating reading comprehension skills
- A supportive home environment and an early start are crucial in shaping children's reading literacy
- Successful schools tend to be well-resourced

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# PIRLS 2011 main results

Highest performing countries

Most countries scored above the PIRLS Scale centerpoint.

Spain scored just above the Scale Centerpoint

Spanish students among the youngest in the assessment

**Exhibit 1.1: Distribution of Reading Achievement**

PIRLS 2011 4th Grade

| Country | Average Scale Score | Reading Achievement Distribution |
|---|---|---|
| 3 Hong Kong SAR | 571 (2.3) | ▲ |
| Russian Federation | 568 (2.7) | ▲ |
| Finland | 568 (1.9) | ▲ |
| 2 Singapore | 567 (3.3) | ▲ |
| † Northern Ireland | 558 (2.4) | ▲ |
| 2 United States | 556 (1.5) | ▲ |
| 2 Denmark | 554 (1.7) | ▲ |
| 2 Croatia | 553 (1.9) | ▲ |
| Chinese Taipei | 553 (1.9) | ▲ |
| Ireland | 552 (2.3) | ▲ |
| † England | 552 (2.6) | ▲ |
| 2 Canada | 548 (1.6) | ▲ |
| † Netherlands | 546 (1.9) | ▲ |
| Czech Republic | 545 (2.2) | ▲ |
| Sweden | 542 (2.1) | ▲ |
| Italy | 541 (2.2) | ▲ |
| Germany | 541 (2.2) | ▲ |
| 3 Israel | 541 (2.7) | ▲ |
| Portugal | 541 (2.6) | ▲ |
| Hungary | 539 (2.9) | ▲ |
| Slovak Republic | 535 (2.8) | ▲ |
| Bulgaria | 532 (4.1) | ▲ |
| New Zealand | 531 (1.9) | ▲ |
| Slovenia | 530 (2.0) | ▲ |
| Austria | 529 (2.0) | ▲ |
| 1 2 Lithuania | 528 (2.0) | ▲ |
| Australia | 527 (2.2) | ▲ |
| Poland | 526 (2.1) | ▲ |
| France | 520 (2.6) | ▲ |
| Spain | 513 (2.3) | ▲ |
| ‡ Norway | 507 (1.9) | ▲ |
| 2 † Belgium (French) | 506 (2.9) | ▲ |
| Romania | 502 (4.3) | |
| PIRLS Scale Centerpoint | 500 | |
| 1 Georgia | 488 (3.1) | ▼ |
| Malta | 477 (1.4) | ▼ |
| Trinidad and Tobago | 471 (3.8) | ▼ |
| 2 Azerbaijan | 462 (3.3) | ▼ |
| Iran, Islamic Rep. of | 457 (2.8) | ▼ |
| Colombia | 448 (4.1) | ▼ |
| United Arab Emirates | 439 (2.2) | ▼ |
| Saudi Arabia | 430 (4.4) | ▼ |
| Indonesia | 428 (4.2) | ▼ |
| 2 Qatar | 425 (3.5) | ▼ |
| Ψ Oman | 391 (2.8) | ▼ |
| Ж Morocco | 310 (3.9) | ▼ |

100 200 300 400 500 600 700 800

▲ Country average significantly higher than the centerpoint of the PIRLS scale

▼ Country average significantly lower than the centerpoint of the PIRLS scale

Percentiles of Performance
5th 25th 75th 95th
95% Confidence Interval for Average (±2SE)

SOURCE: IEA's Progress in International Reading Literacy Study – PIRLS 2011

# PIRLS 2016 launch

- 50 countries and 10 benchmarking entities participated in PIRLS 2016. Results will be launched in December 2017
- **The *PIRLS 2016 International Results in Reading*** report will provide
  - overall national achievement reports
  - trends in achievement
  - achievement at the PIRLS International Benchmarks
  - reports on home environment, school resources, school climate, school safety, teacher and principal preparation, classroom instruction, and student engagement and attitudes
- **The *ePIRLS 2016 International Results in Online Informational Reading*** report includes two chapters focusing on achievement results and a third chapter focusing on contextual factors and student navigation.

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# TIMSS – Trends in International Mathematics and Science Study

- TIMSS assesses mathematics and science achievement of grade 4 and grade 8 students, and also of grade 12 specialist-advanced students
- Quasi-longitudinal design, with the fourth grade student cohort assessed four years later at the eighth grade.
- Gathers rich background information from students, their mathematics and science teachers, principals, and grade 4 parents

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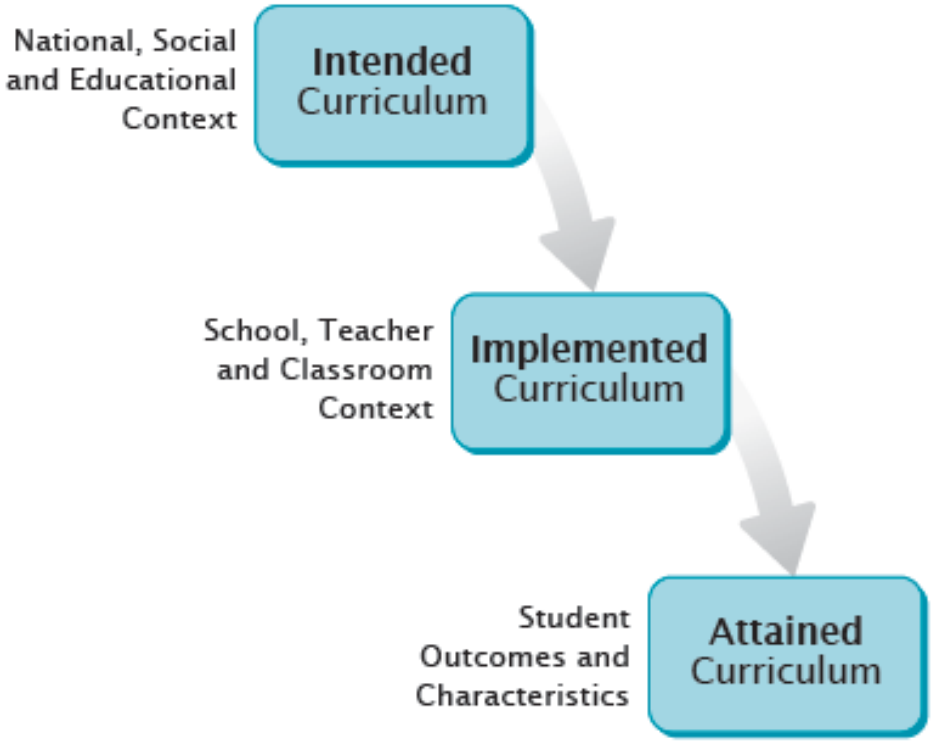
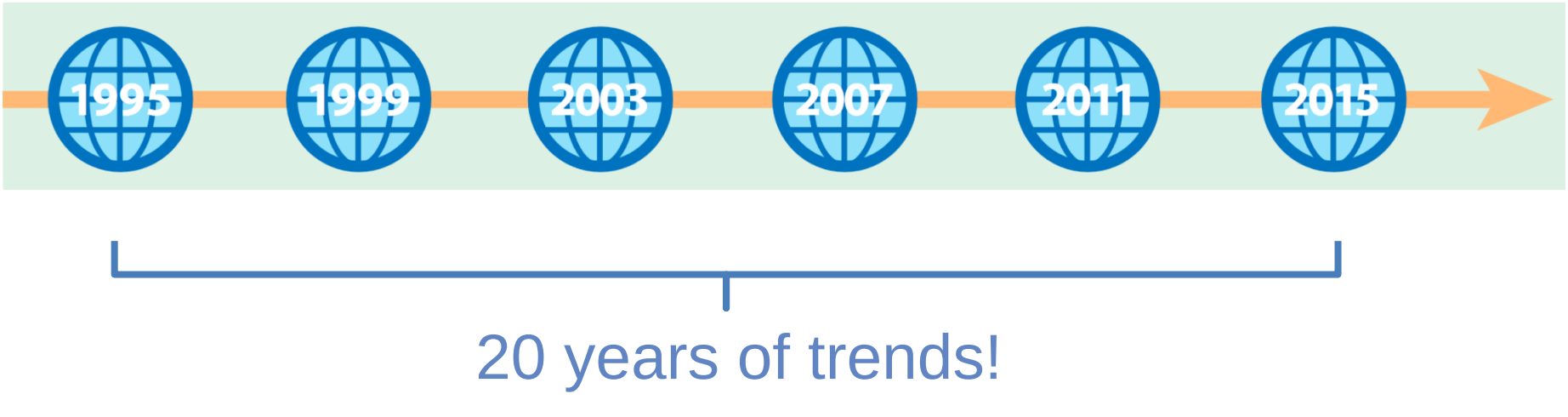
# What is TIMSS?

- The curriculum model ensures the relevance for policy makers and practitioners:



# TIMSS 2015 overview

- TIMSS has been conducted every 4 years since 1995
- In 2015 the 6th cycle was administered
- 20 years of trends can be investigated



# TIMSS 2015 overview

## 57 countries and 7 benchmark entities:

Armenia
Australia
Bahrain
Belgium (Flemish)
Botswana
Bulgaria
Canada
Chile
Chinese Taipei
Croatia
Cyprus
Czech Republic
Denmark
Egypt
England
Finland
France
Georgia
Germany
Hong Kong SAR
Hungary
Indonesia
Iran, Islamic Rp. of
Ireland
Israel
Italy
Japan
Jordan
Kazakhstan
Korea, Rep. of
Kuwait
Lebanon
Lithuania
Malaysia
Malta
Morocco
Netherlands
New Zealand
Northern Ireland
Norway
Oman
Poland
Portugal
Qatar
Russian Federation
Saudi Arabia
Serbia
Singapore
Slovak Republic
Slovenia
South Africa
Spain
Sweden
Thailand
United Arab Emirates
United States

**Benchmark entities**

Buenos Aires, Arg.
Ontario, Canada
Quebec, Canada
Abu Dhabi, UAE
Dubai, UAE
Florida, US

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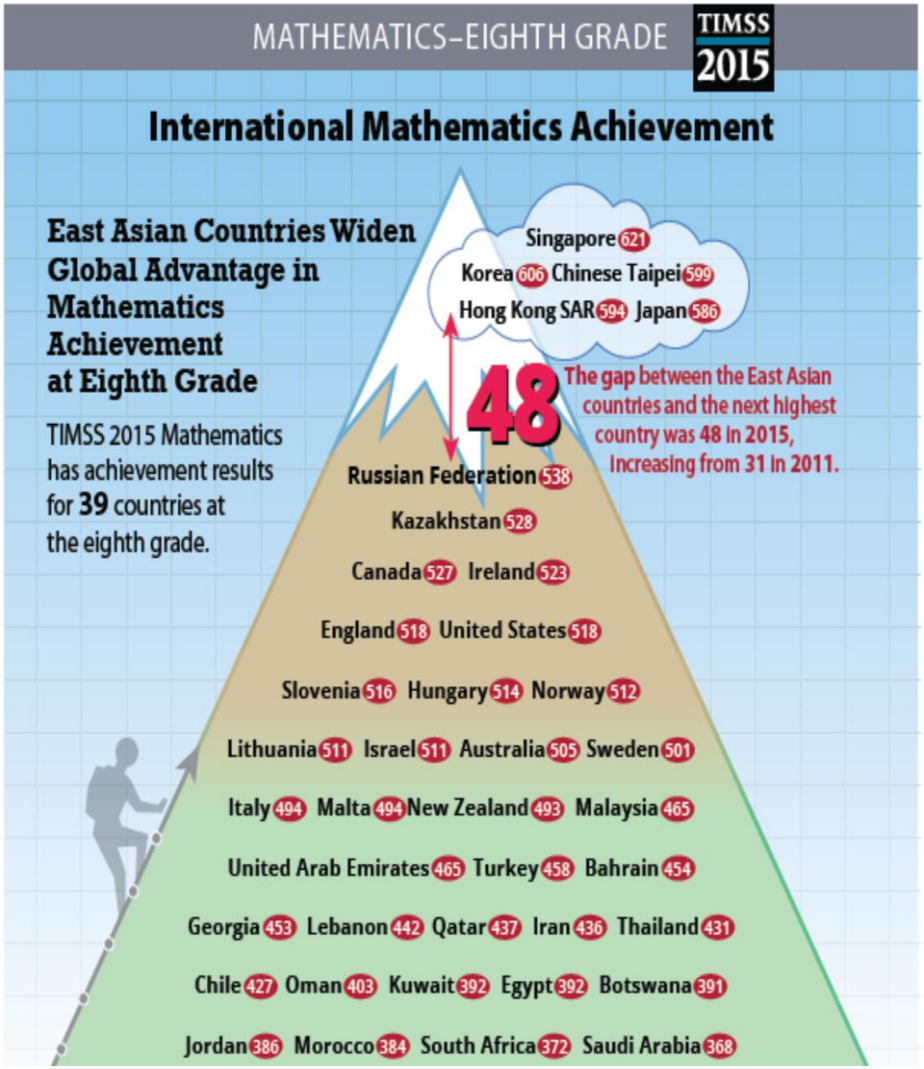
# Selected results

# Key results - mathematics

# Key results – science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# Trends in achievement

# Mathematics grade 4 – trends in 41 countries

**21 Countries Higher Average Achievement**

Bahrain, Chinese Taipei, Croatia, Czech Republic, Georgia, Hong Kong SAR, Hungary, Ireland, Japan, Kazakhstan, Morocco, Oman, Portugal, Qatar, Russian Federation, Singapore, Slovenia, Spain, Sweden, Turkey, United Arab Emirates

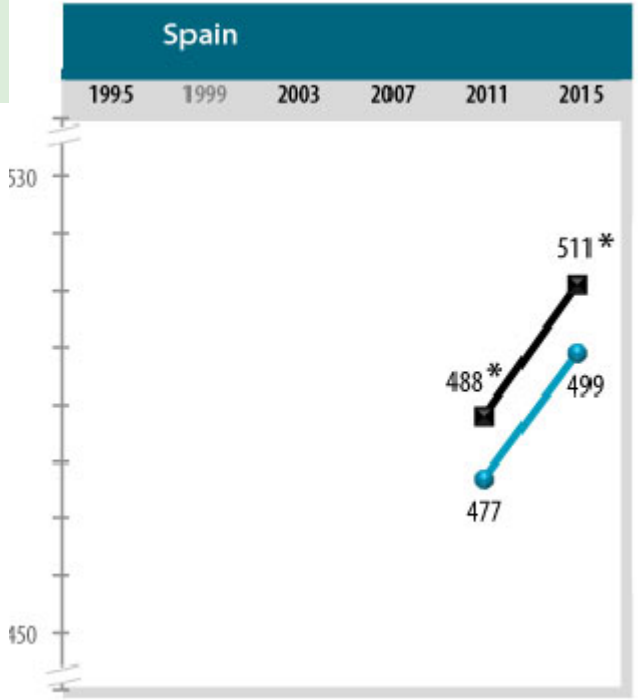
**15 Countries Same Average Achievement**

Australia, Belgium (Flemish), Chile, Denmark, England, Iran, Italy, Korea, Lithuania, New Zealand, Northern Ireland, Norway, Serbia, Slovak Republic, the United States

**5 Countries Lower Average Achievement**

Finland, Germany, Kuwait, Netherlands, Saudi Arabia

- Both girls and boys in Spain increased their overall achievement in math from 2011 to 2015



# Science grade 4 – 41 trend countries

**17 Countries Higher Average Achievement**

Australia, Bahrain, Croatia, Hong Kong SAR, Ireland, Japan, Kazakhstan, Lithuania, Morocco, New Zealand, Oman, Qatar, Russian Federation, Slovenia, Spain, Turkey, United Arab Emirates

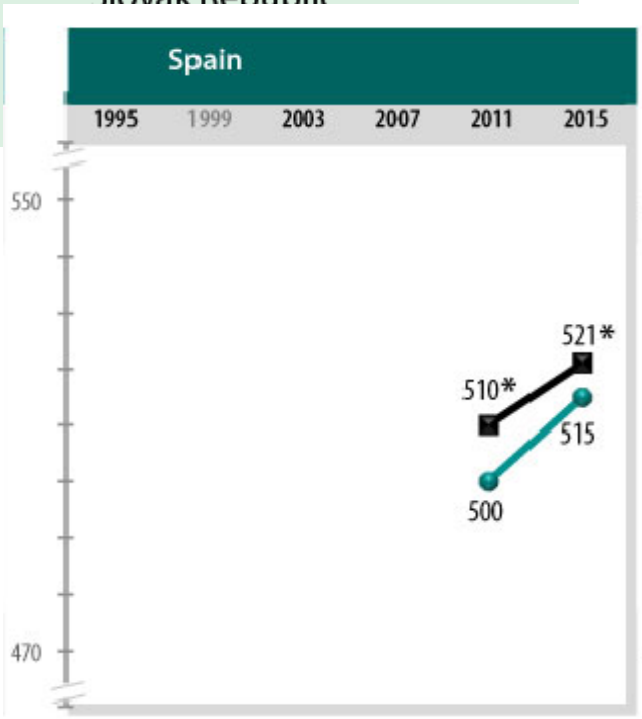
**16 Countries Same Average Achievement**

Belgium (Flemish), Chile, Chinese Taipei, Czech Republic, Denmark, England, Georgia, Germany, Hungary, Korea, Northern Ireland, Norway, Serbia, Singapore, Sweden, the United States

**8 Countries Lower Average Achievement**

Finland, Iran, Italy, Kuwait, Netherlands, Portugal, Saudi Arabia, Slovak Republic

- Spain had a small but significant increase in science achievement
- Girls' results increased more than boys'



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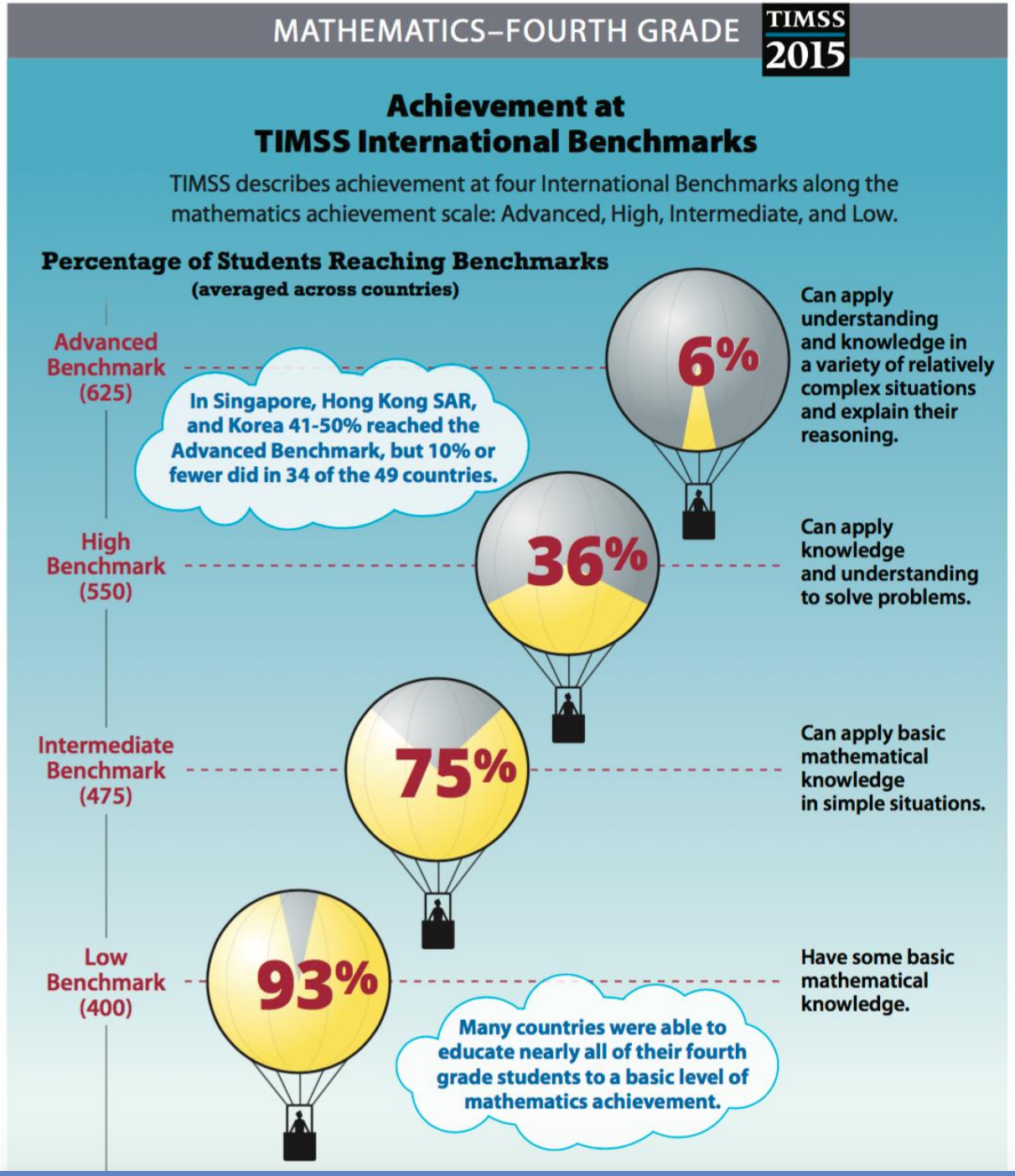
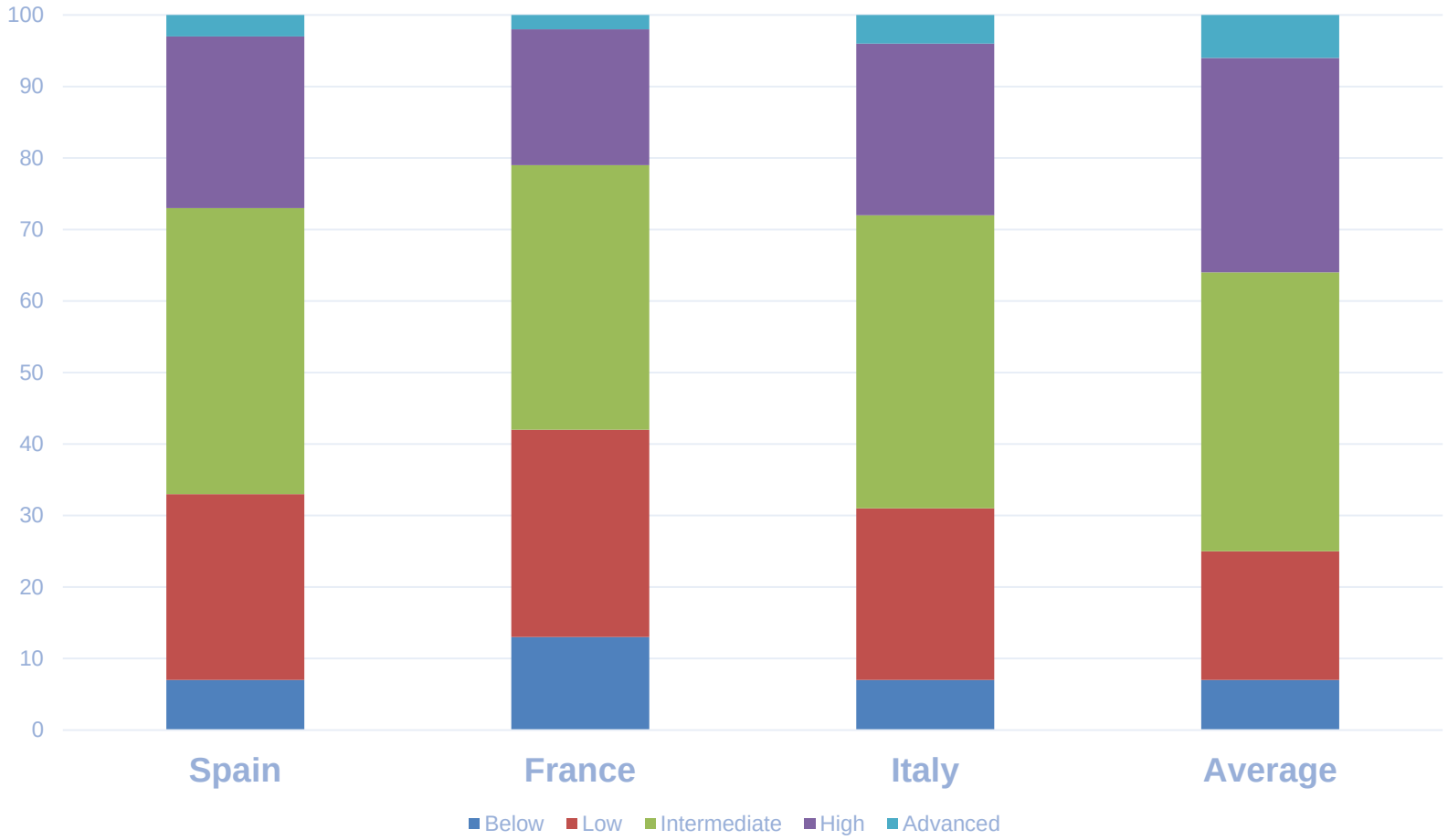
# International benchmarks


MATHEMATICS–FOURTH GRADE
TIMSS 2015
Achievement at TIMSS International Benchmarks
TIMSS describes achievement at four International Benchmarks along the mathematics achievement scale: Advanced, High, Intermediate, and Low.
Percentage of Students Reaching Benchmarks
(averaged across countries)
Advanced Benchmark (625)
6%
Can apply understanding and knowledge in a variety of relatively complex situations and explain their reasoning.
In Singapore, Hong Kong SAR, and Korea 41-50% reached the Advanced Benchmark, but 10% or fewer did in 34 of the 49 countries.
High Benchmark (550)
36%
Can apply knowledge and understanding to solve problems.
Intermediate Benchmark (475)
75%
Can apply basic mathematical knowledge in simple situations.
Low Benchmark (400)
93%
Have some basic mathematical knowledge.
Many countries were able to educate nearly all of their fourth grade students to a basic level of mathematics achievement.

# Percentage of students reaching international benchmarks, Math grade 4



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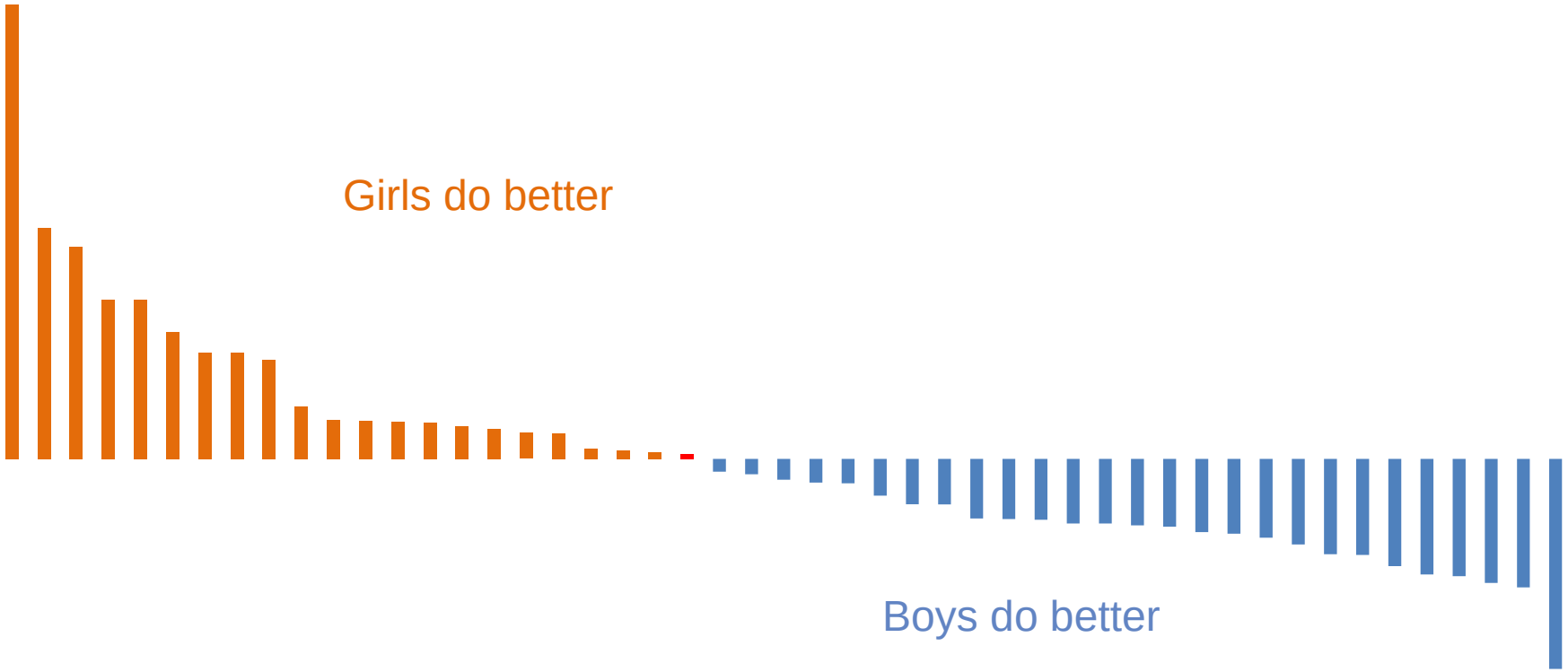
# Gender differences

# Background

- Gender differences in education have always been of interest to policy makers and other stakeholders in education
- There is an agreement that no student should be disadvantaged in education because of gender – in terms of participation as well as teaching
- Most countries observe significant gender differences in reading in the favor of girls, but only small gender differences in mathematics and science

# Gender differences – mathematics grade 4

- Boys and girls have the same international average (505)
- However, in all countries but Japan there were gender differences:



# Little Difference in Mathematics Achievement by Gender

## Of the 39 TIMSS 2015 Countries:

- **26** countries had no difference between girls and boys in higher achievement.
- Girls had higher achievement in **7** countries, with an average difference of **17** points.
- Boys had higher average achievement in **6** countries, with an average achievement of **9** points.


# Mathematics Achievement Trends by Gender Show Little Change

## Trends 2011-2015: 34 Countries

For **25** of the **34** countries with comparable data in 2011 and 2015, the gender **gaps did not change**.

- **16** countries had no difference in average mathematics achievement between girls and boys in either 2011 or 2015.
- In **7** countries girls had higher achievement in both assessments compared to **2** countries for boys.

## Trends 1995-2015: 16 Countries

- In 1995, boys had higher achievement than girls in **4** countries with an average achievement advantage of **17** points. There was no difference in **12** countries.
- In 2015, boys had higher achievement than girls in **3** countries, with an average achievement advantage of **9** points. Girls had higher achievement in Singapore, with an average achievement advantage of **10** points.

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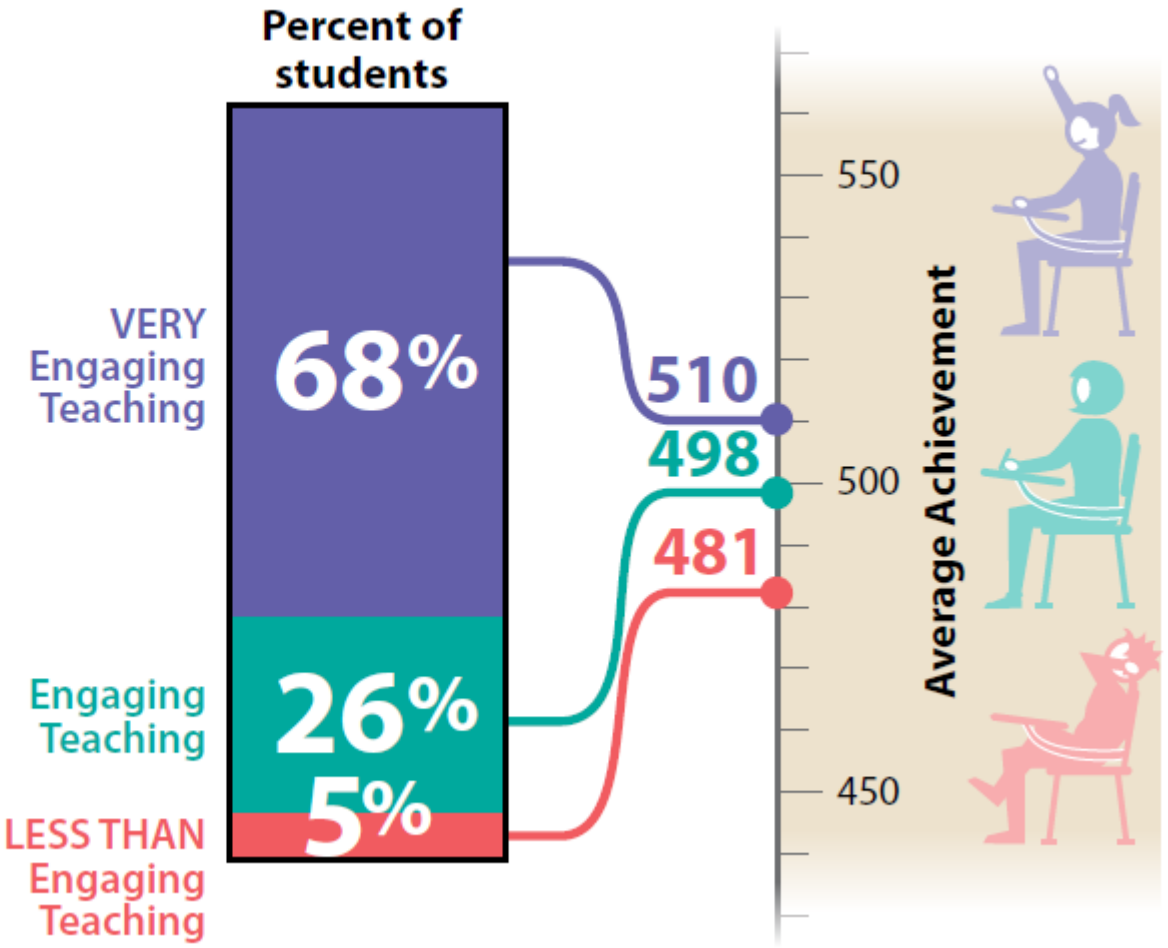
# Attitudes to learning

# Mathematics instruction

The fourth grade students were very positive about their mathematics teaching, but less so about the subject.

**Almost all students (94%) were positive about their instruction—68% reported VERY engaging teaching and 26% engaging teaching.**

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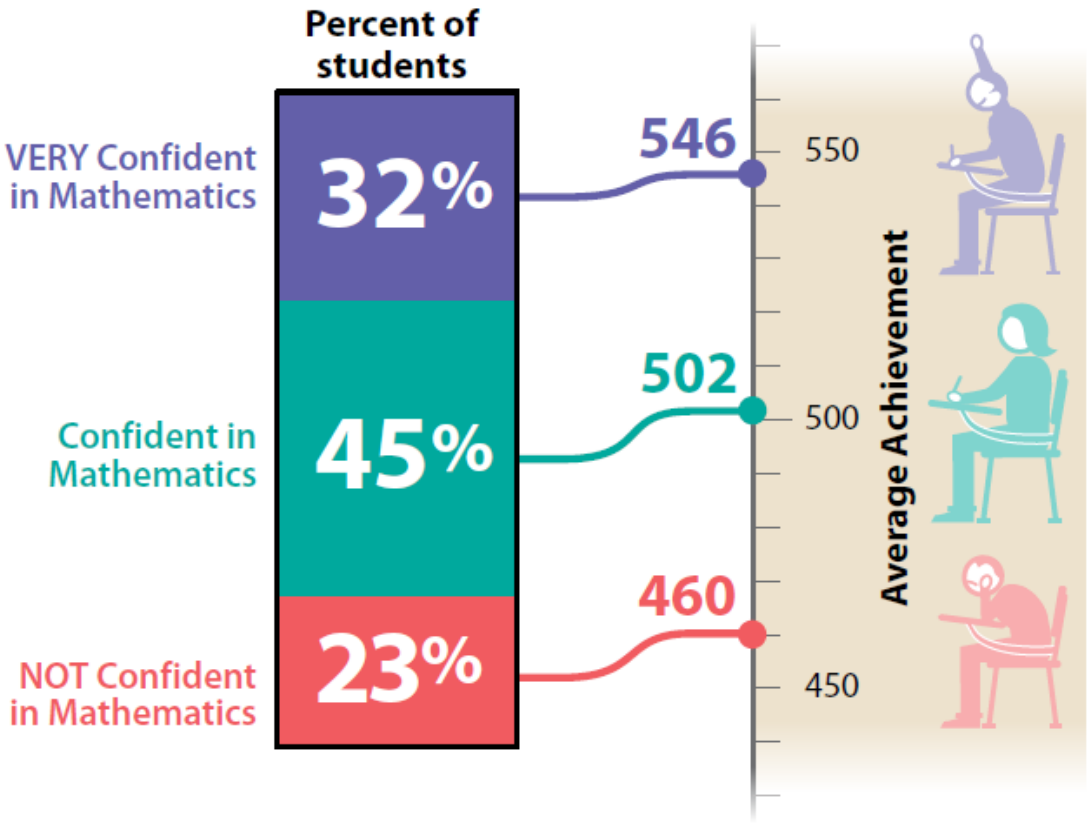
# Confidence in mathematics

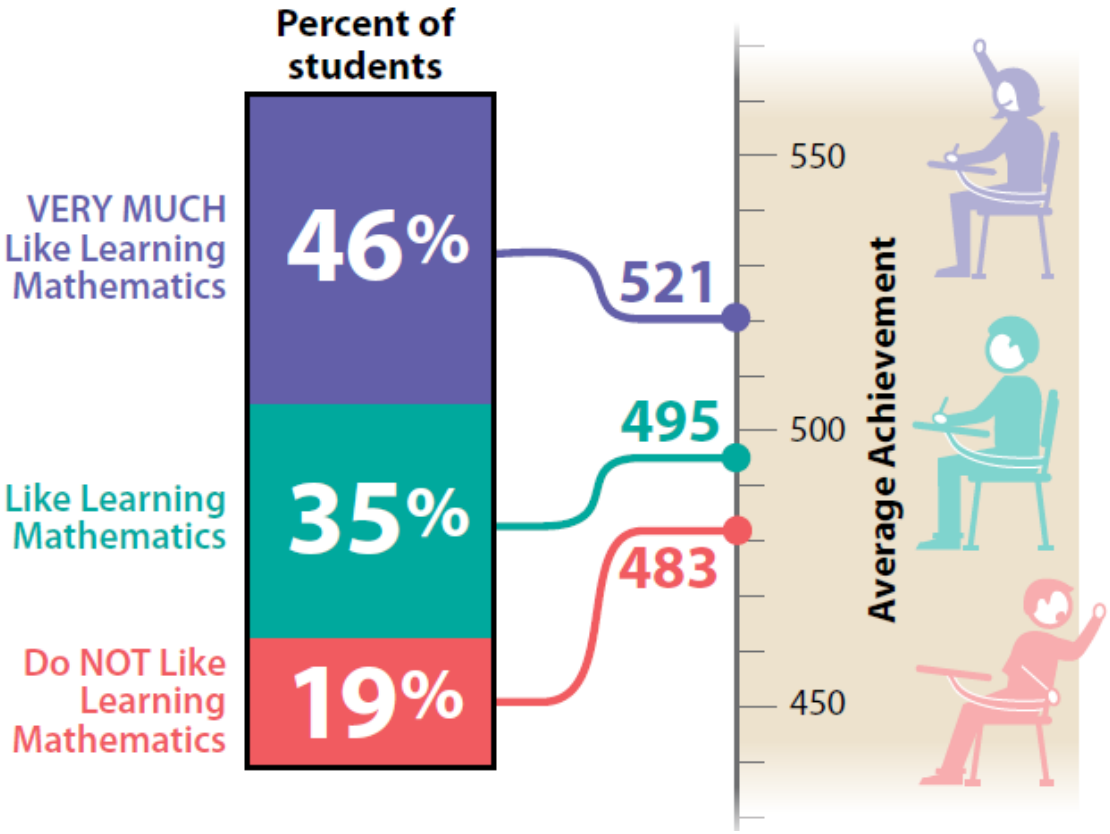
Most students (77%) were VERY confident or confident in mathematics, but 23% were NOT confident.




| *Spain* | Very condfident | Confident | Not confident |
|---|---|---|---|
| Confidence in math | 33% | 41% | 26% |
| Average score | 542 | 503 | 461 |

# Like mathematics

Most students (81%) VERY MUCH liked or liked learning mathematics, but 19% did NOT.




| Spain | Very much like | Like | Do not like |
|---|---|---|---|
| Like learning math | 46% | 34% | 19% |
| Average score | 516 | 500 | 492 |

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# Class size

# Class size trends: Grade 8

## 1995

- Average: 29 students
  - 4 Asian countries 40
  - 9 European countries 24
- Highest average:
  - Korea (51)

## 2015

- Average: 26 students
  - 4 Asian countries 33
  - 9 European 26
- Highest average:
  - Singapore 36
  - Korea and Japan 32
  - Hong Kong 30
- Lowest average:
  - Hungary 21
  - Slovenia 17

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# Class size trends

- Especially countries with a larger average class size – predominantly Asian countries – seem to have reduced the class sizes
- Countries with smaller classes like Norway or Lithuania have modestly increased class sizes
- Overall average class sizes seem to converge

# Class size and achievement

- There is no clear relationship between class size and achievement of students – neither in absolute terms nor in trends
- Classes in Asia were and still are larger (although the difference decreased) and the Asian countries have higher achievement
- But neither within Asia nor Europe there is a clear relationship between class size and achievement, or between class size changes and changes in achievement

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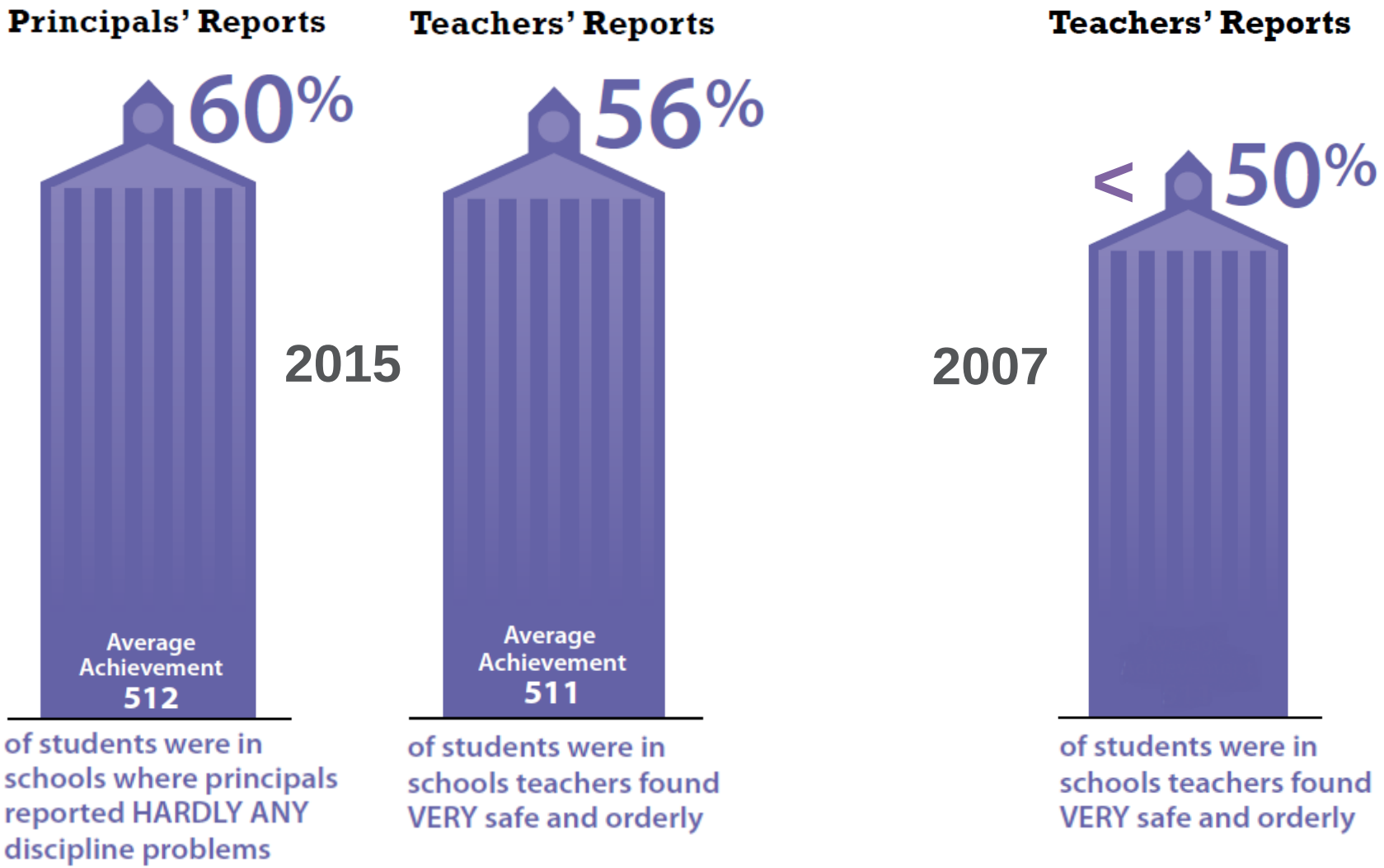
# Safe and orderly schools

# Background

- Research shows a relationship between students' feeling of safety at school and their achievement
- Students who feel safe at school achieve higher on average
- The relationship between achievement and students' social behavior is bi-directional, as researchers have found
- Consequently, it is important to investigate whether students feel safe at school

# School safety – grade 4



# School safety

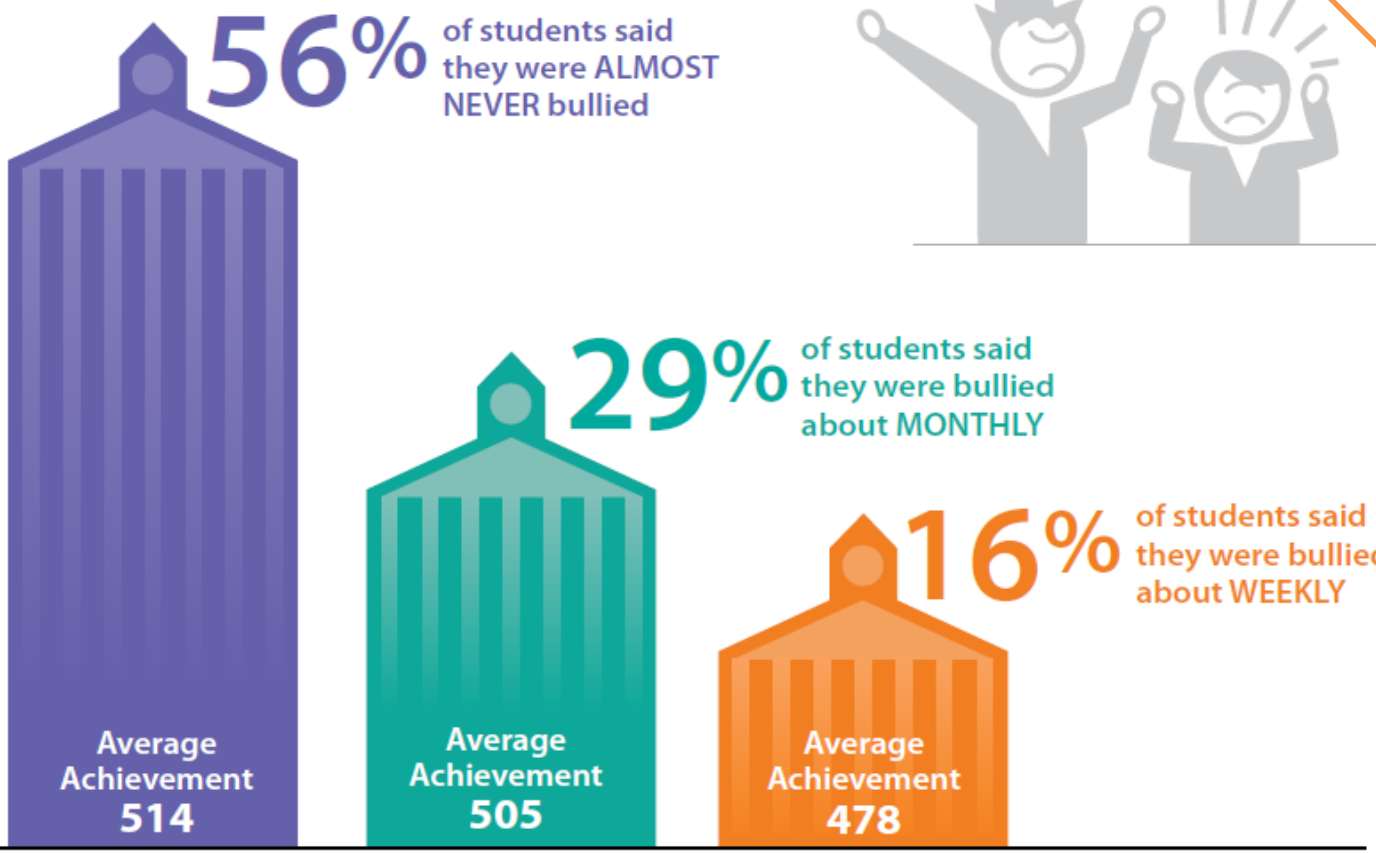
- When students being asked if they feel safe at school,
  - 63% of the grade 4 students, and
  - 47% of the grade 8 students

  agreed a lot that they feel safe at school.

# Bullying

With the emergence of cyber-bullying, there is growing evidence that school-related bullying is on the rise and does have a negative impact on student achievement.

**Students' Reports**






Spanish pupils reported some more frequent bullying than international average

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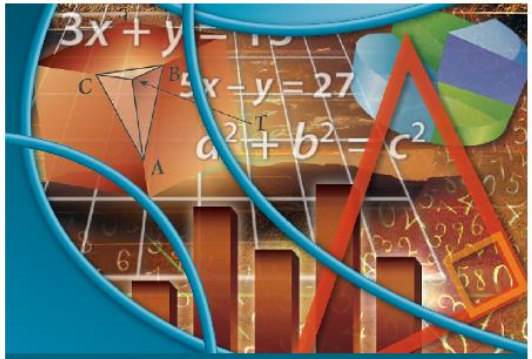
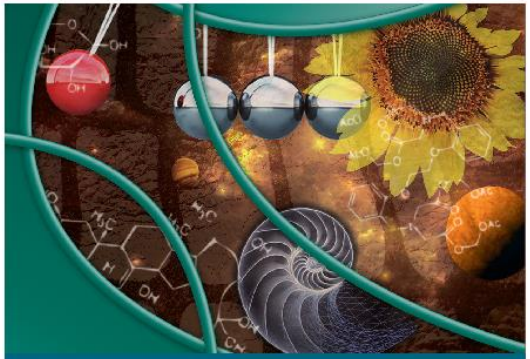
# International reports (https://timssandpirls.bc.edu/)



TIMSS 2015 INTERNATIONAL RESULTS IN MATHEMATICS

VISIT THE REPORT



TIMSS 2015 INTERNATIONAL RESULTS IN SCIENCE

VISIT THE REPORT

TIMSS ADVANCED 2015 INTERNATIONAL RESULTS IN ADVANCED MATHEMATICS AND PHYSICS

VISIT THE REPORT

## OTHER PUBLICATIONS

ASSESSMENT FRAMEWORKS

TIMSS 2015

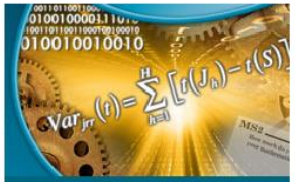
TIMSS ADVANCED 2015

ENCYCLOPEDIA

VISIT PUBLICATION

20 YEARS OF TIMSS

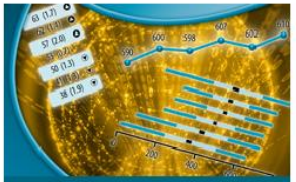
VISIT PUBLICATION



METHODS AND PROCEDURES

TIMSS 2015

TIMSS ADVANCED 2015



INTERNATIONAL DATABASE

TIMSS 2015

TIMSS ADVANCED 2015

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# TIMSS 2019 was launched with the first meeting of national research coordinators in February

# TIMSS 2019

- Offers the opportunity to continue measuring trends for grade 4 and grade 8 students in mathematics and science
- Will collect rich background information to help countries better understand the strengths and weaknesses of their system
- Offers participating countries the opportunity to collect data either traditionally in a paper and pencil mode or to use a computer based mode for a more engaging experience for the students
- eTIMSS will also include problem solving and enquiry modules

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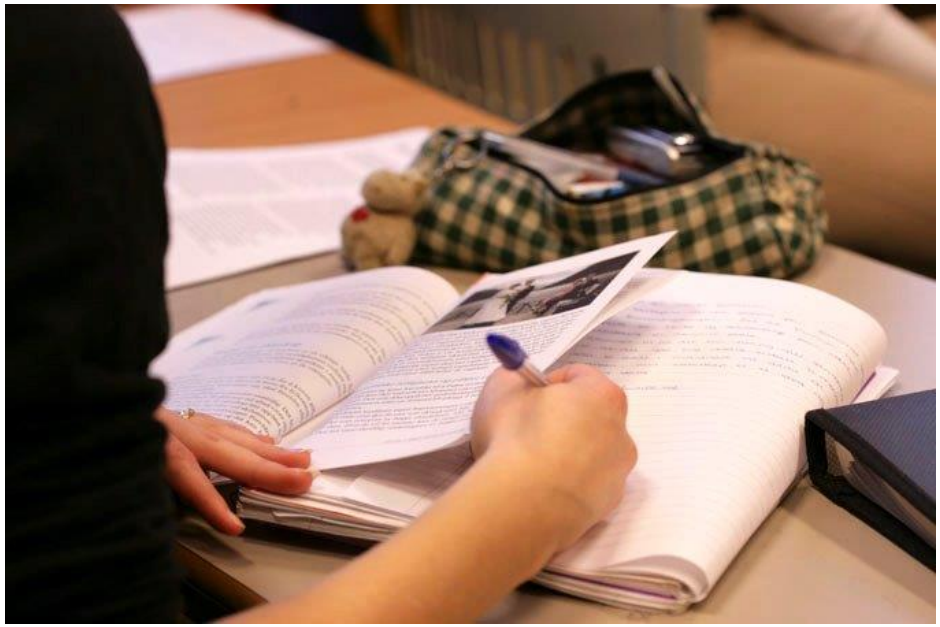
# Quality in Education



# Educational quality – Educational goals

**Quality in education is recognised by the extent to which the expressed educational goals are reached:**

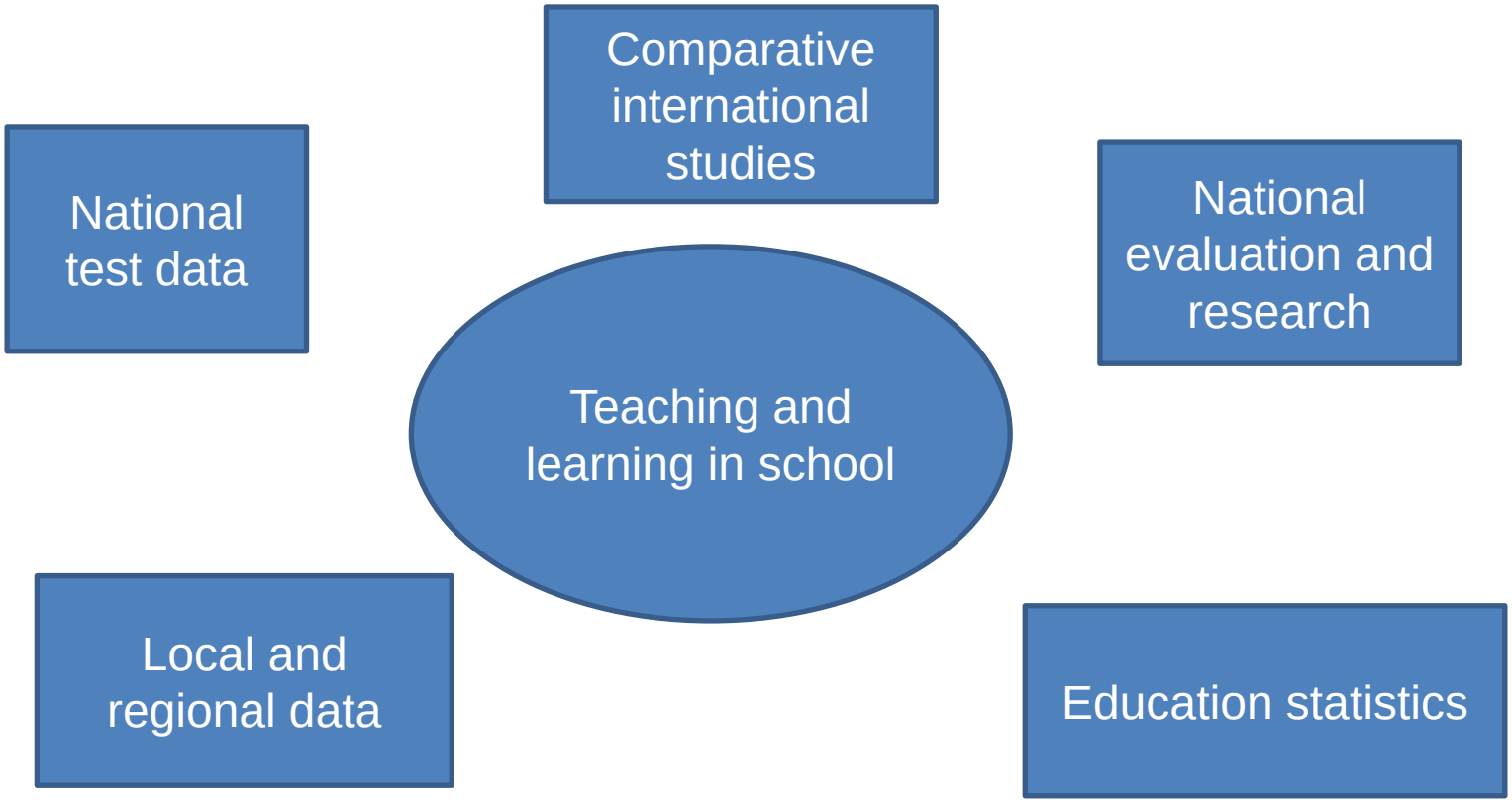
- *Global goals on access, equity and learning outcomes (Sustainable Development Agenda 2030)*
- *National educational goals expressed in curricula and steering documents*
- *Local goals (state, district and school level)*

**A comprehensive quality assessment system aims to enable all levels in the education system to assess to what degree the educational goals are reached.**

# Analyses in a national context

- International large scale assessment will never give a full picture of a country's educational system
- Assessments of key competencies provides indicators of educational outcomes
- Data must be analysed in a national context
- Policy analyses should be based on a rich variety of data and research, both qualitative and quantitative

# International studies form part of a broader national knowledge base

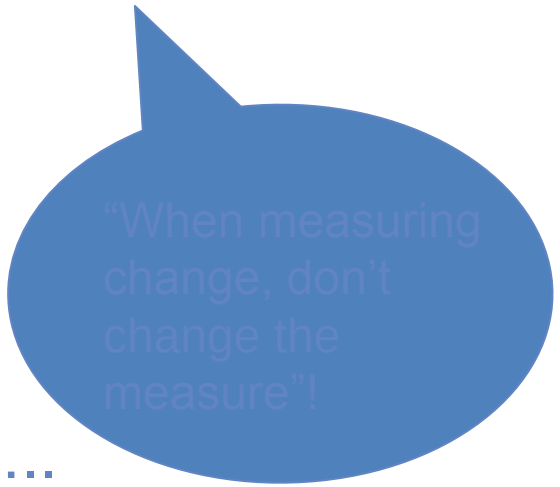


# Quality assessment for improved learning


**Improvement requires feedback and support to stakeholders at all levels**

# Questions and dilemmas

- Representativity and test fatigue
- Changing to computer based testing – how will that influence costs, trends, reliability?
- Correlations vs causal effects?
- Adaptive testing?
- Challenge:
  - Non cognitive skills
- What you test is what you measure …..



# Thank you!

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