PISA

Data speaks – things we can do to build better schools

Hong Kong, June 2017

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OECD
BETTER POLICIES FOR BETTER LIVES

PISA in brief - 2015

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

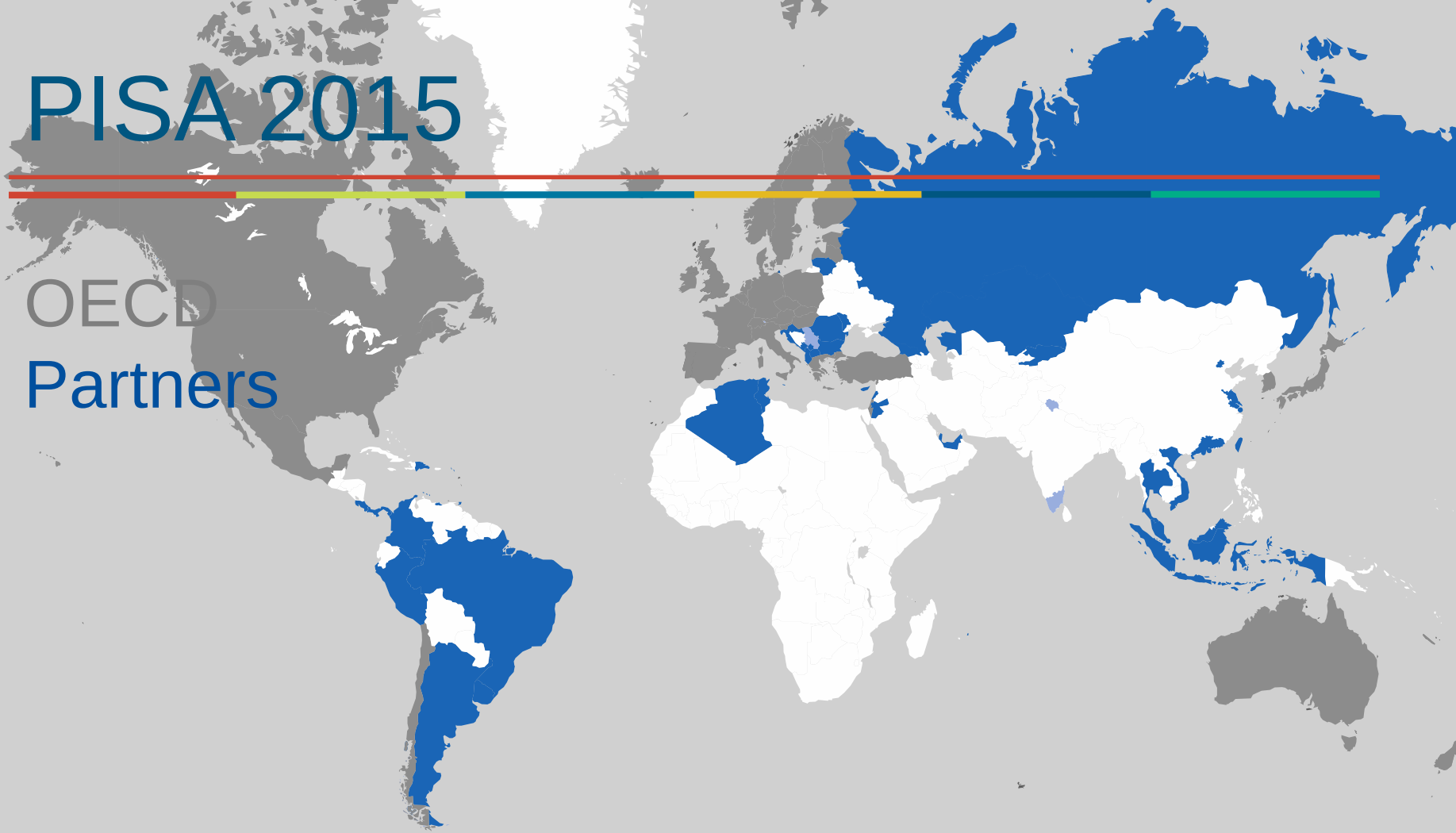
… and responded to questions on…

- 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

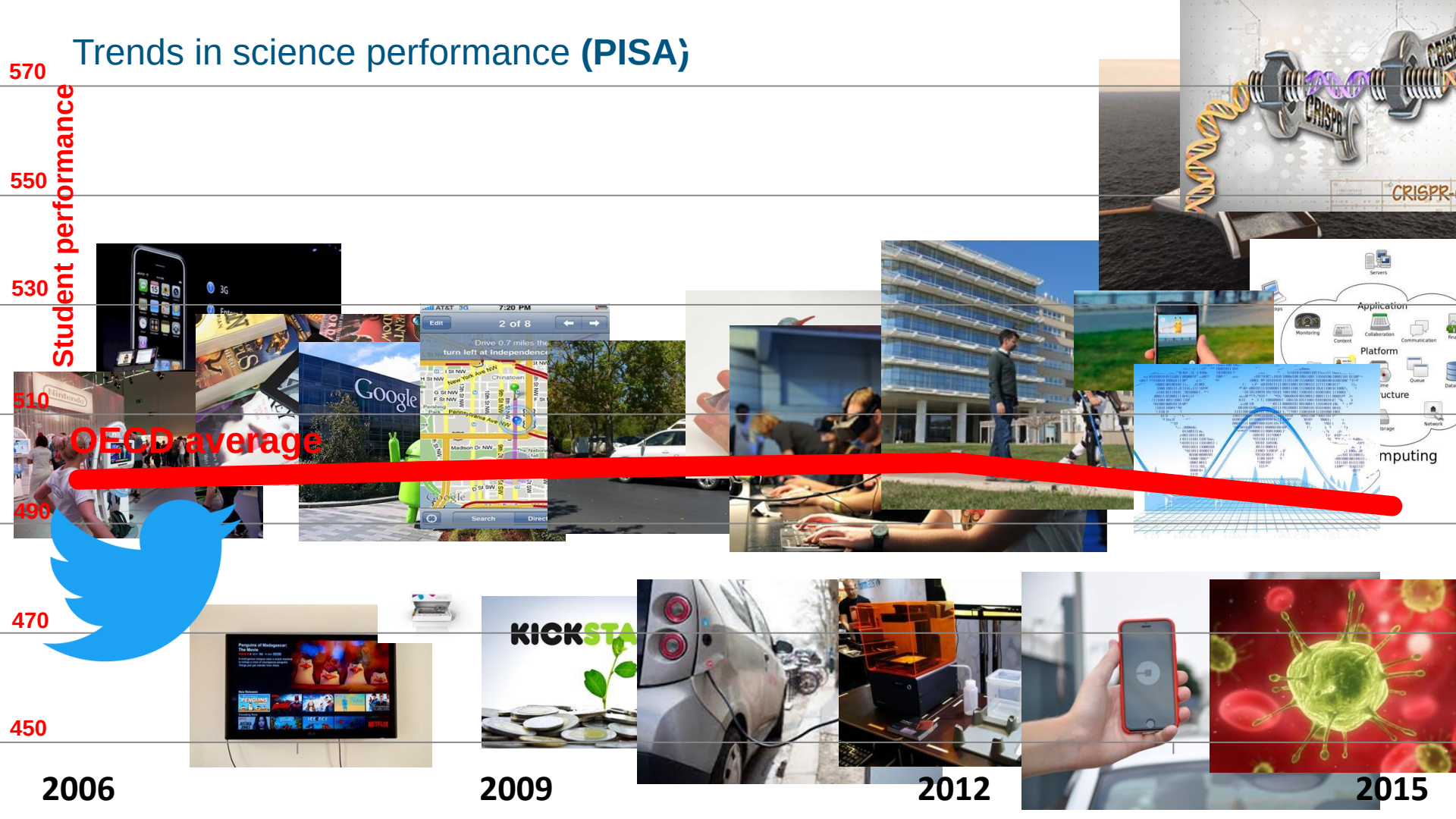


Trends in science performance **(PISA)**

Student performance

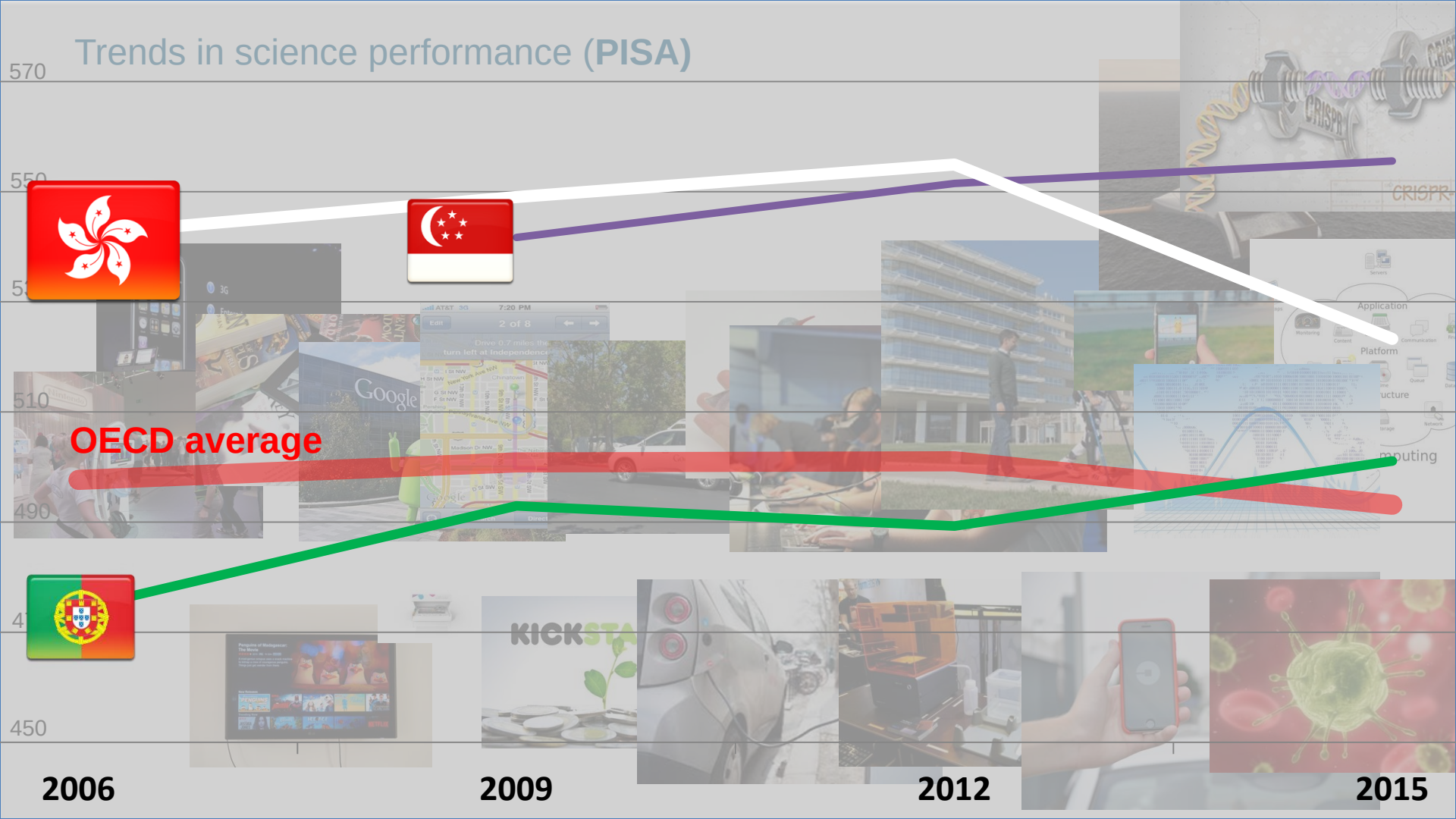
570
550
530
510
490
470
450

OECD average



2006 2009 2012 2015

Trends in science performance (**PISA**)



Science in PISA

"the ability to engage with science-related issues, and with the ideas of science, as a reflective citizen"

Competencies

- Explain phenomena scientifically
- Evaluate and design scientific enquiry
- Interpret data and evidence scientifically

Recognise, offer and evaluate explanations for a range of natural and technological phenomena

Describe and appraise scientific investigations and propose ways of addressing questions scientifically.

Analyse and evaluate data, claims and arguments in a variety of representations and draw appropriate scientific conclusions.

Competencies

- Explain phenomena scientifically
- Evaluate and design scientific enquiry
- Interpret data and evidence scientifically

Knowledge

- Content knowledge
- Knowledge of methodological procedures used in science
- Knowledge of the epistemic reasons and ideas used by scientists to justify their claims

Each of the scientific competencies requires content knowledge (knowledge of theories, explanatory ideas, information and facts), but also an understanding of how such knowledge has been derived (procedural knowledge) and of the nature of that knowledge (epistemic knowledge)

"Epistemic knowledge" reflects students' capacity to think like a scientist and distinguish between observations, facts, hypotheses, models and theories

Competencies

- Explain phenomena scientifically
- Evaluate and design scientific enquiry
- Interpret data and evidence scientifically

Knowledge

- Content knowledge
- Knowledge of methodological procedures used in science
- Knowledge of the epistemic reasons and ideas used by scientists to justify their claims

Attitudes

- Attitudes to science
- Scientific attitudes

Peoples' attitudes and beliefs play a significant role in their interest, attention and response to science and technology.

PISA distinguishes between attitudes towards science (e.g. interest in different content areas of science) and scientific attitudes (e.g. whether students value scientific approaches to enquiry)

Context

- Personal, local, global
- Current and historical

Competencies

- Explain phenomena scientifically
- Evaluate and design scientific enquiry
- Interpret data and evidence scientifically

Knowledge

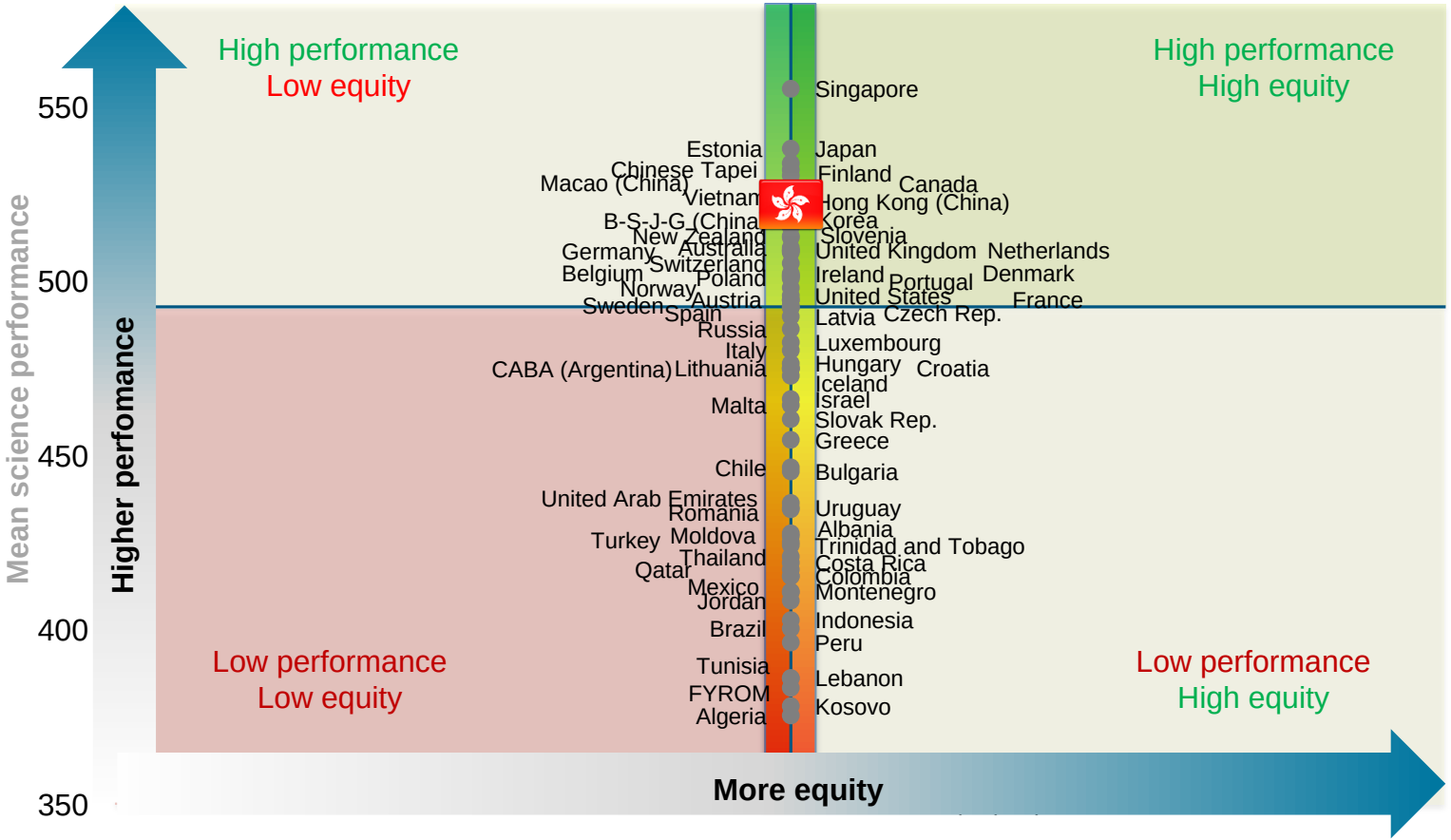
- Content knowledge
- Knowledge of methodological procedures used in science
- Knowledge of the epistemic reasons and ideas used by scientists to justify their claims

Attitudes

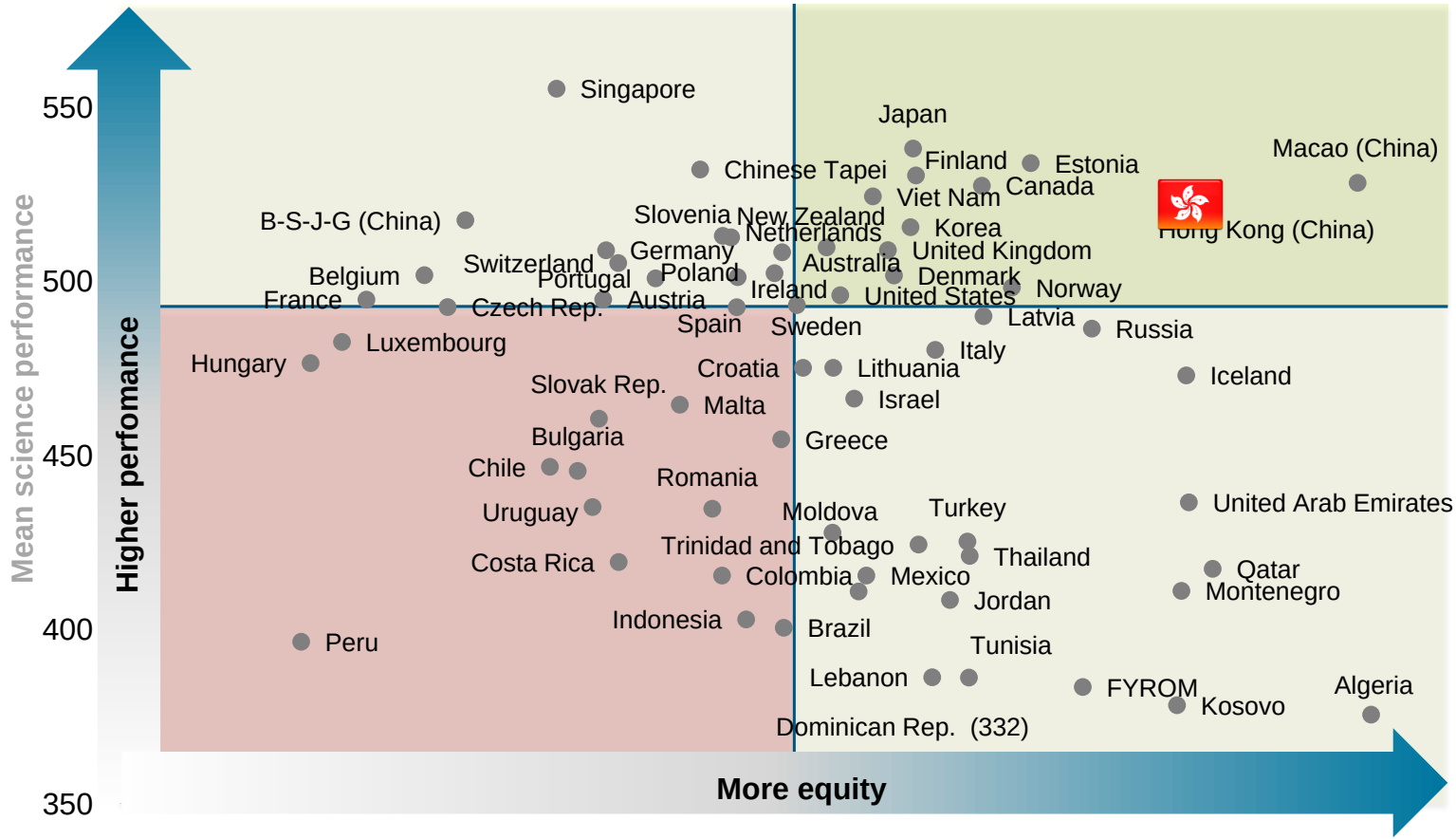
- Attitudes to science
- Scientific attitudes

Personal, local/national and global issues, both current and historical, which demand some understanding of science and technology

Science performance in PISA (2015)



Science performance and equity in PISA (2015)



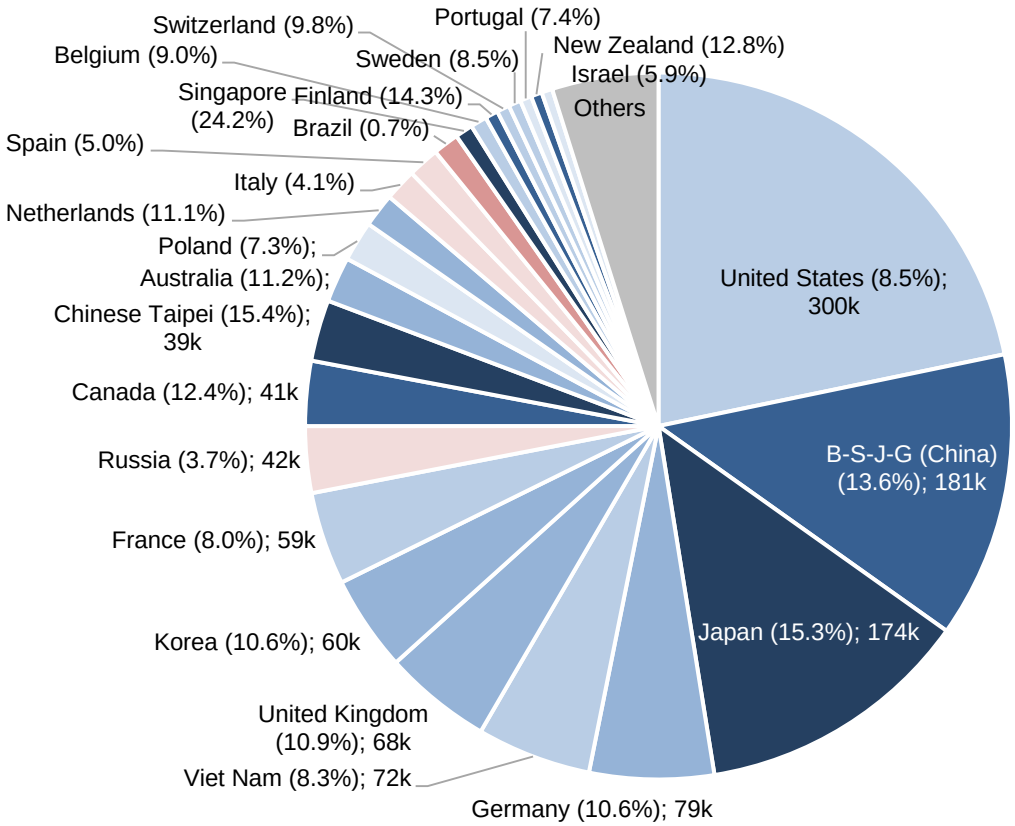
Some countries combine excellence with equity

Top performers

Students who can develop and work with models for complex science situations, identifying constraints and specifying assumptions. They can select, compare and evaluate appropriate problem-solving strategies for dealing with complex problems related to these models.

Figure I.2.18

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%

Figure I.2.29

Boys' and girls' strengths and weaknesses in science

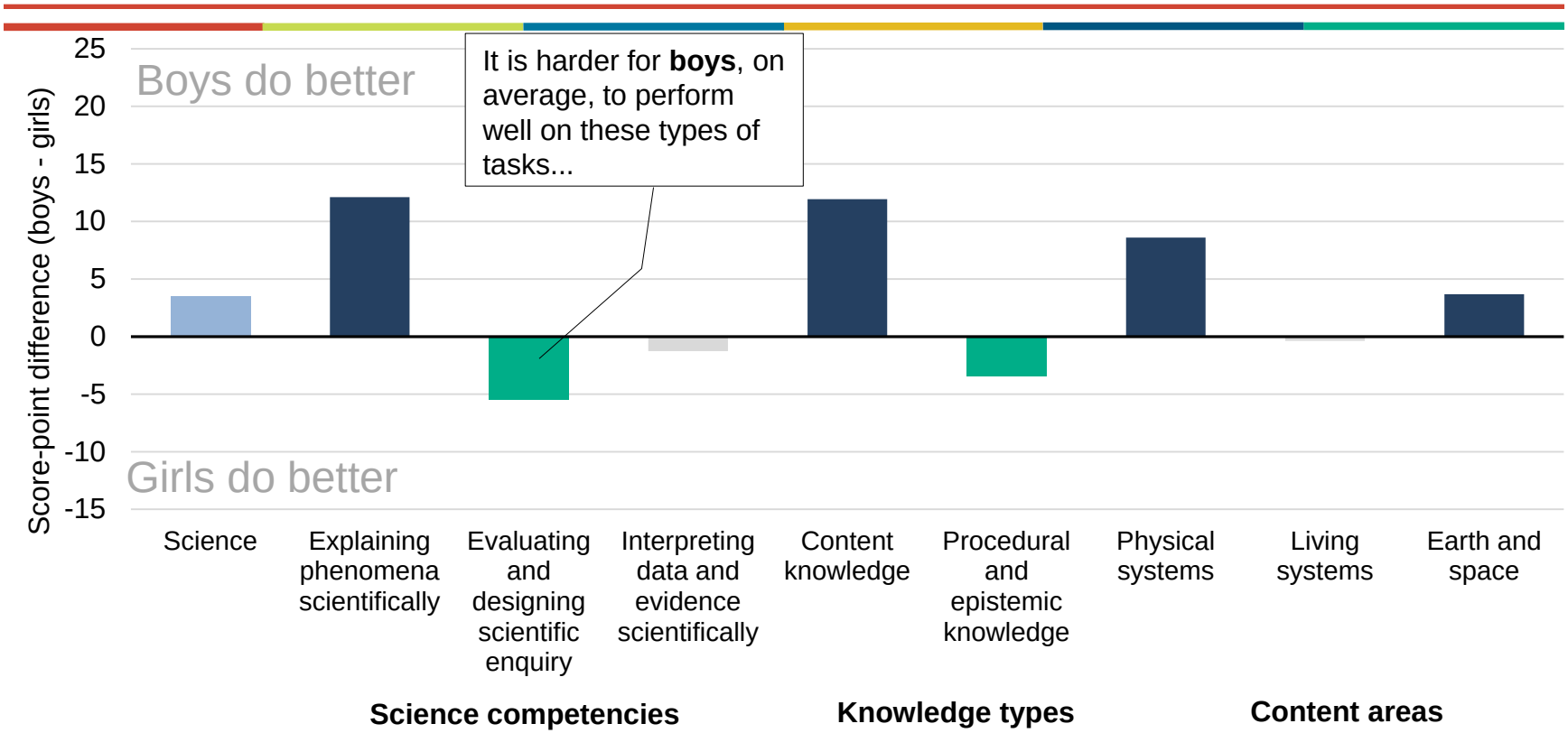


Figure I.2.29

Top-performing boys' and girls' strengths and weaknesses

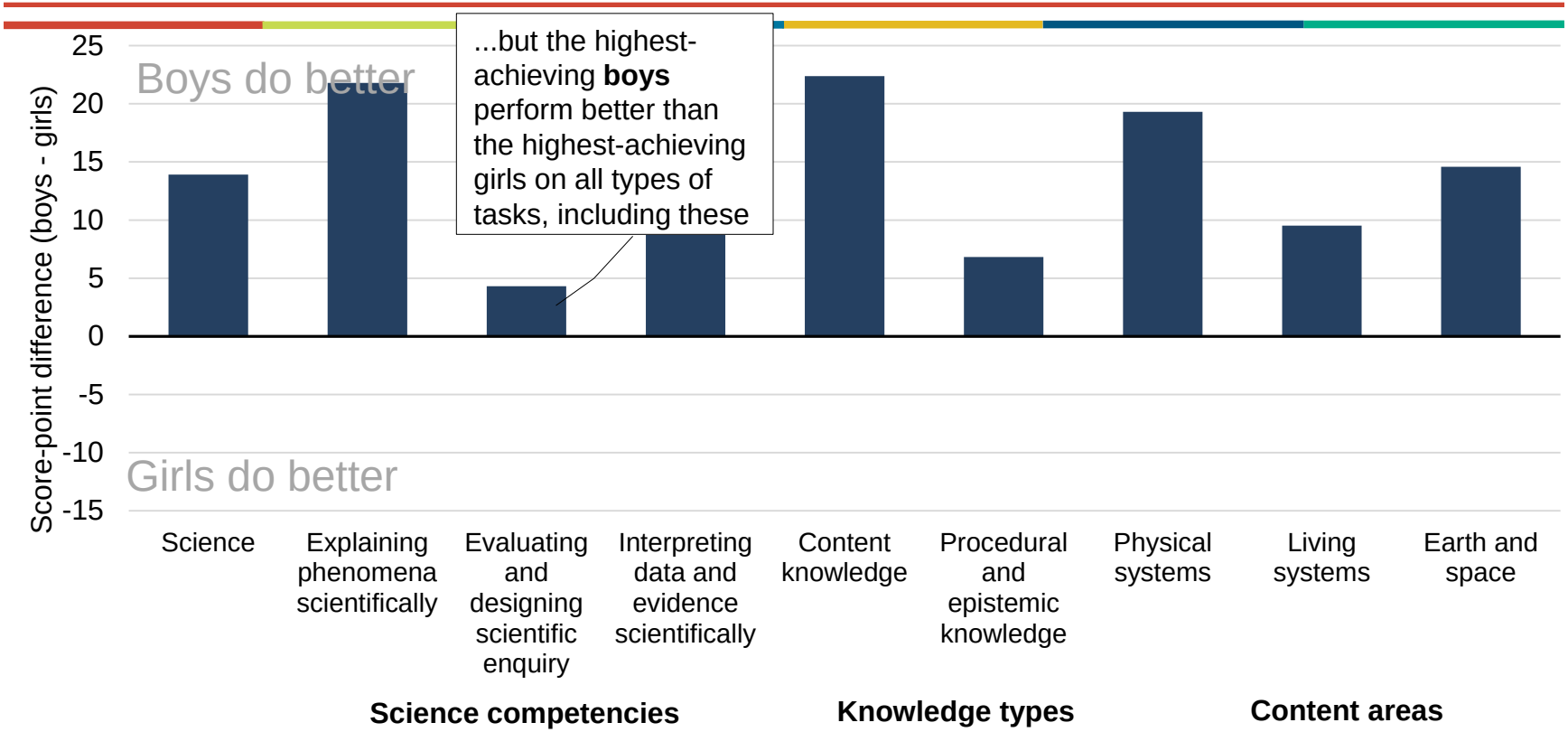
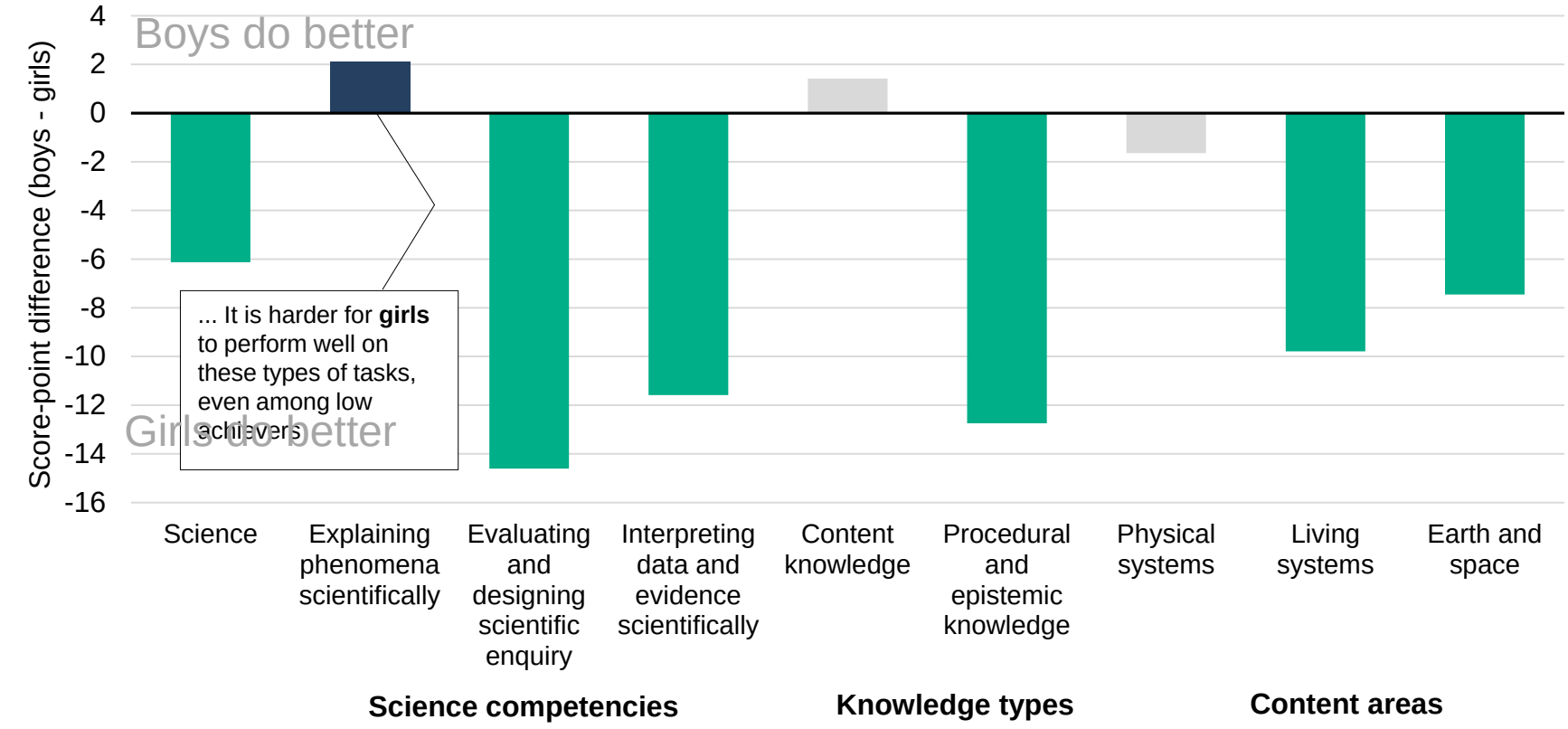


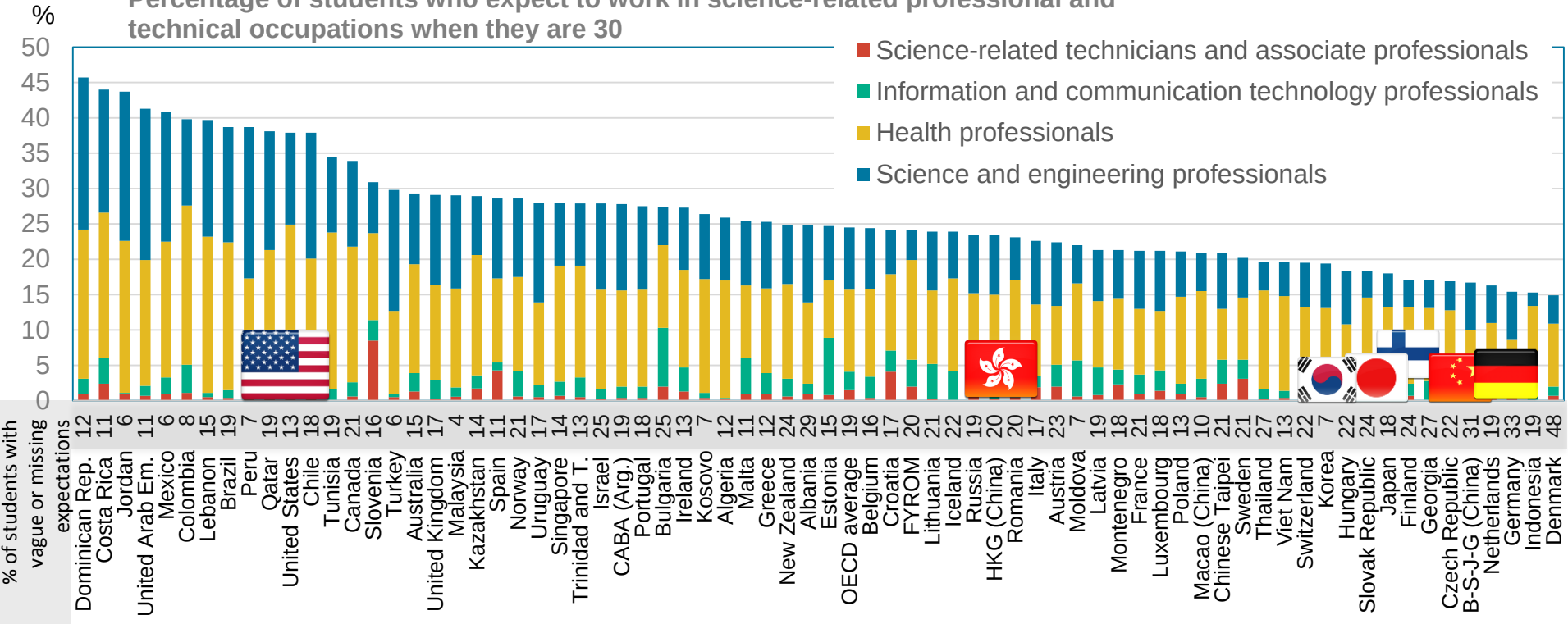
Figure I.2.29

Bottom-performing boys' and girls' strengths and weaknesses



Science and careers

Students expecting a career in science



Multiple outcomes

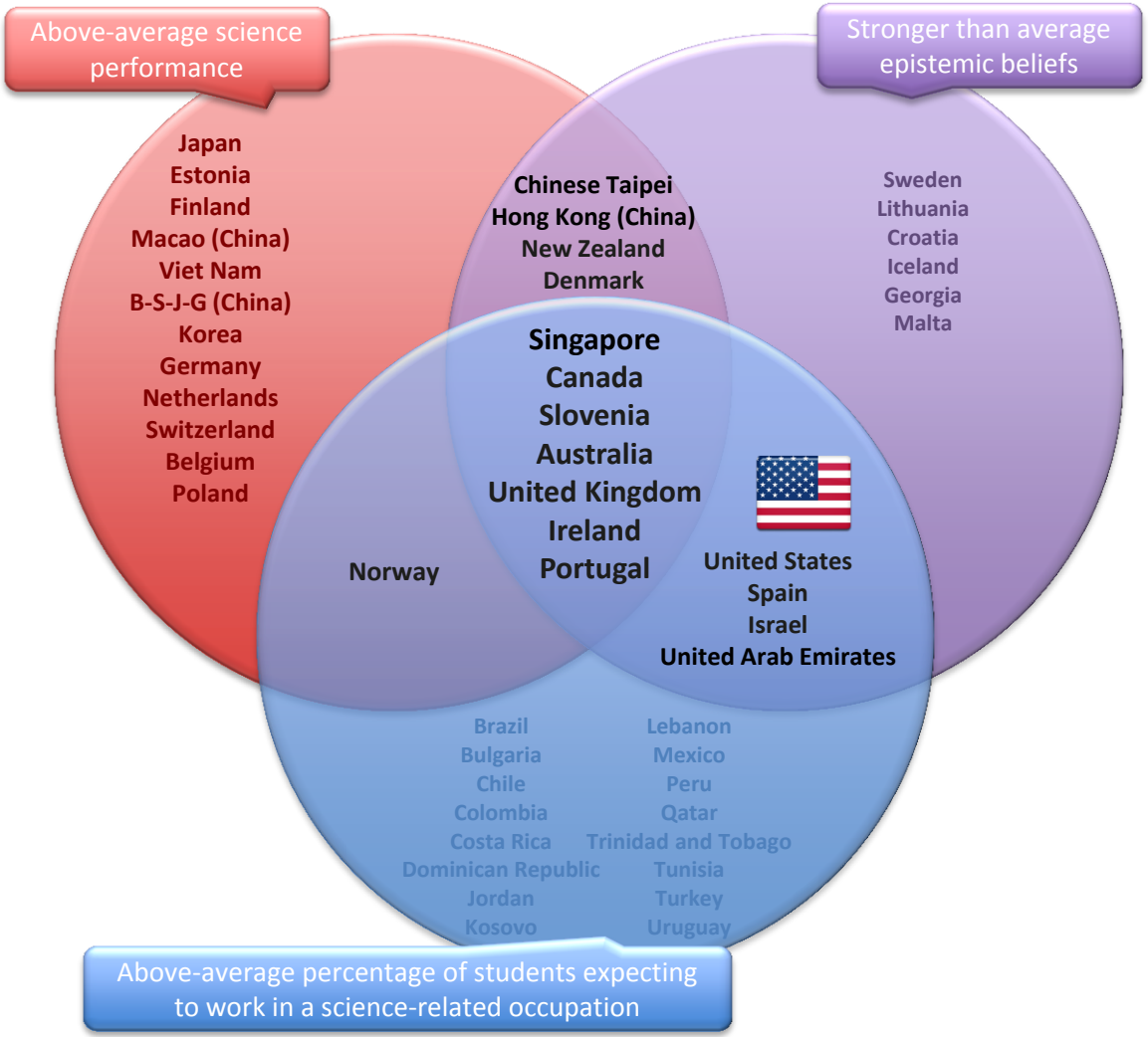


Figure I.3.17

Students expecting a career in science

by performance and enjoyment of learning

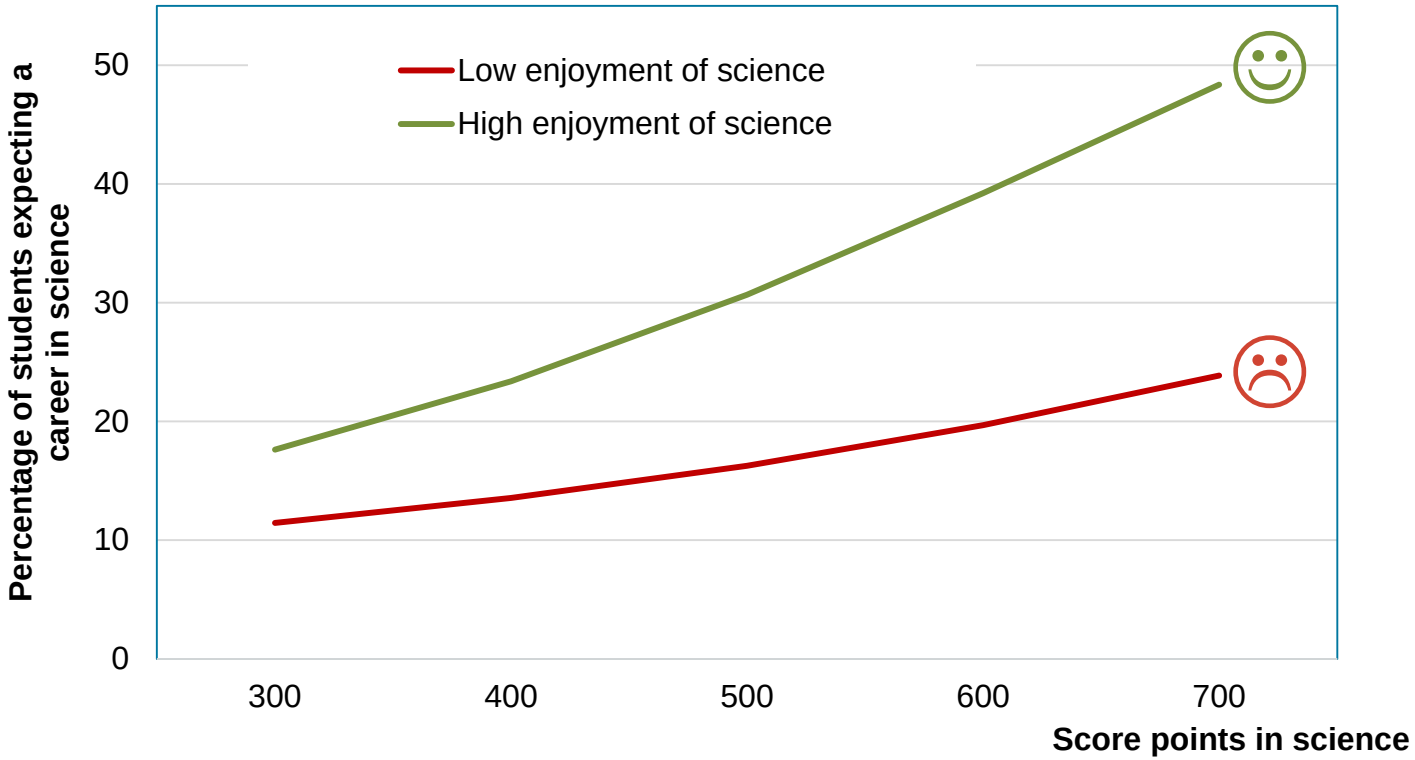
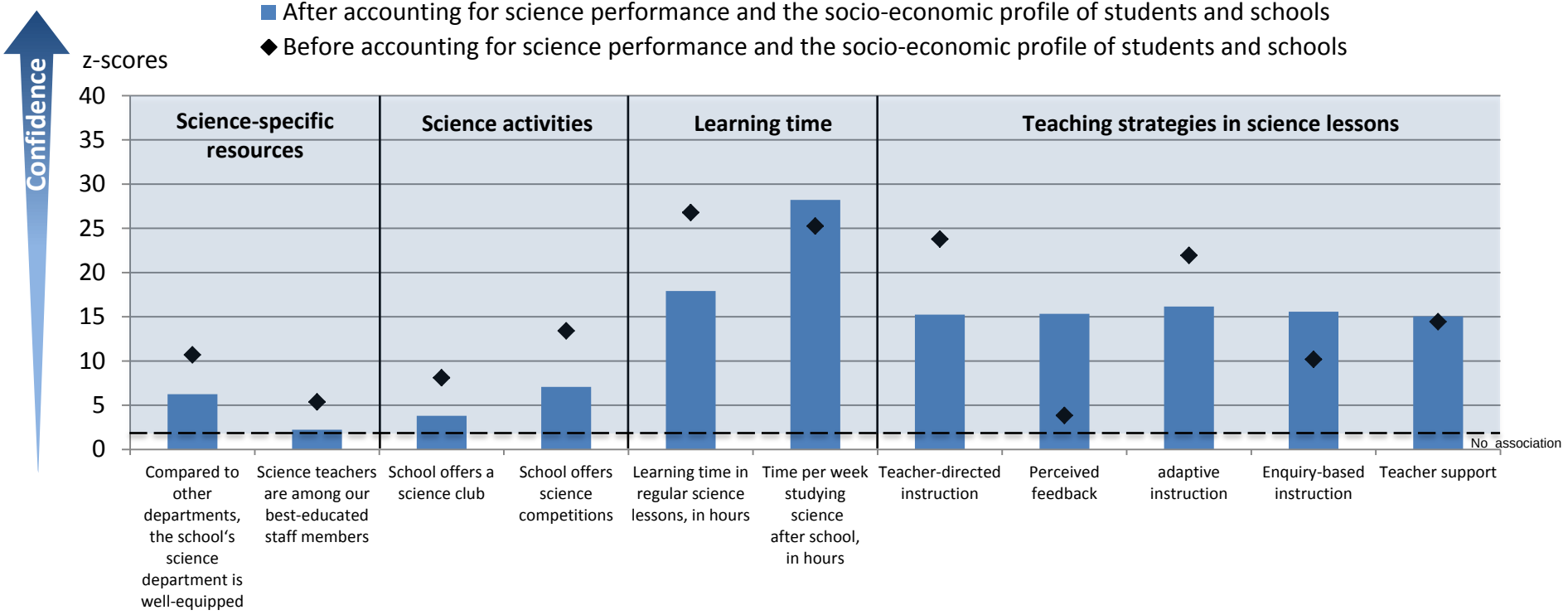
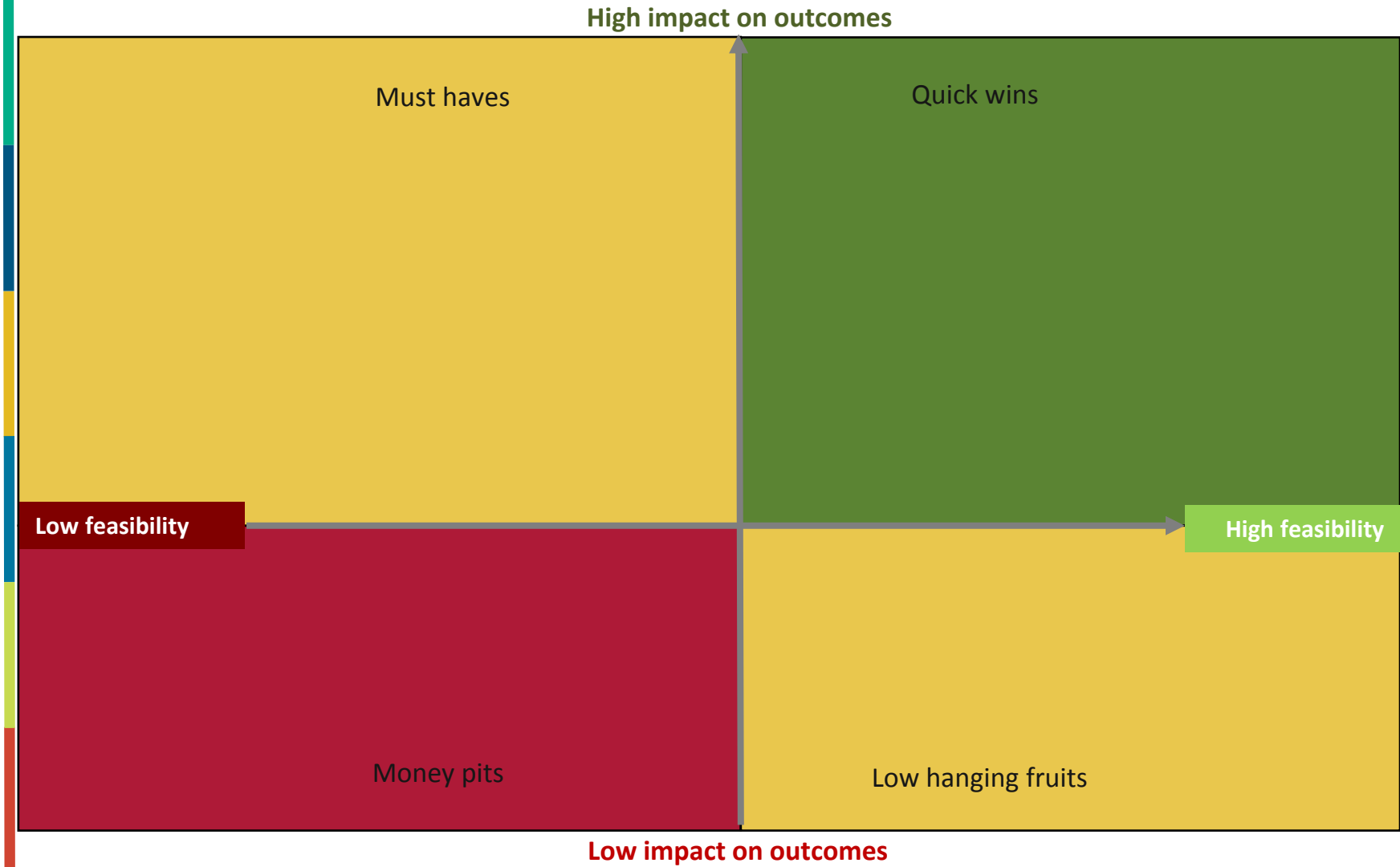


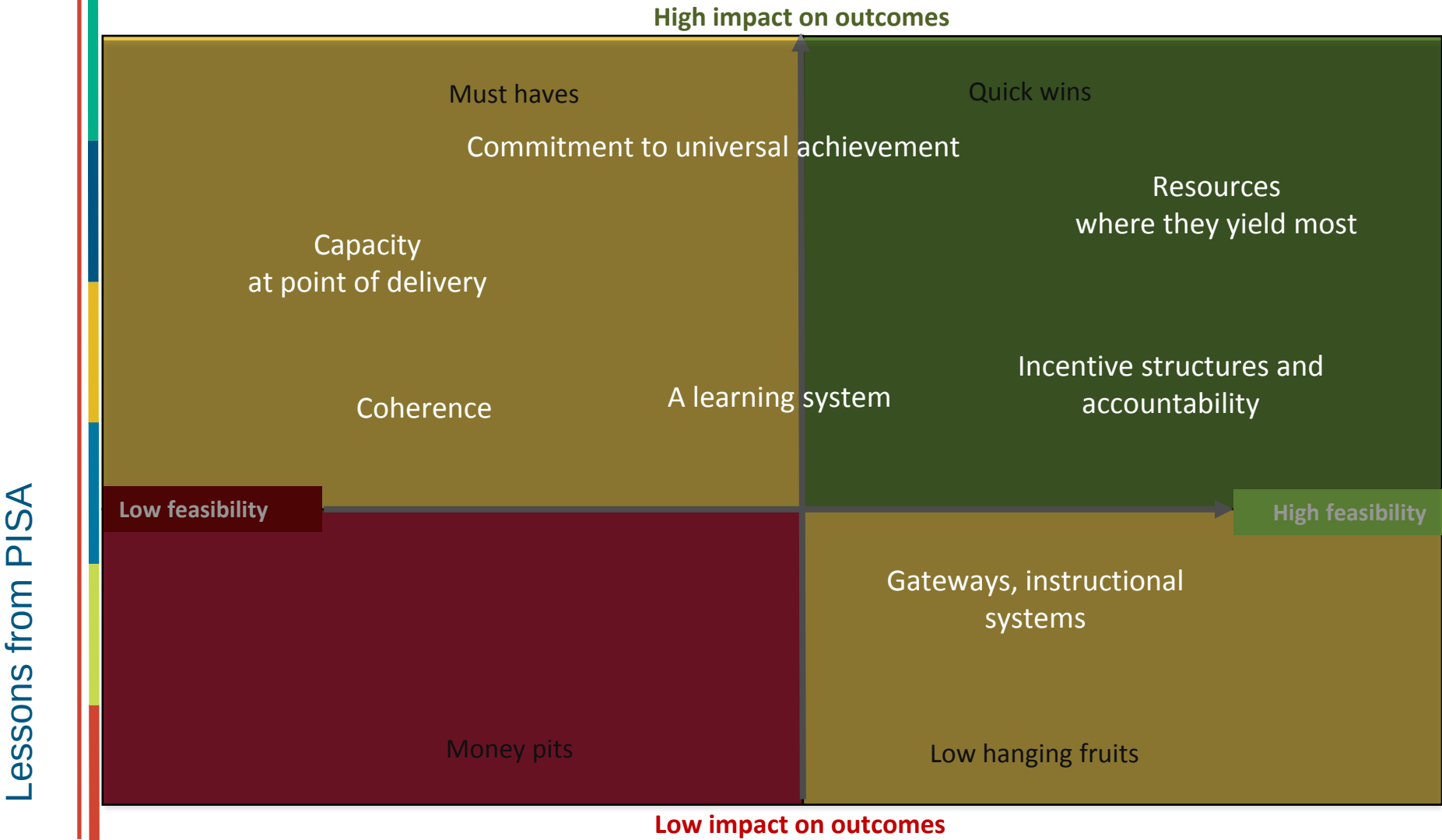
Figure II.2.22

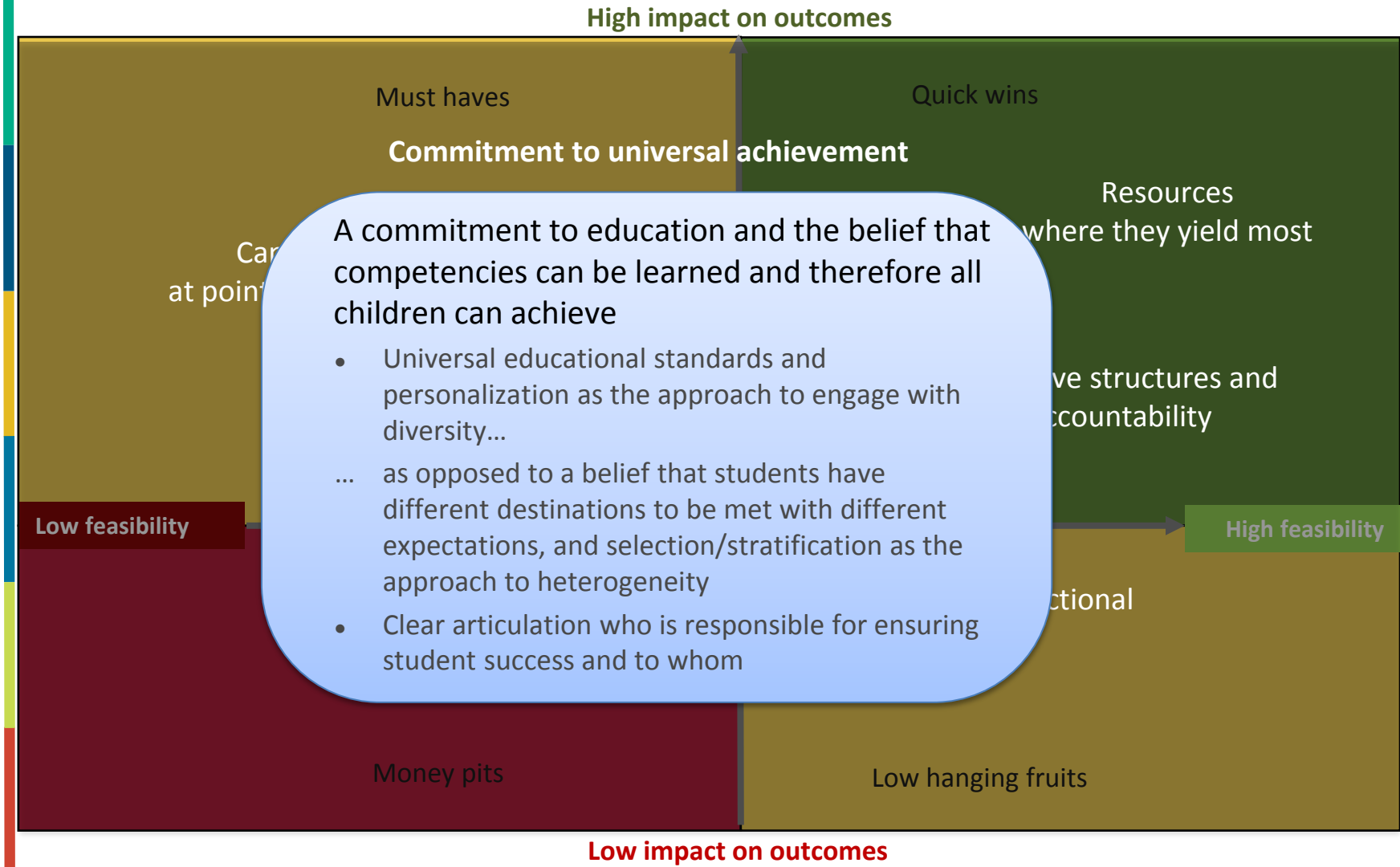
Explaining students' expectations of a career in science



Lessons from PISA

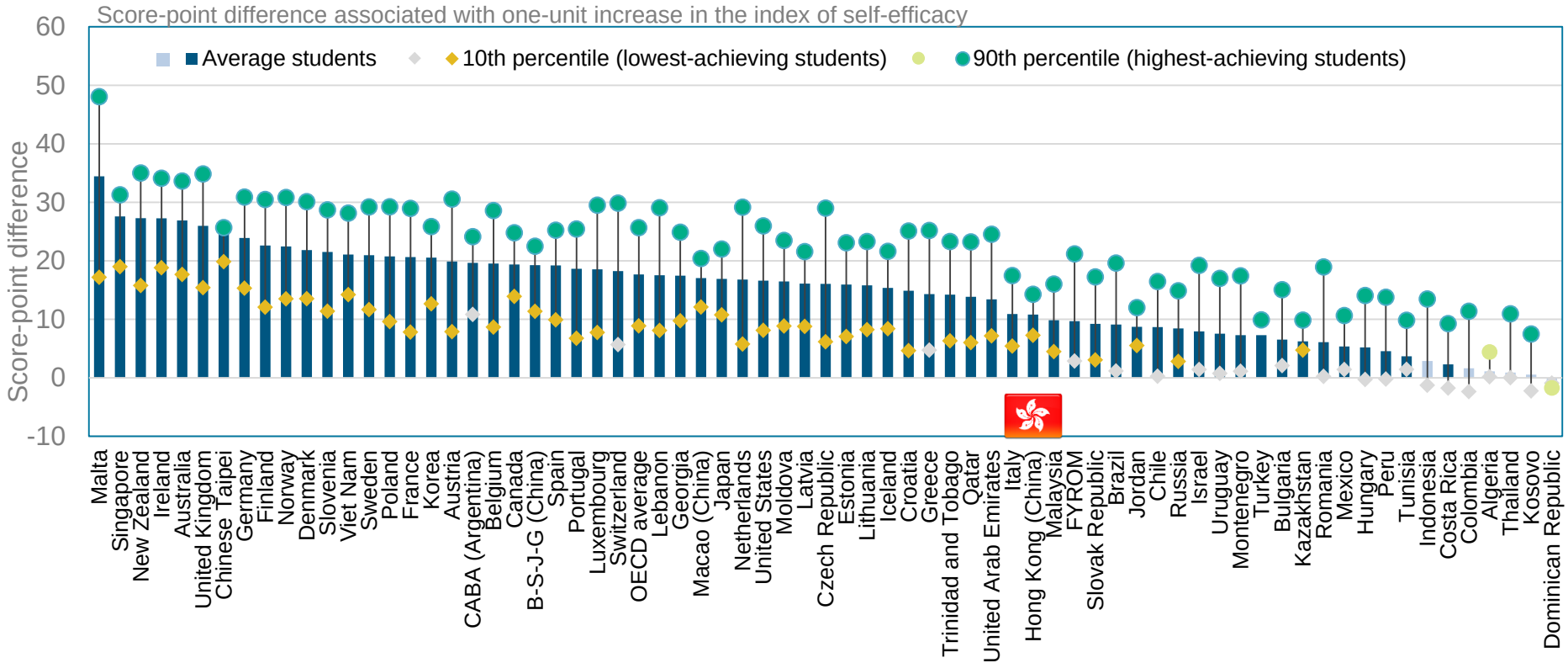


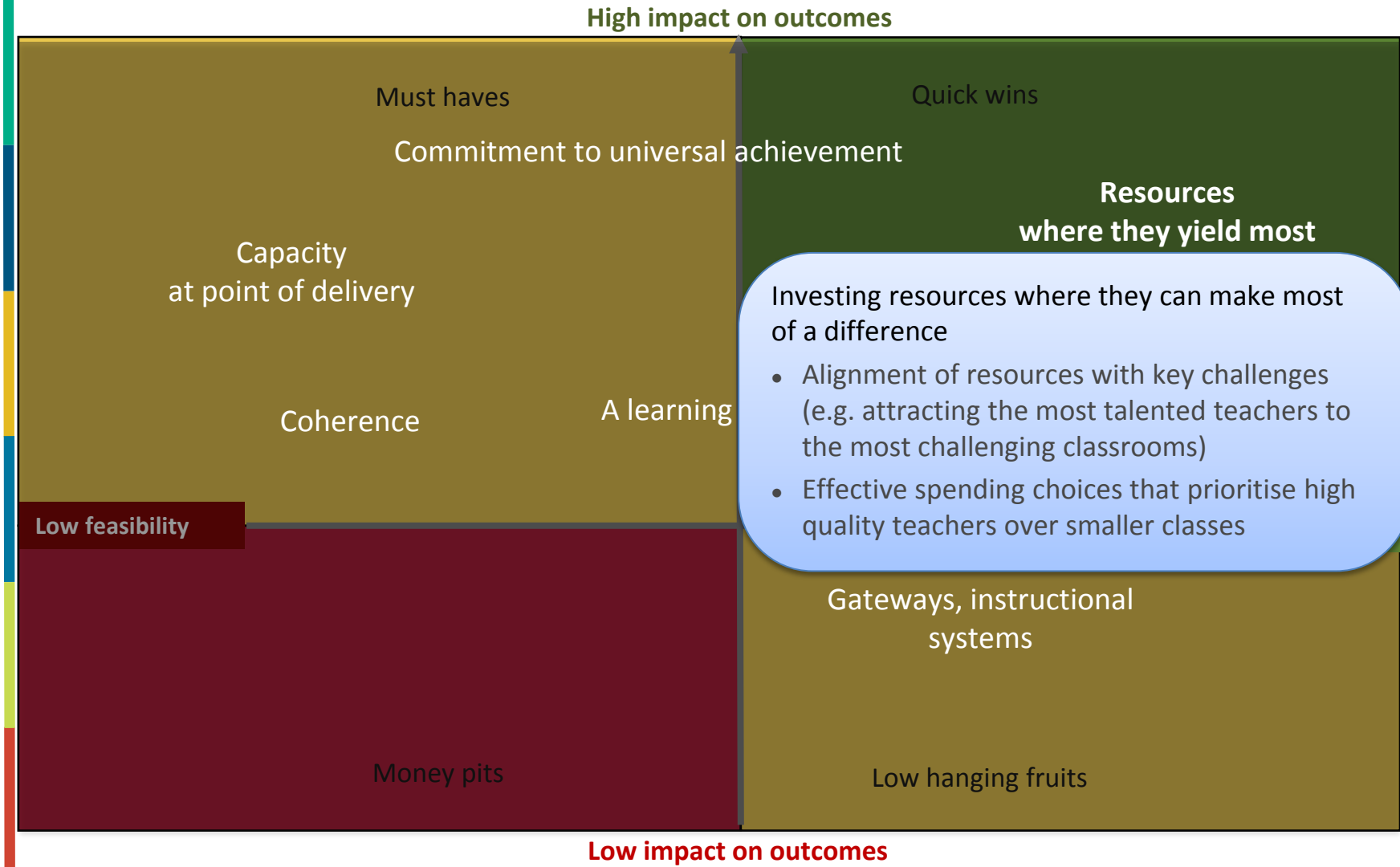

High impact on outcomes
Must haves
Quick wins
Commitment to universal achievement
Resources
where they yield most
Capacity
at point of delivery
Incentive structures and
accountability
Coherence
A learning system
Low feasibility
High feasibility
Gateways, instructional
systems
Money pits
Low hanging fruits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


High impact on outcomes
Must haves
Quick wins
Commitment to universal achievement
Resources
where they yield most
Car
at point
ve structures and
ccountability
Low feasibility
High feasibility
ctional
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
Money pits
Low hanging fruits
Low impact on outcomes

Students' self-efficacy in science and science performance

Figure I.3.22




High impact on outcomes
Must haves
Commitment to universal achievement
Capacity
at point of delivery
Coherence
A learning
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
Low feasibility
Gateways, instructional systems
Money pits
Low hanging fruits
Low impact on outcomes

Inequity in opportunity

Resources

Spending per student from the age of 6 to 15 and science performance

Figure II.6.2

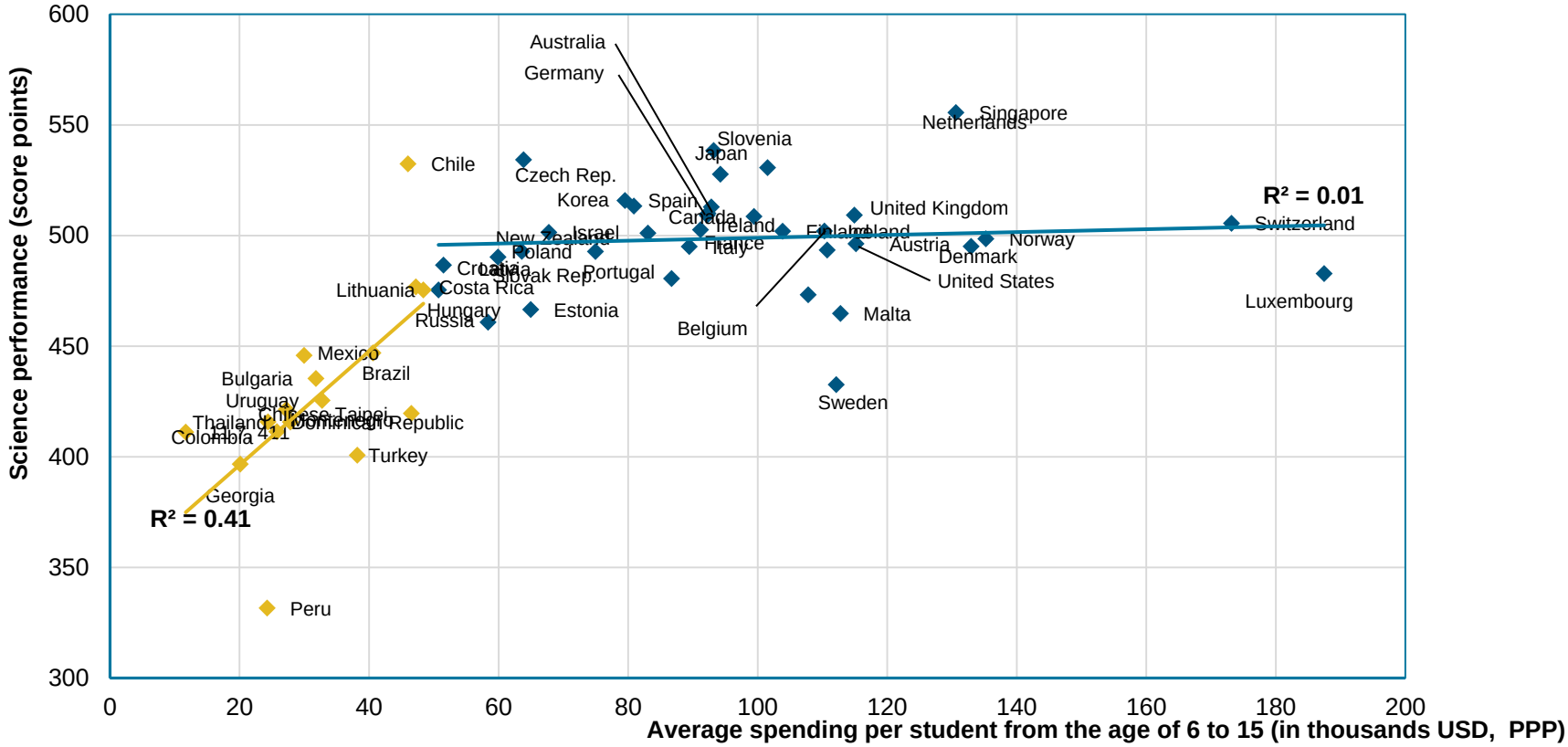
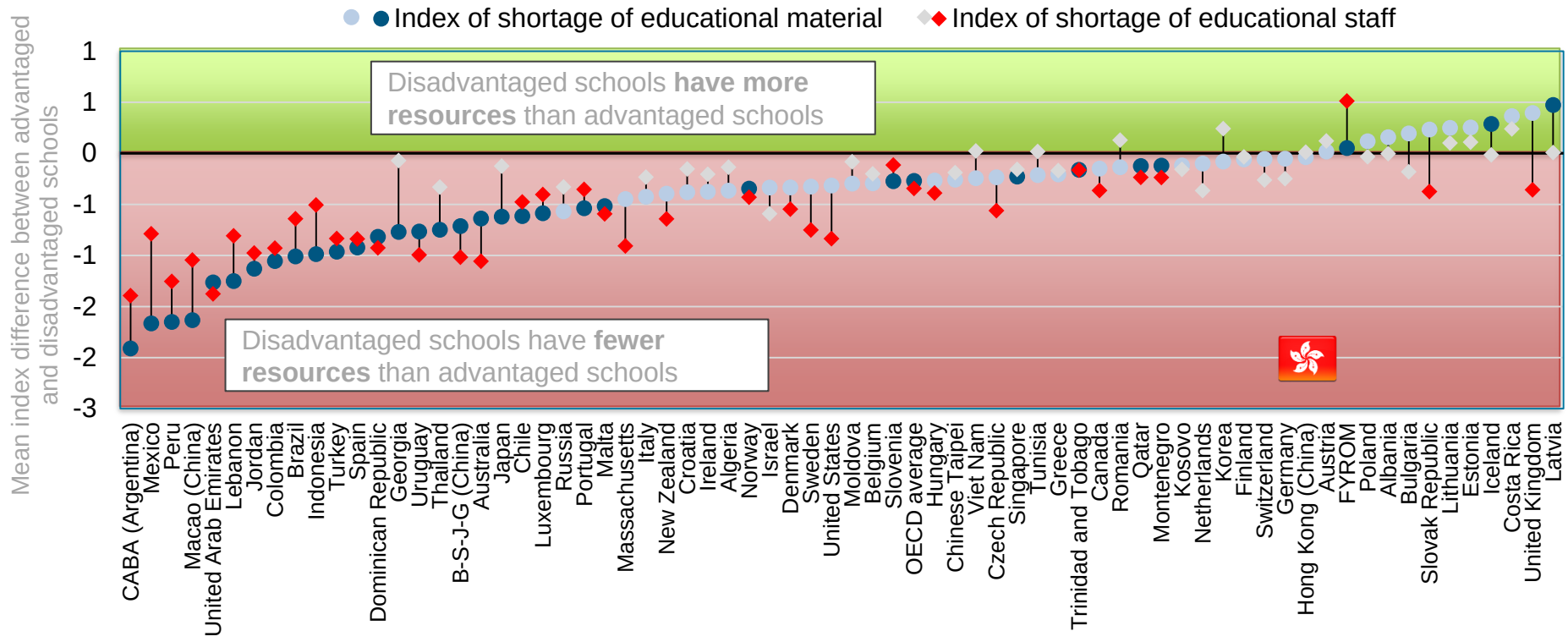


Figure I.6.14

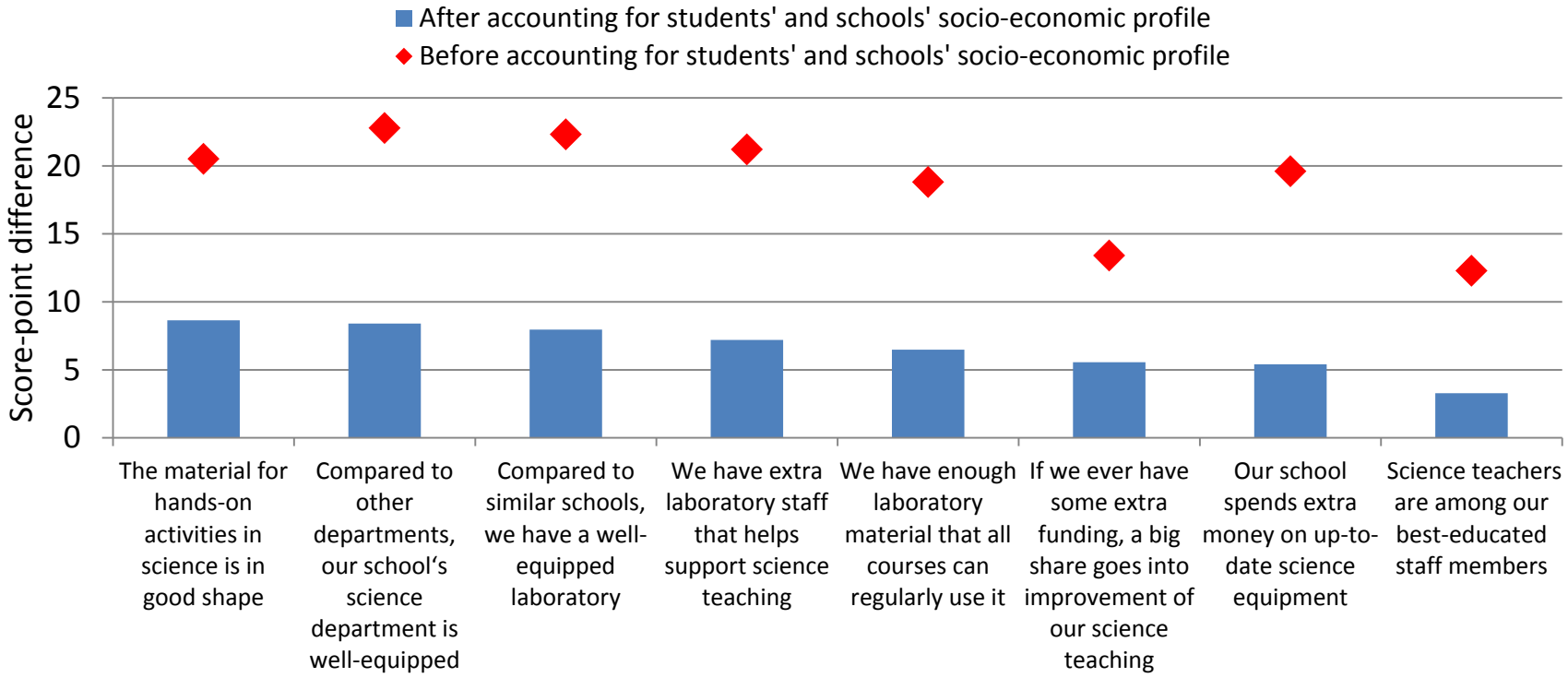
Differences in educational resources

between advantaged and disadvantaged schools



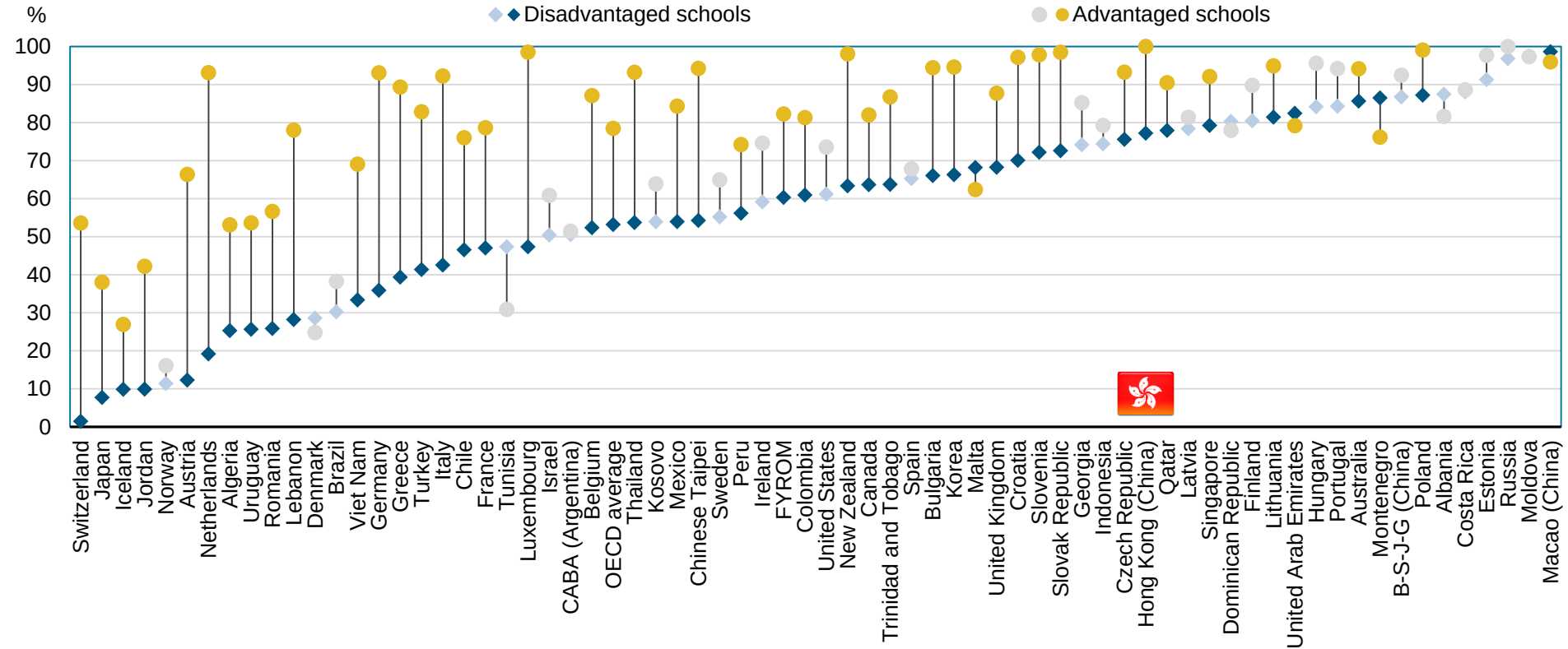
Science-specific resources at school and science performance

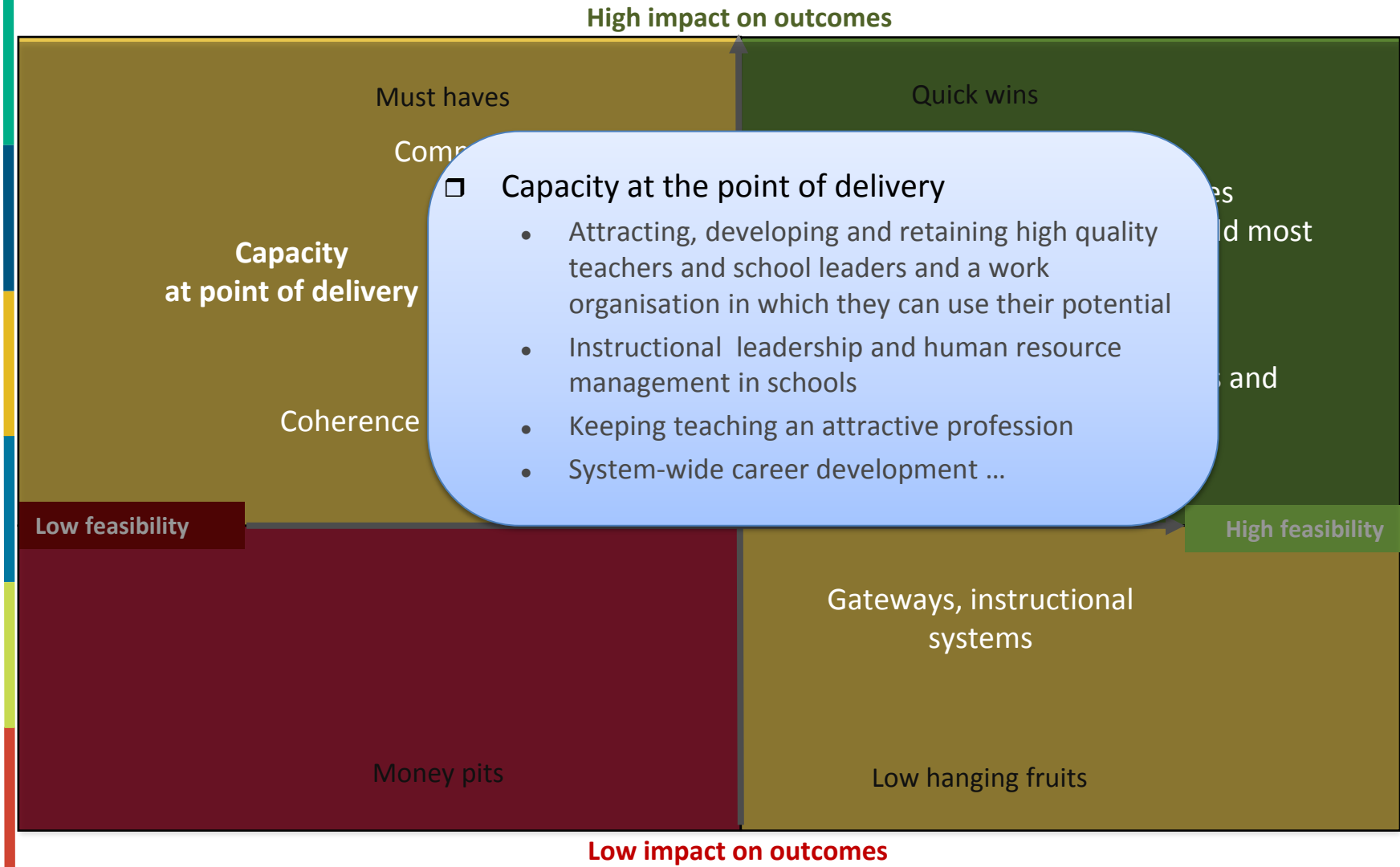
Figure II.2.7



Science competitions offered at school, by schools' socio-economic profile

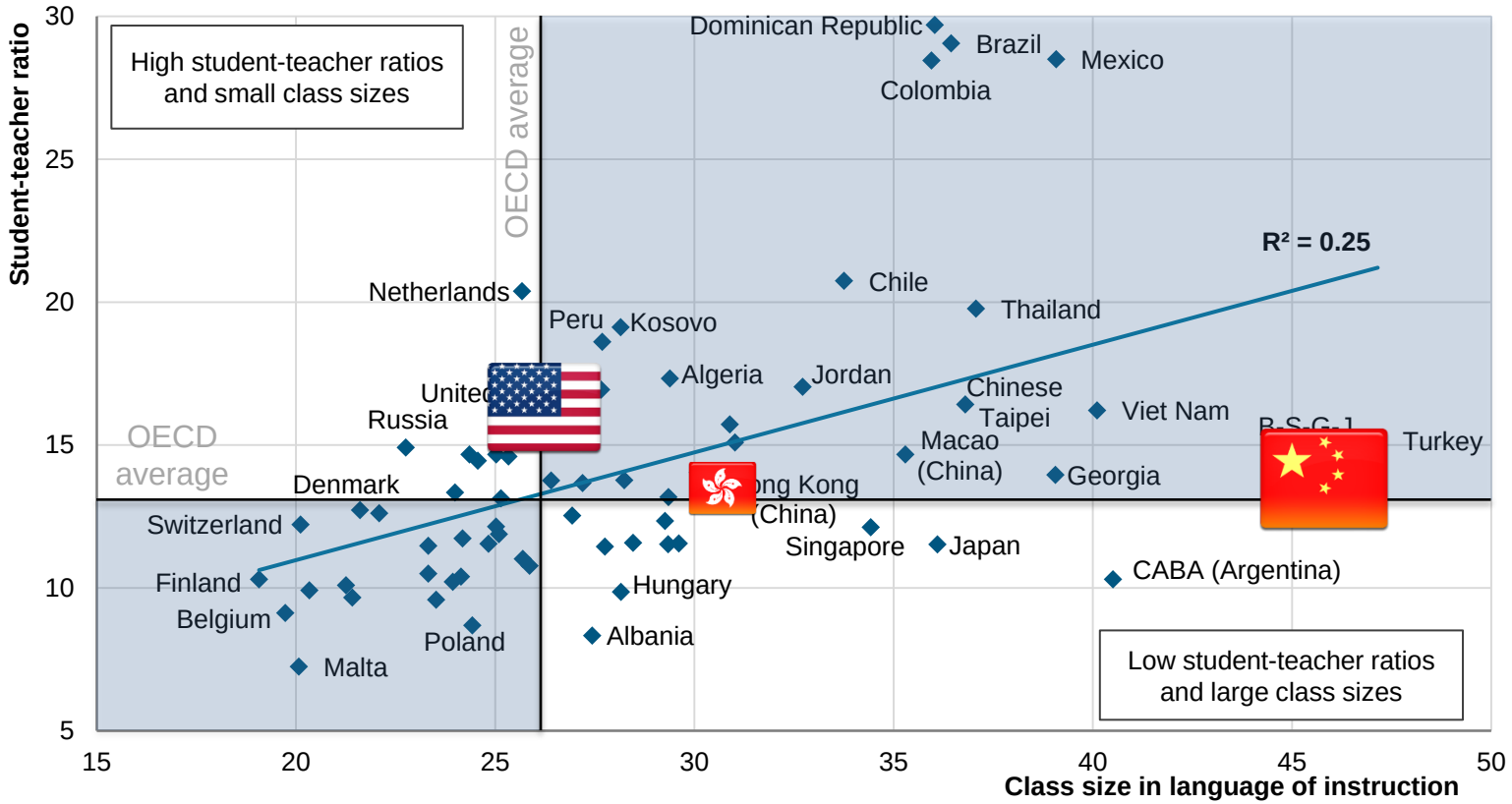
Figure II.2.10





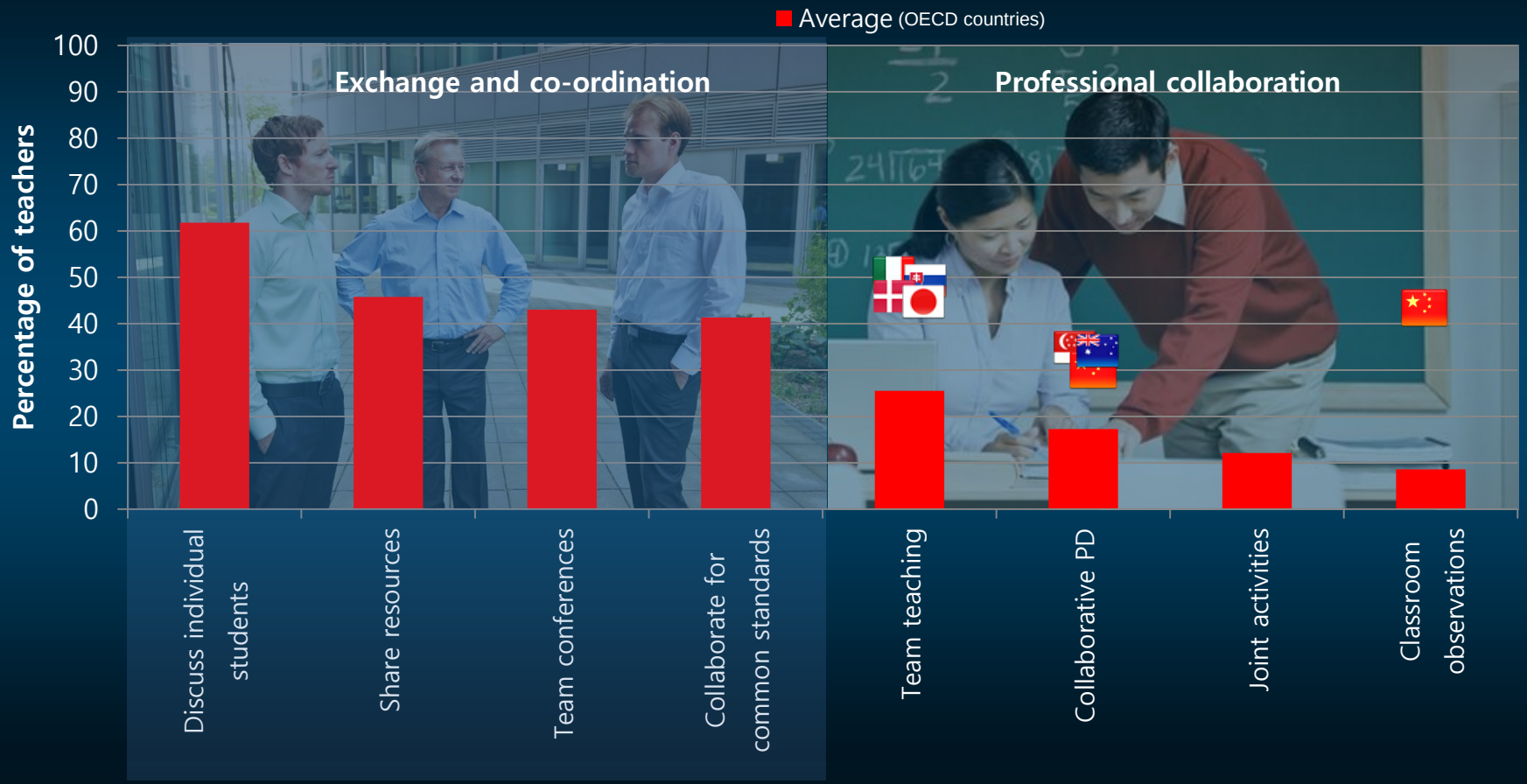
- Capacity at the point of delivery
  - Attracting, developing and retaining high quality teachers and school leaders and a work organisation in which they can use their potential
  - Instructional leadership and human resource management in schools
  - Keeping teaching an attractive profession
  - System-wide career development …

Student-teacher ratios and class size

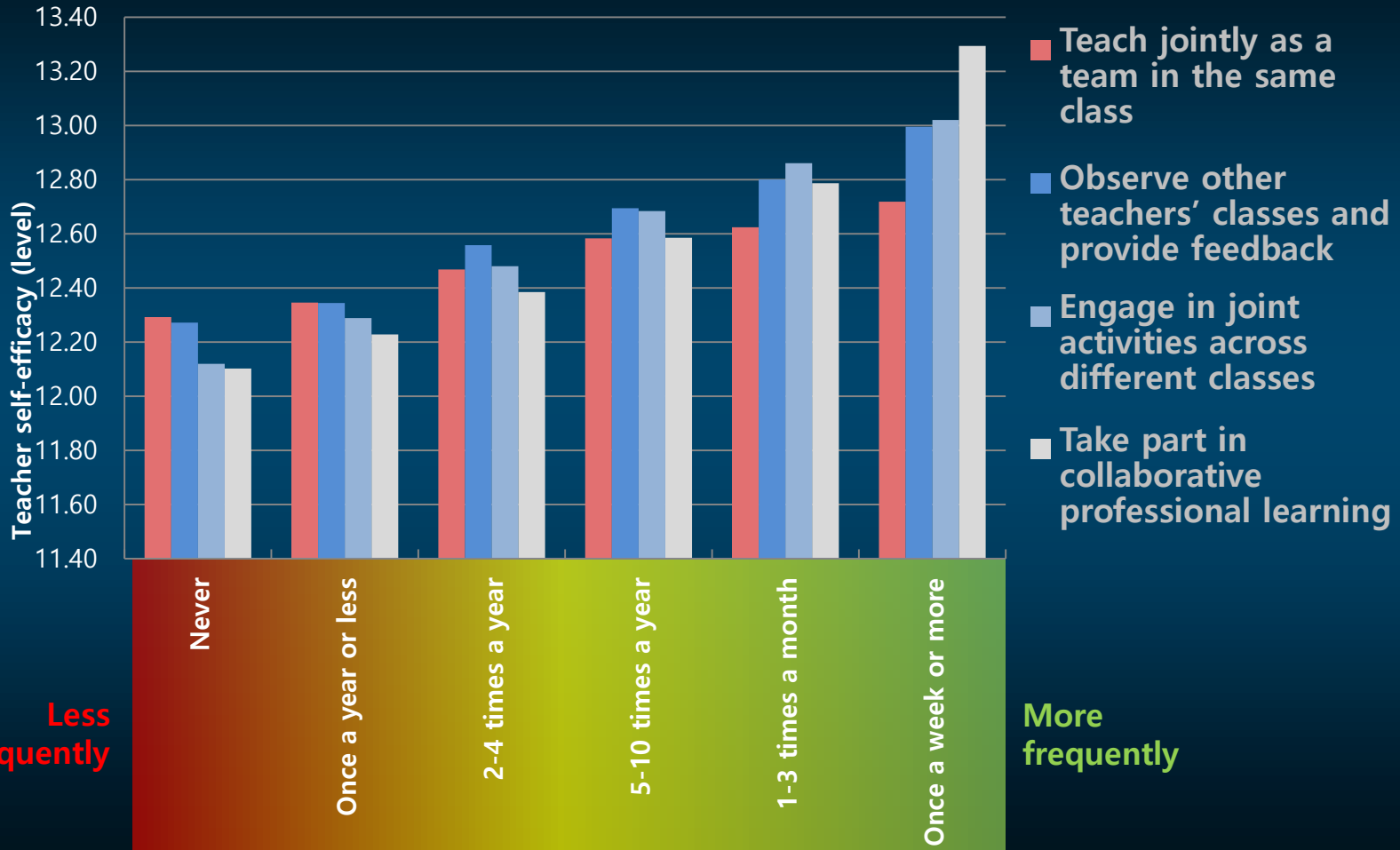


Professional collaboration among teachers

Percentage of lower secondary teachers who report doing the following activities at least once per month

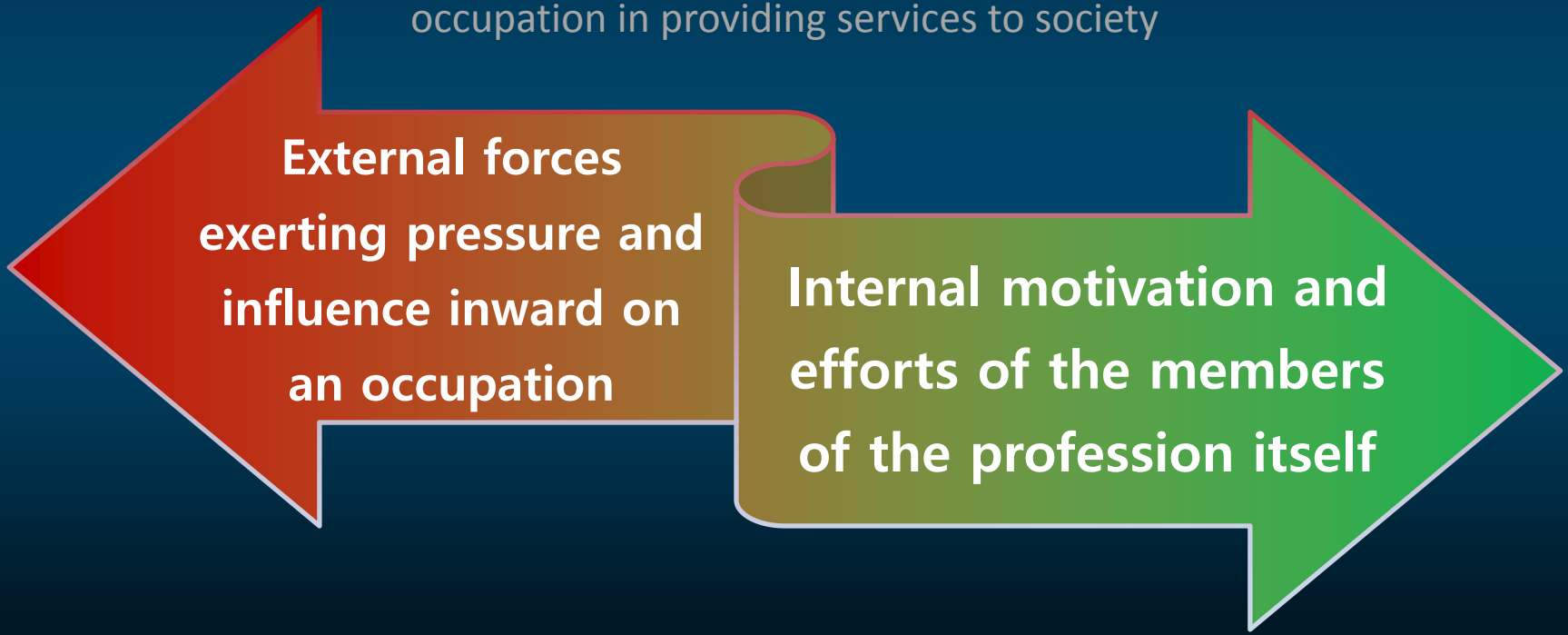


Teachers Self-Efficacy and Professional Collaboration

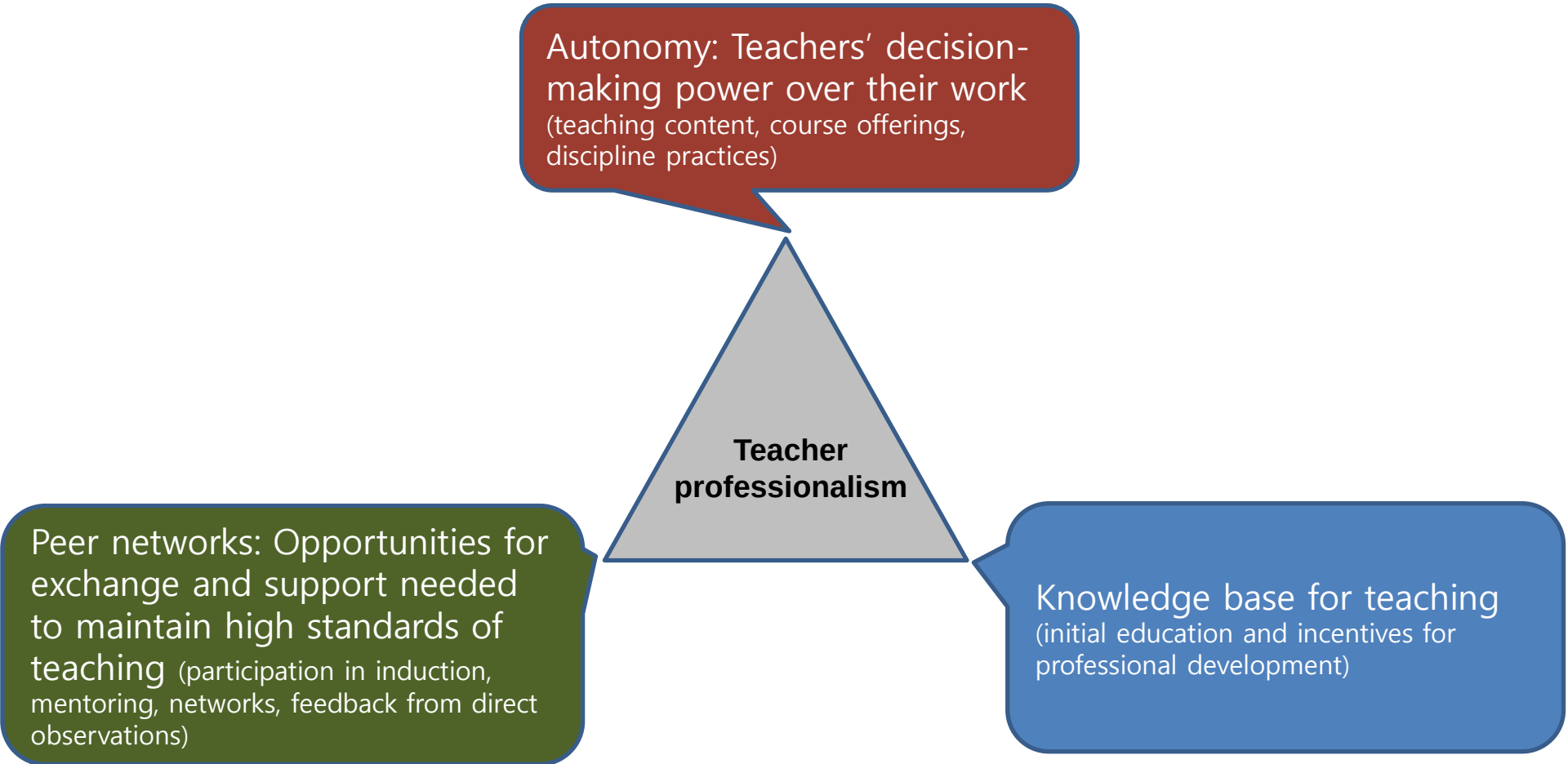


Professionalism

Professionalism is the level of autonomy and internal regulation exercised by members of an occupation in providing services to society

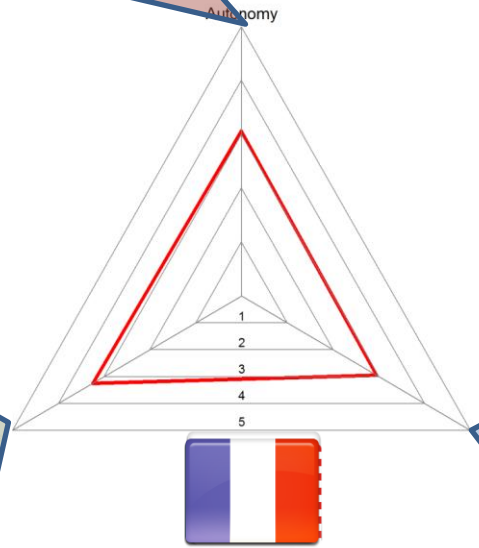


Policy levers to teacher professionalism



Teacher professionalism

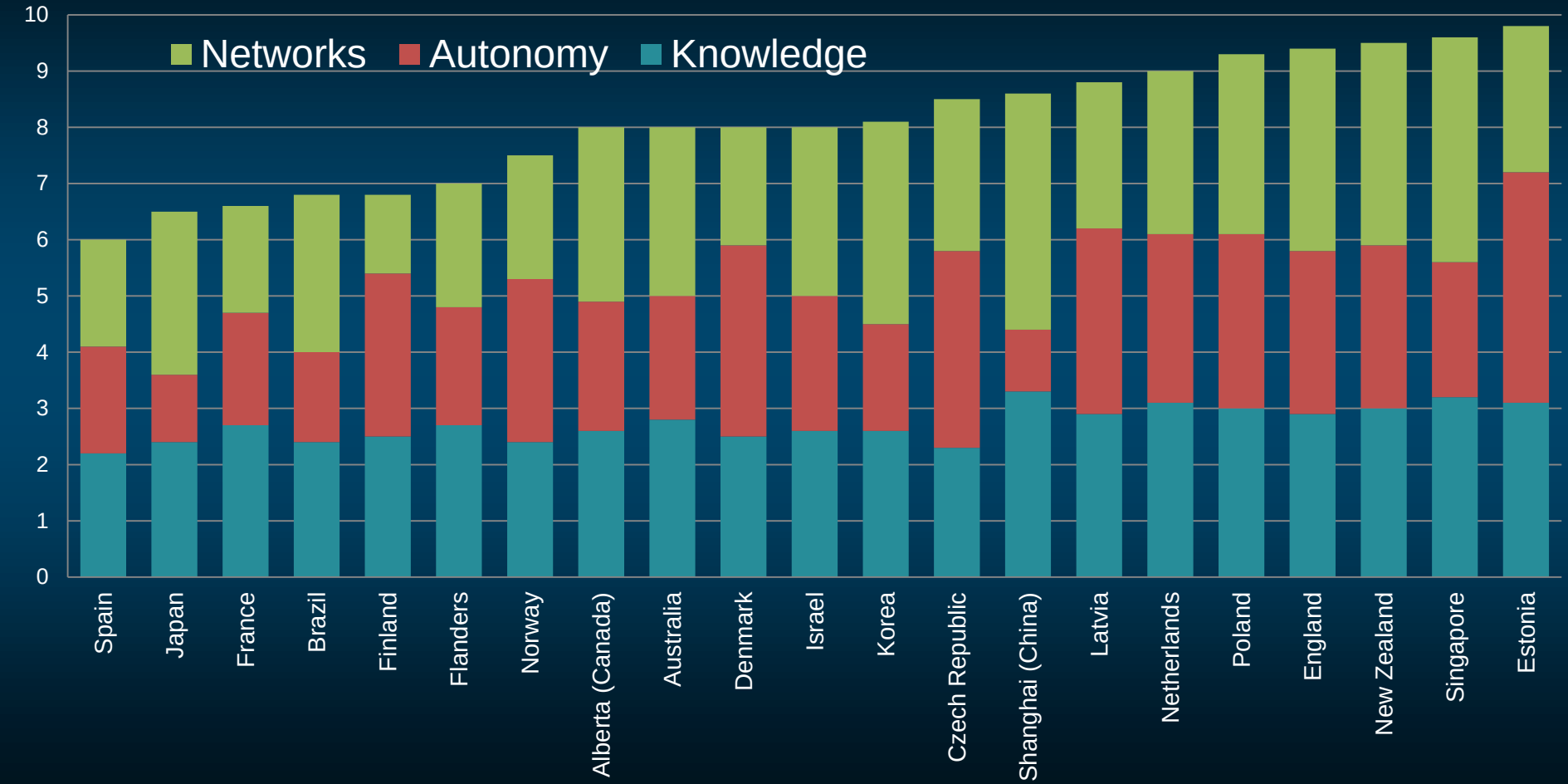
Autonomy: Teachers' decision-making power over their work (teaching content, course offerings, discipline practices)



Peer networks: Opportunities for exchange and support needed to maintain high standards of teaching (participation in induction, mentoring, networks, feedback from direct observations)

Knowledge base for teaching (initial education and incentives for professional development)

TALIS Teacher professionalism index



Teacher professionalism index and teacher outcomes

Students who feel very anxious for a test even if they are well prepared

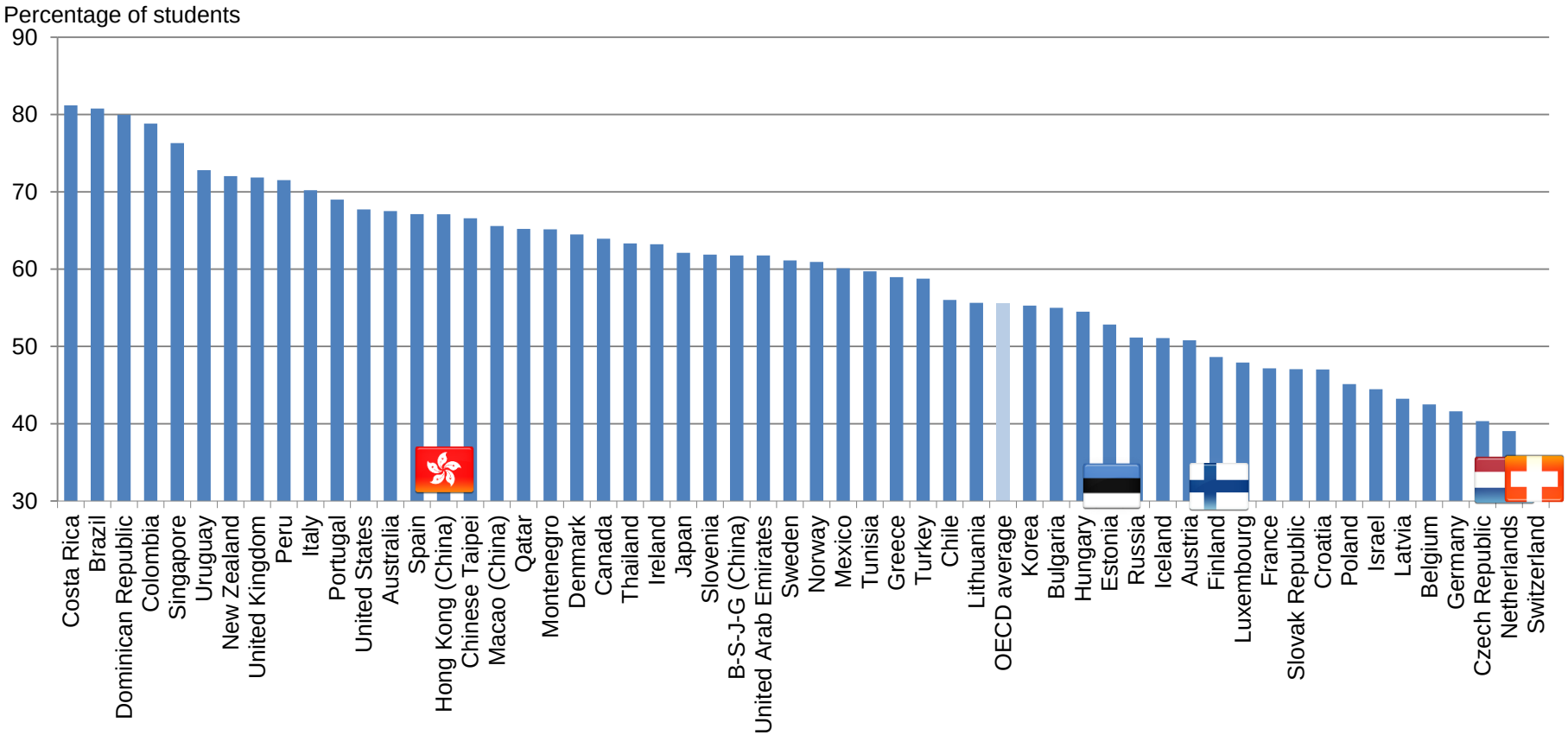
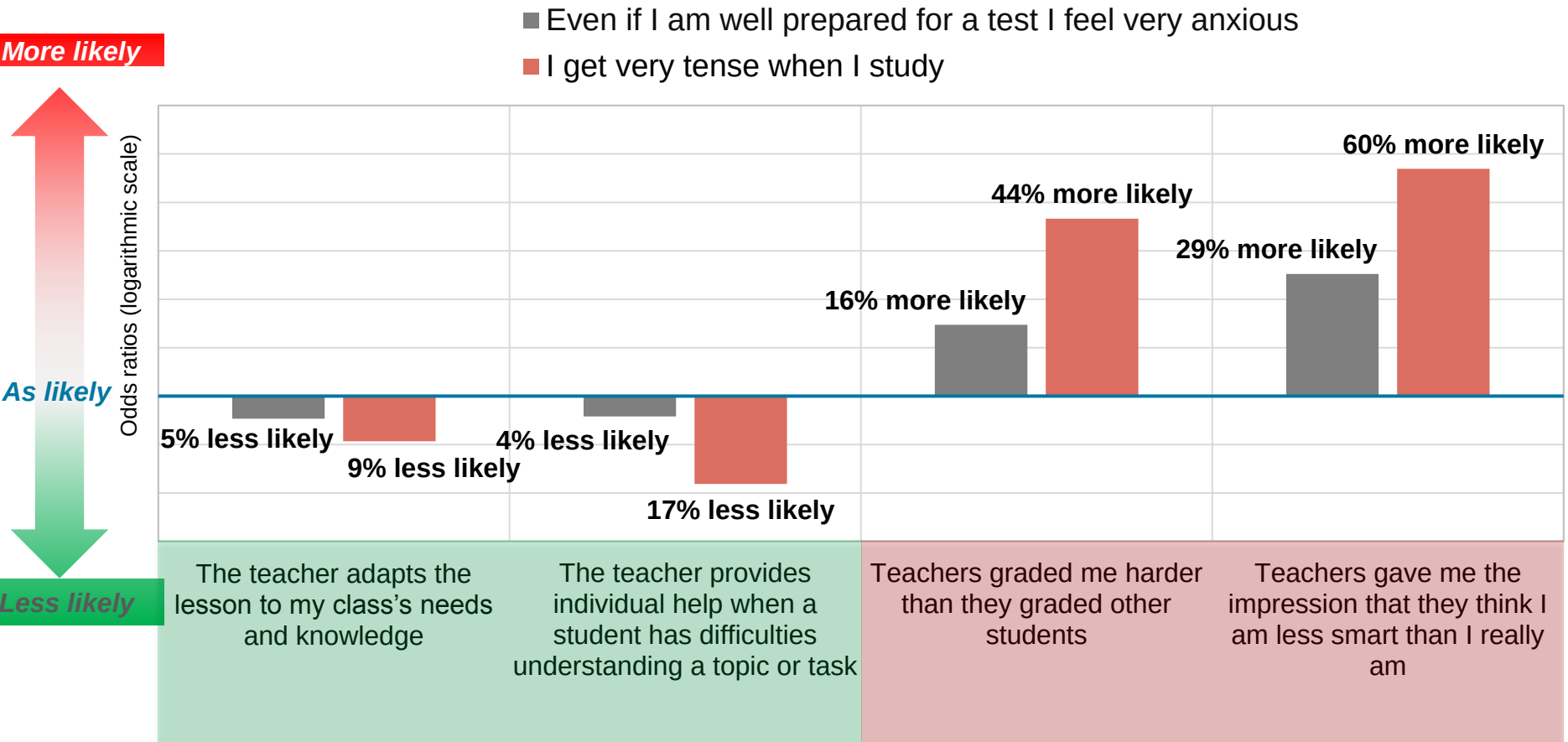


Figure III.4.1

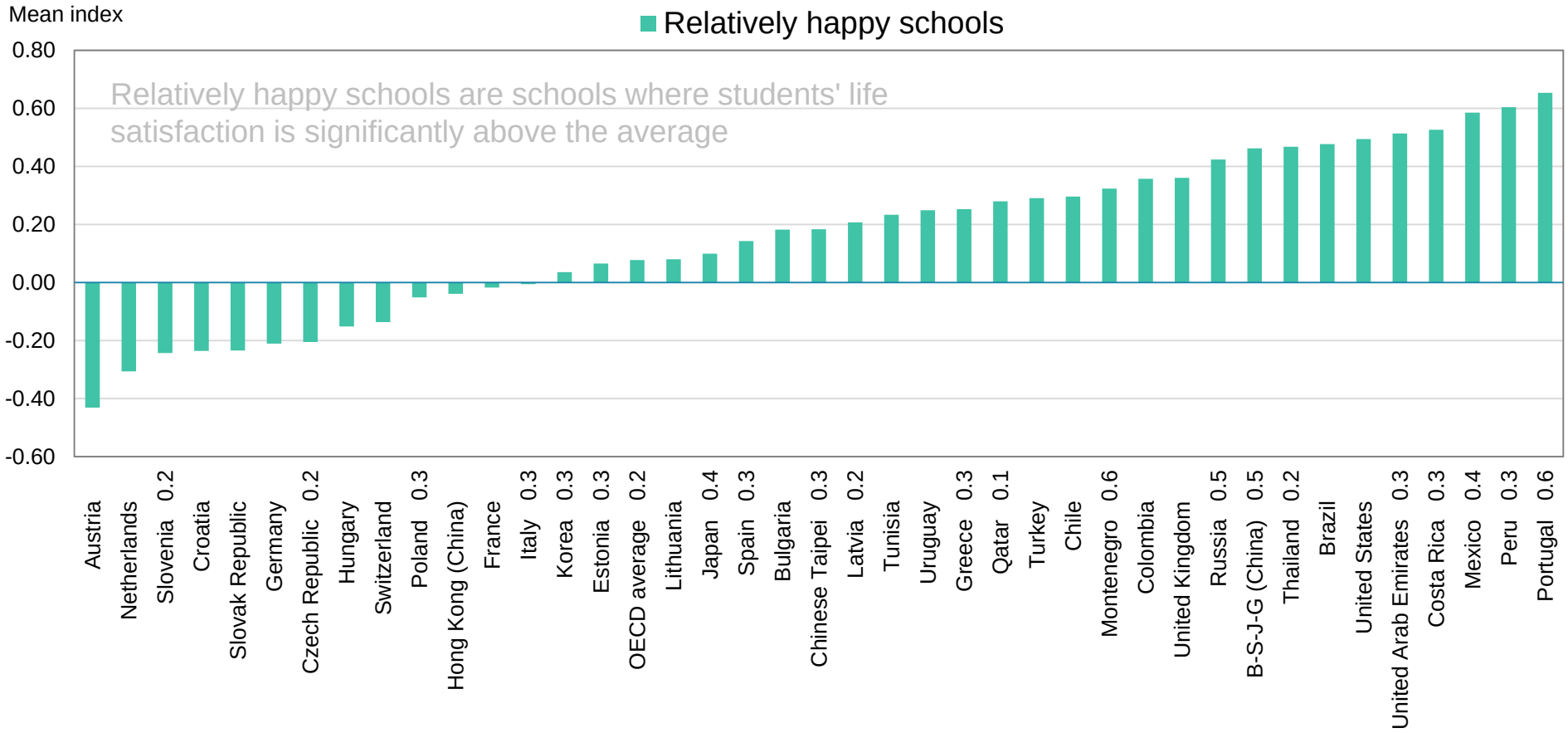
More teacher support and less anxiety

Figure III.4.5



Teacher support is higher in "happy" schools

Figure III.3.7



Lessons from PISA

High impact on outcomes

Must haves

Quick wins

Commitment to universal achievement

Resources
where they yield most

Capacity
at point of delivery

Incentive structures and
accountability

Coherence

A learning system

- 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

High feasibility

Gateways, instructional systems

Low hanging fruits

Low impact on outcomes

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

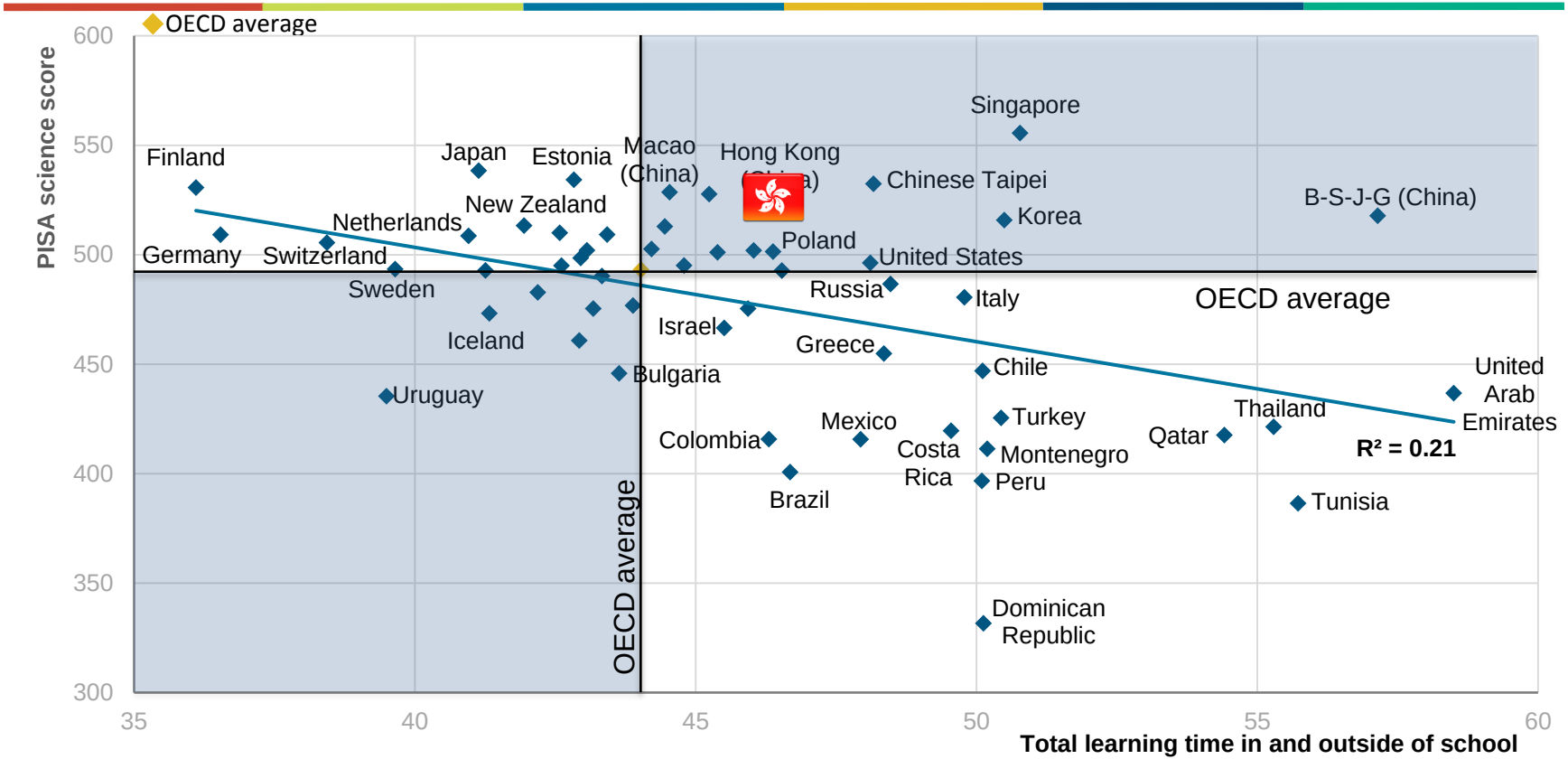
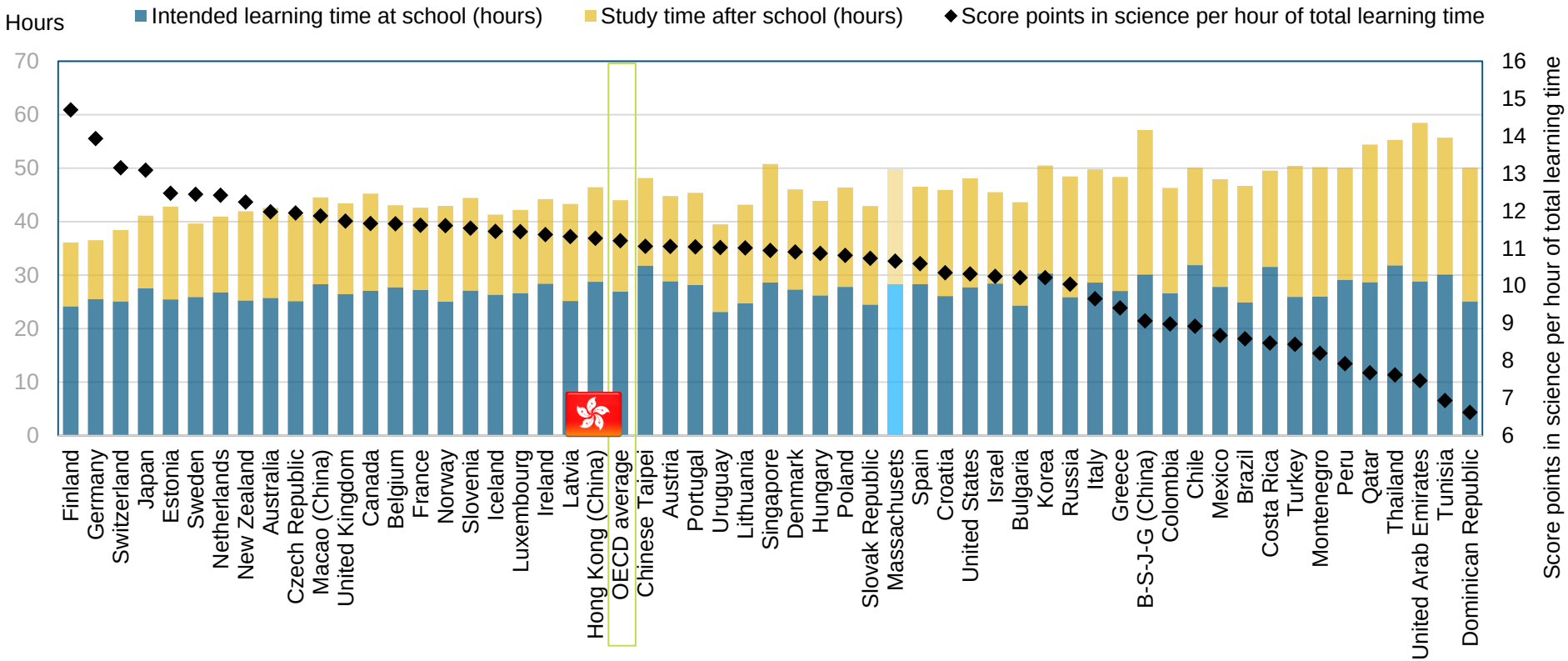


Figure II.6.23

Learning time and science performance



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

What teachers say and what teachers do

lge, skills
alities do
require?

lge, skills
alities do
require?

74%: Thinking and reasoning is more important than curriculum content

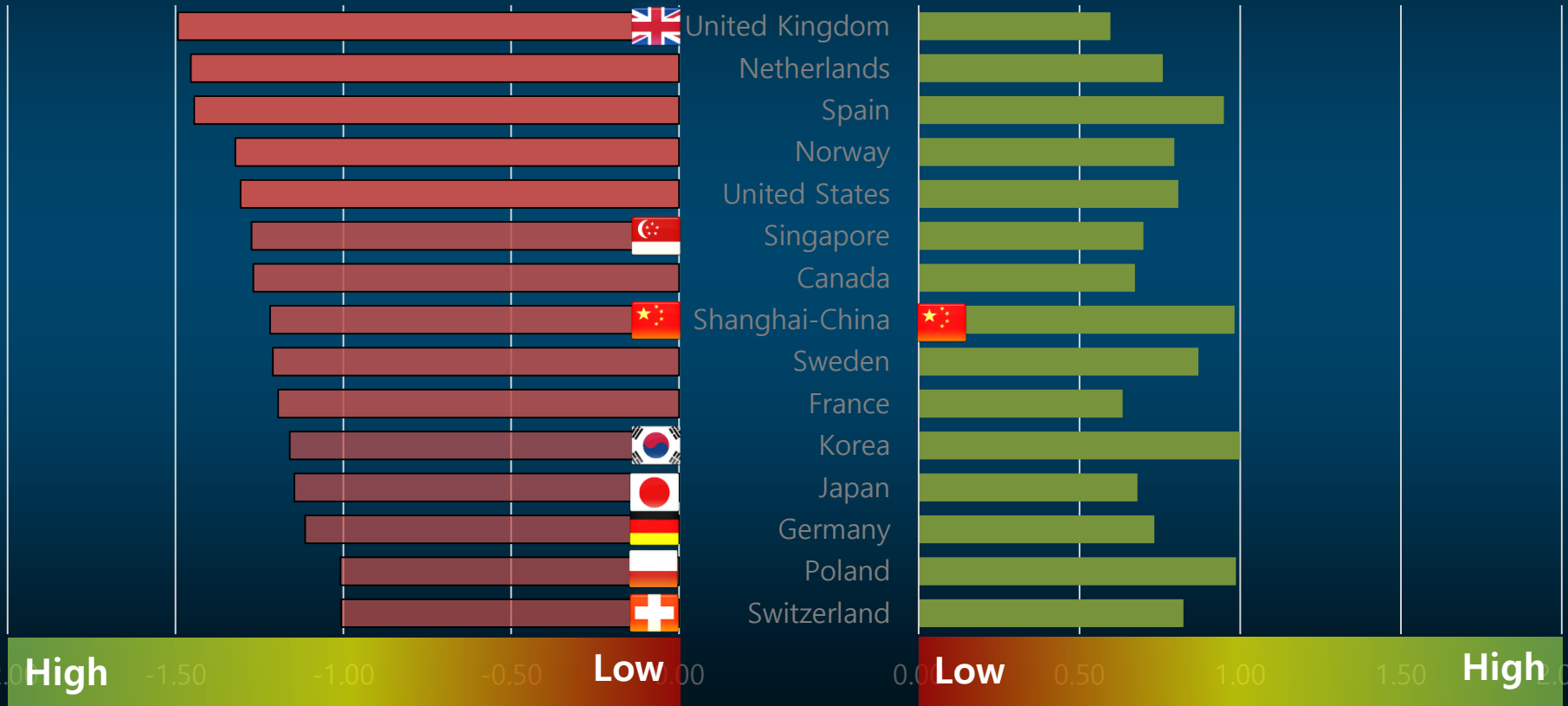
lge, skills
alities do
require?

Prevalence of memorisation

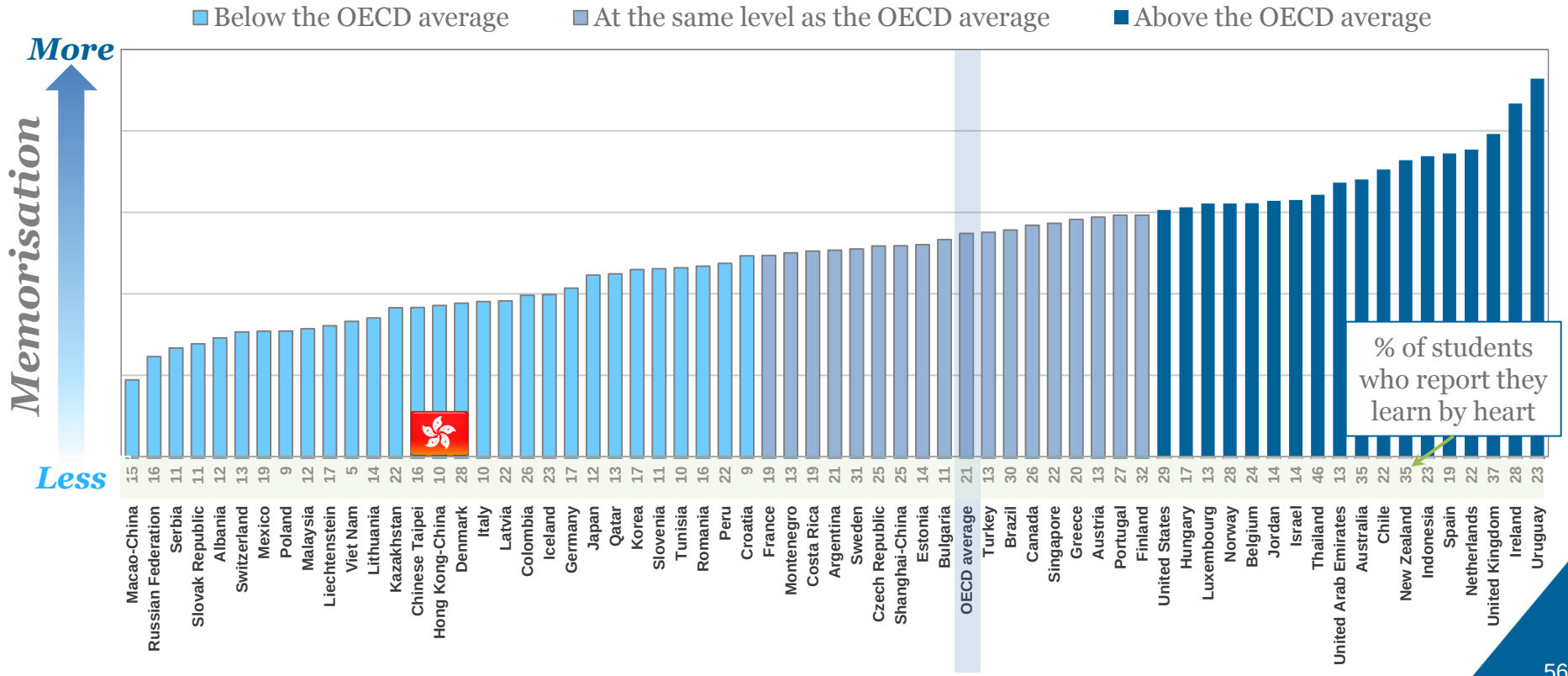
rehearsal, routine exercises, drill and practice and/or repetition

Prevalence of elaboration

reasoning, deep learning, intrinsic motivation, critical thinking, creativity, non-routine problems

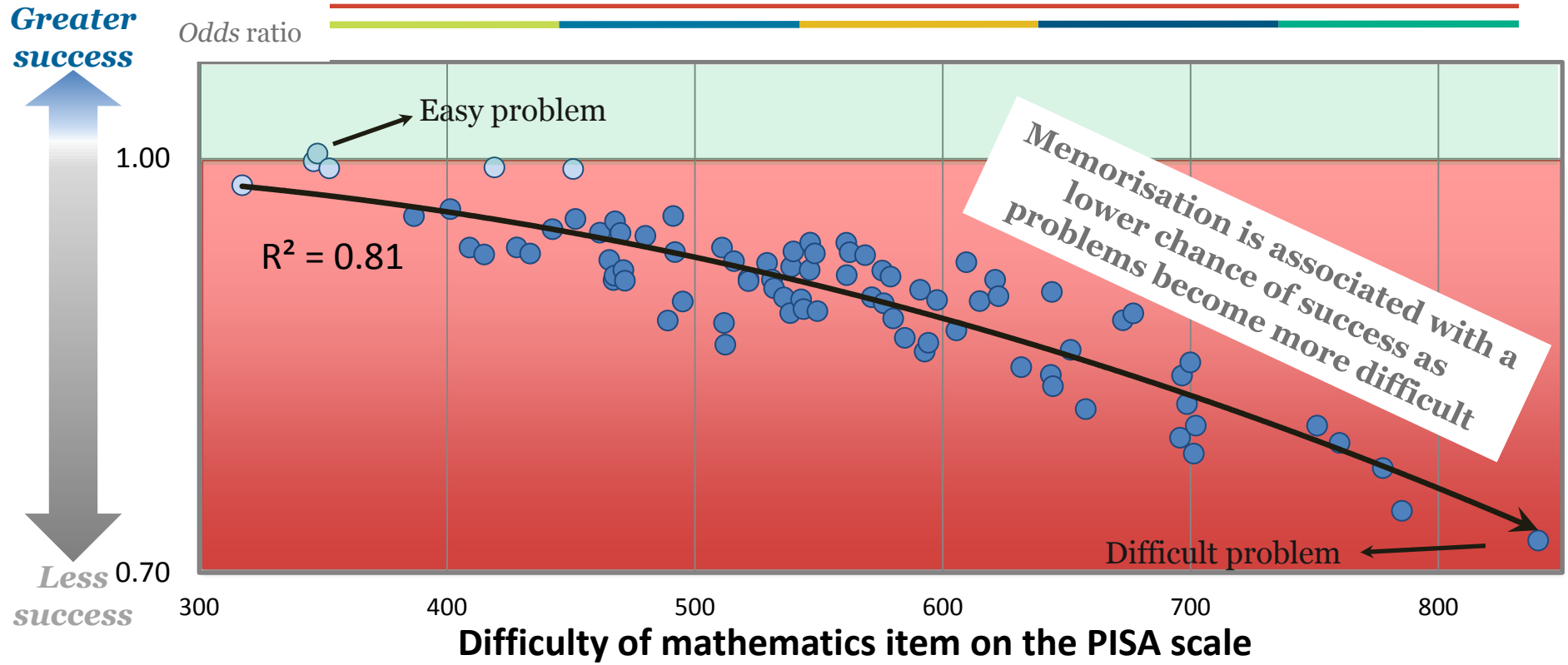


Students' use of **memorisation strategies**



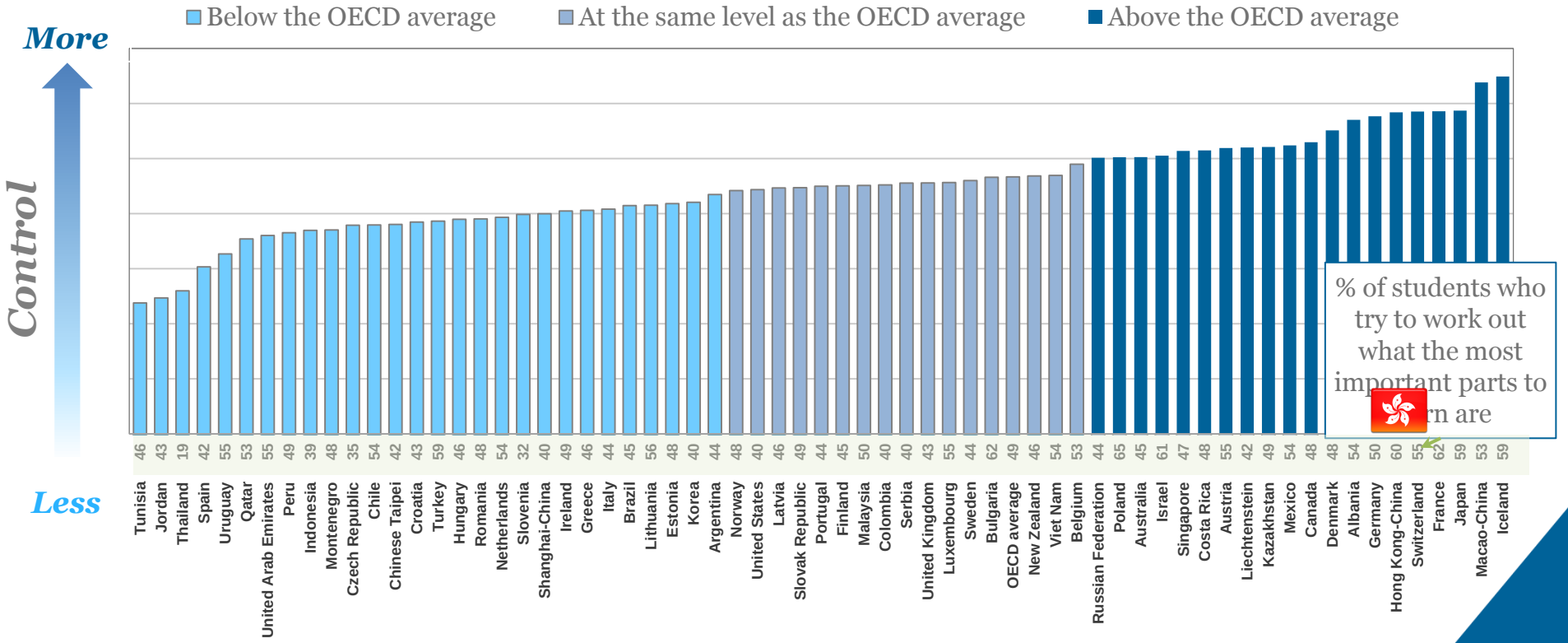
Source: Figure 4.1

Memorisation is **less useful** as problems become **more difficult** *(OECD average)*



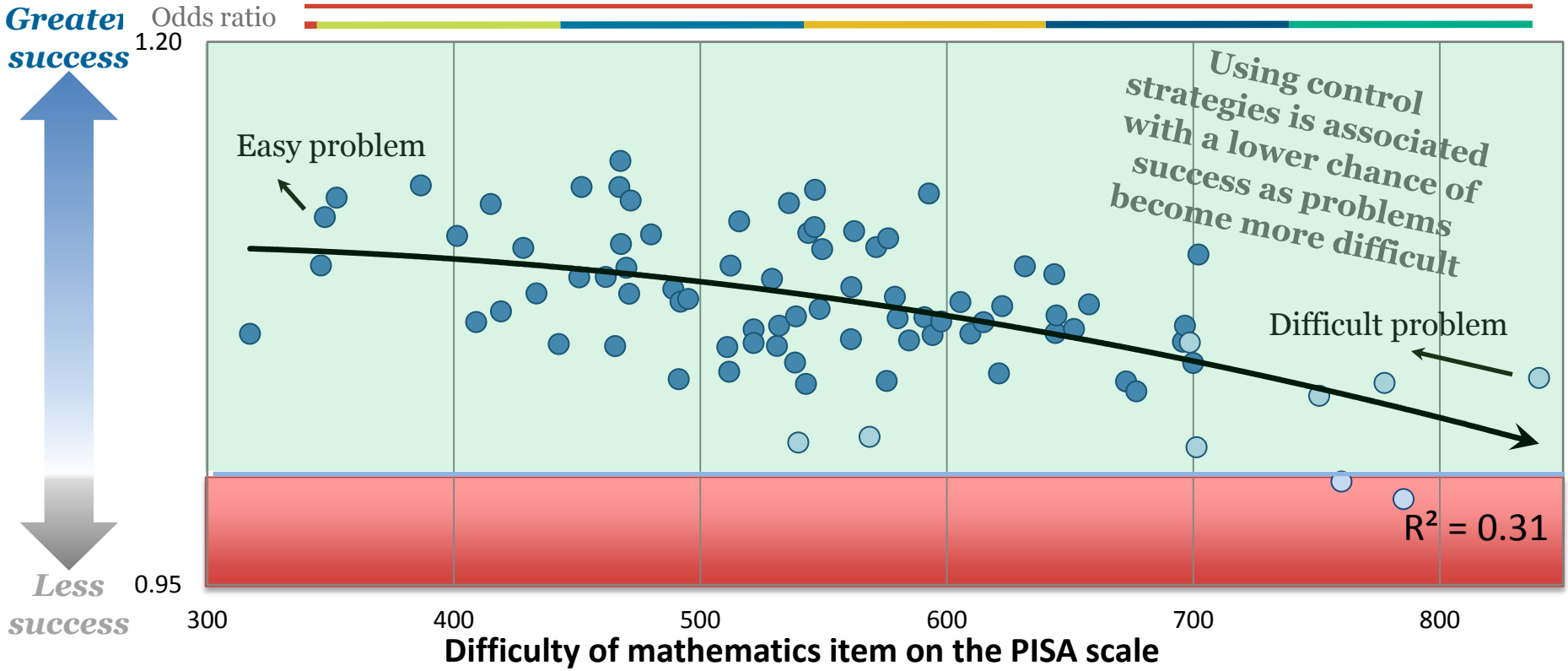
Source: Figure 4.3

There are large international differences in the use of **control strategies**



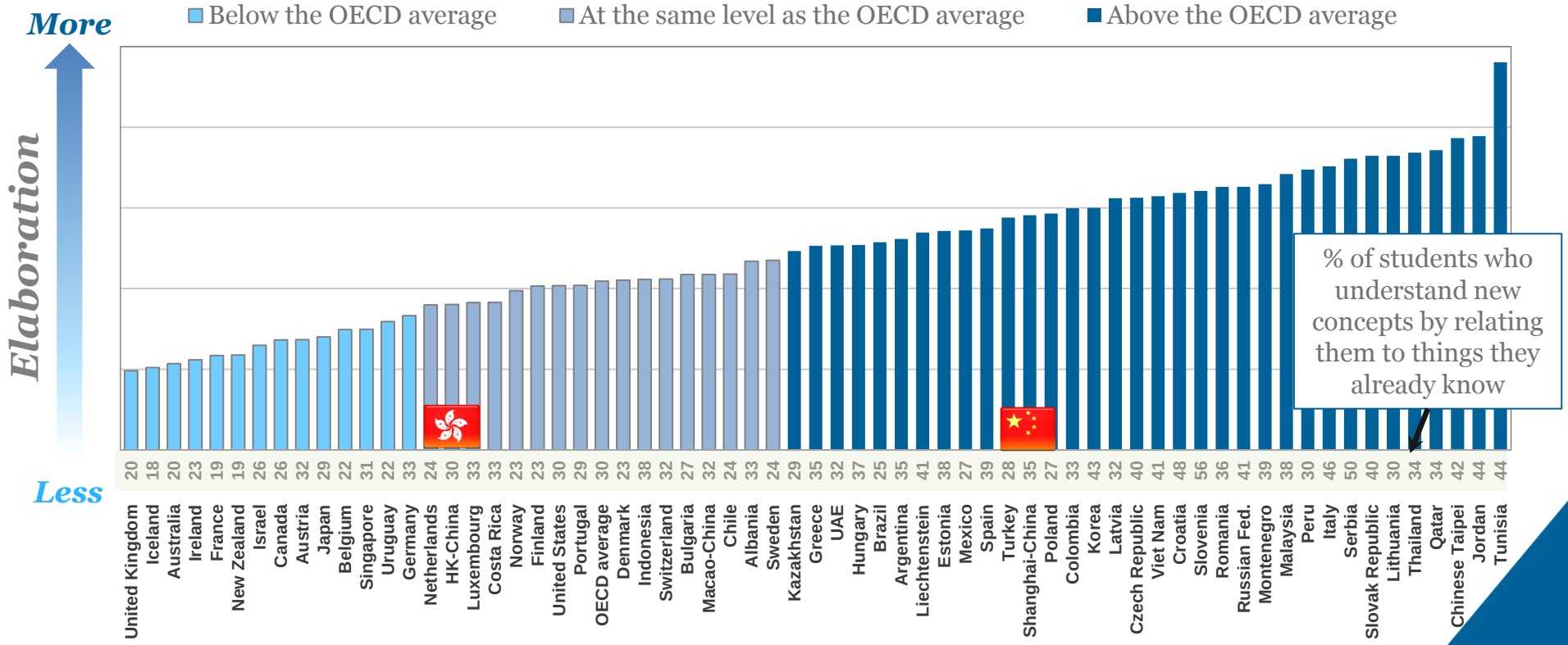
Source: Figure 5.1

Control strategies are **always helpful** but **less so** as problems become **more difficult** *(OECD average)*



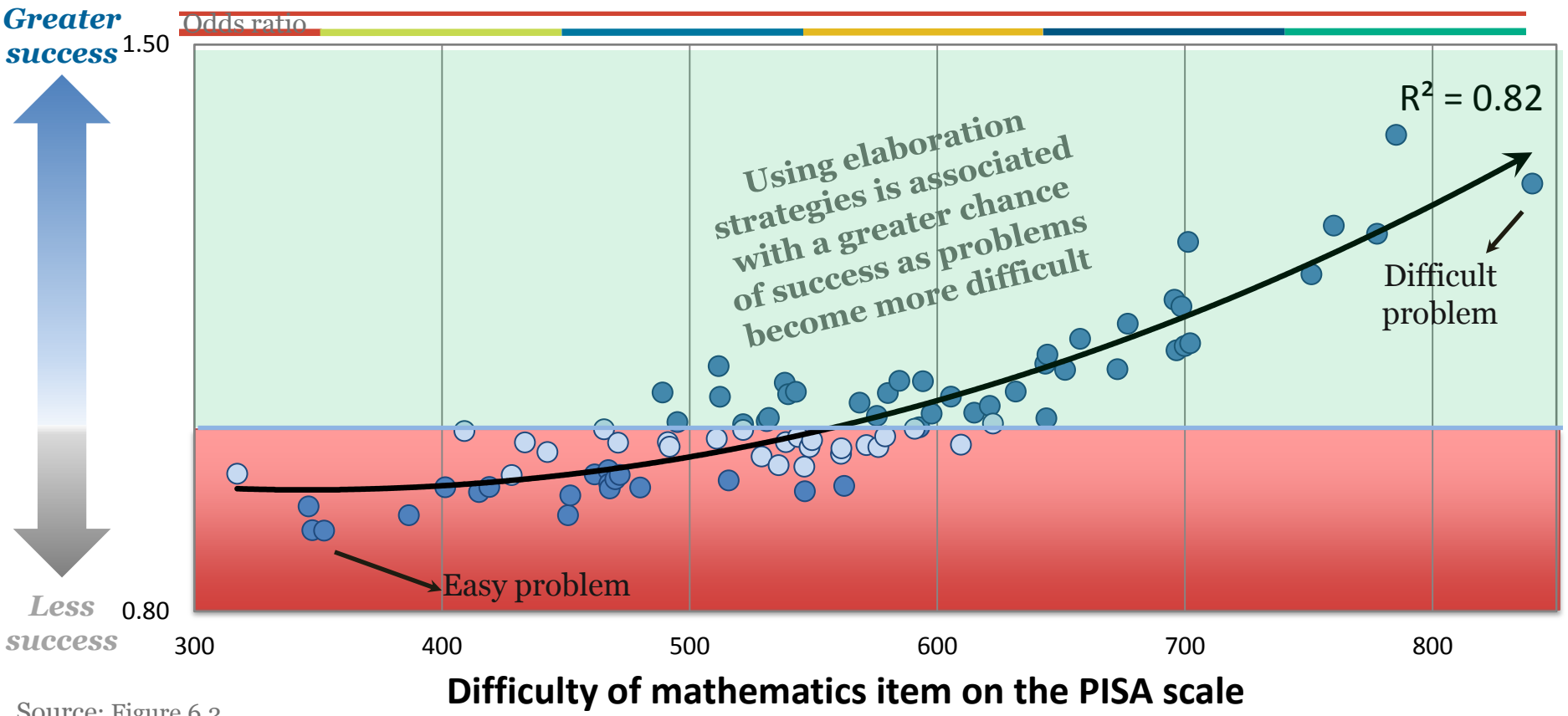
Source: Figure 5.2

Students' use of **elaboration strategies**



Source: Figure 6.1

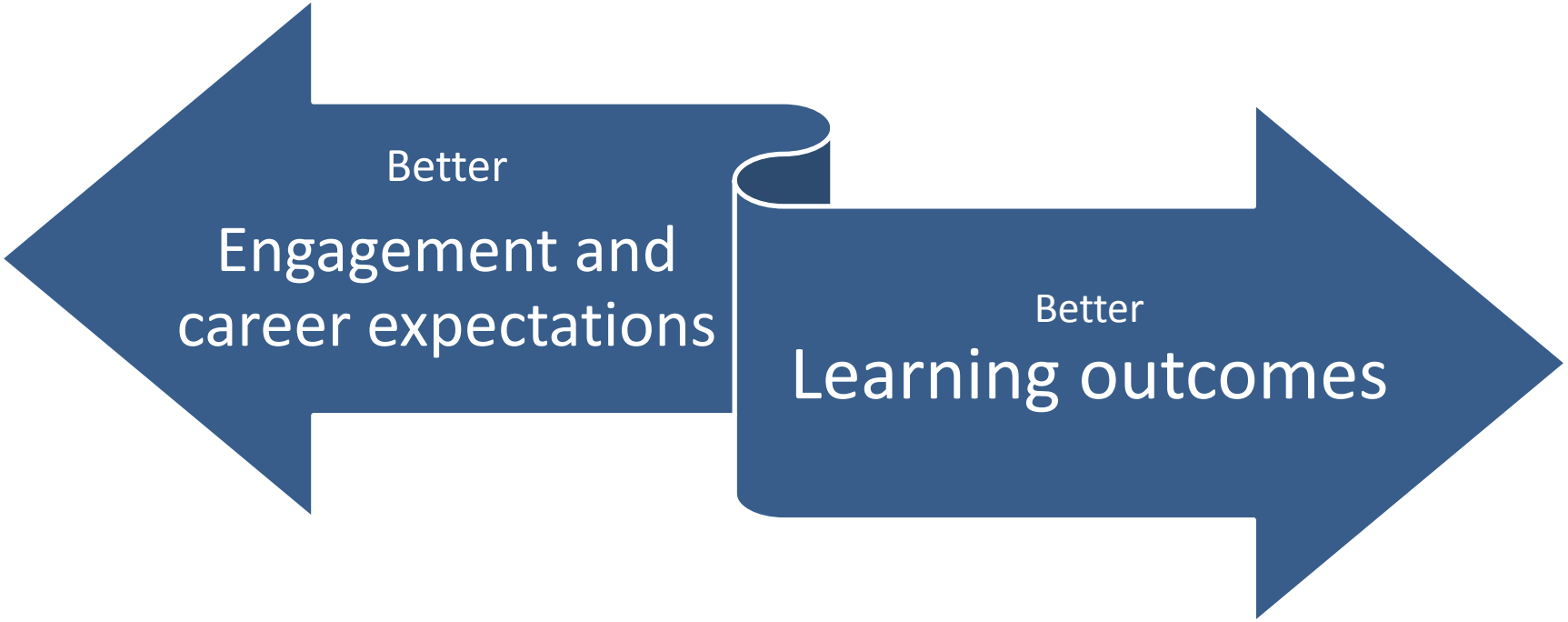
Elaboration strategies are **more useful** as problems become **more difficult** *(OECD average)*

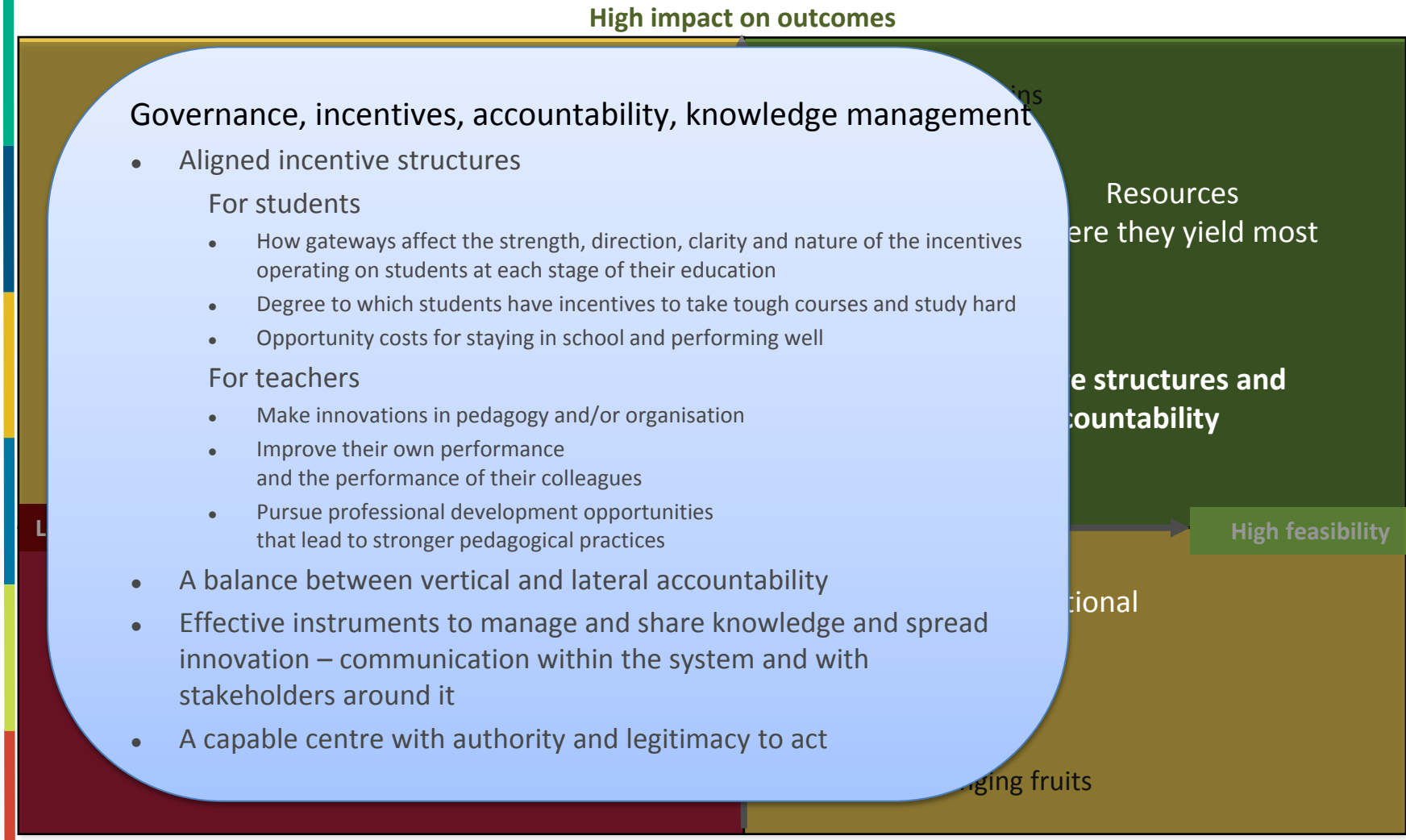


Source: Figure 6.2

Teaching and **learning strategies** in **mathematics**

Approaches to teaching



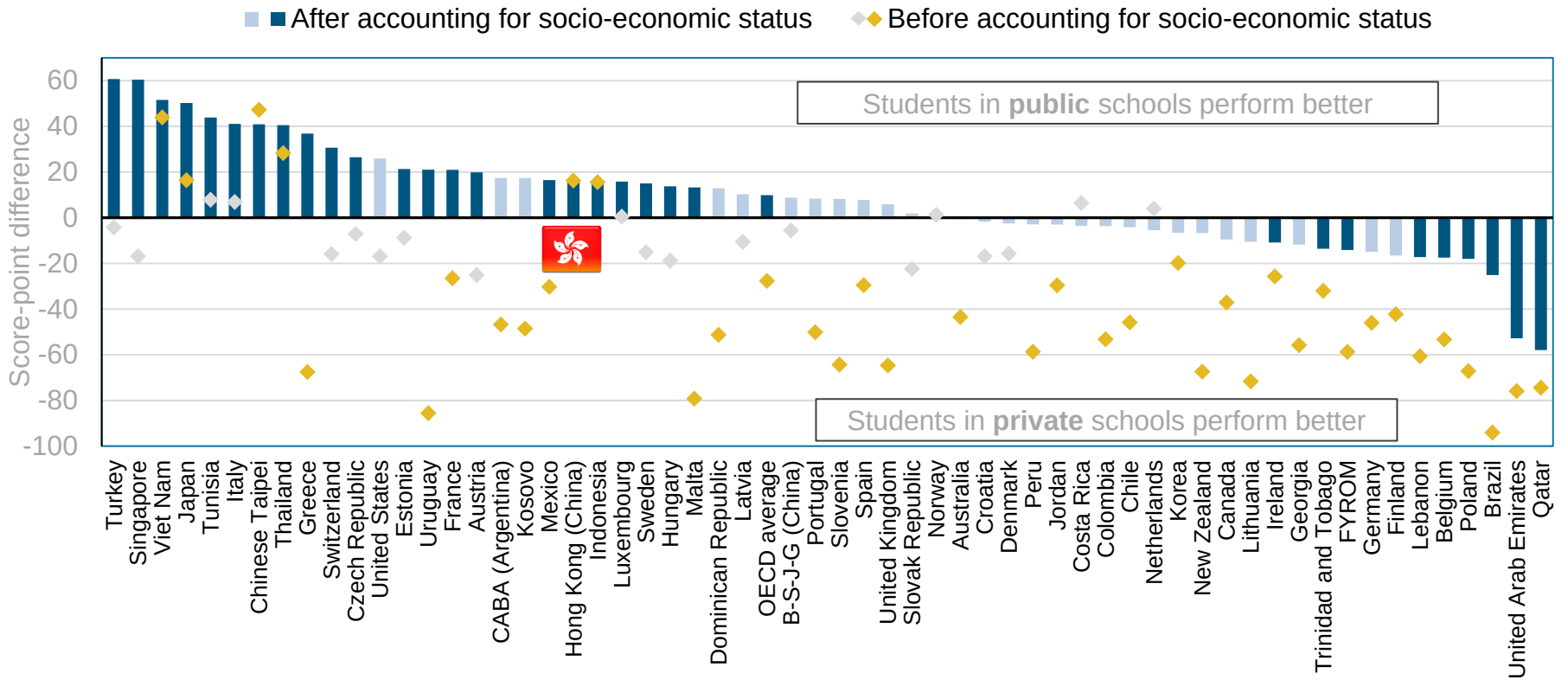

High impact on outcomes
Governance, incentives, accountability, knowledge management
• Aligned incentive structures
For students
• How gateways affect the strength, direction, clarity and nature of the incentives operating on students at each stage of their education
• Degree to which students have incentives 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
Resources
ere they yield most
e structures and
countability
High feasibility
tional
ging fruits
Low impact on outcomes

Public and private schools

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

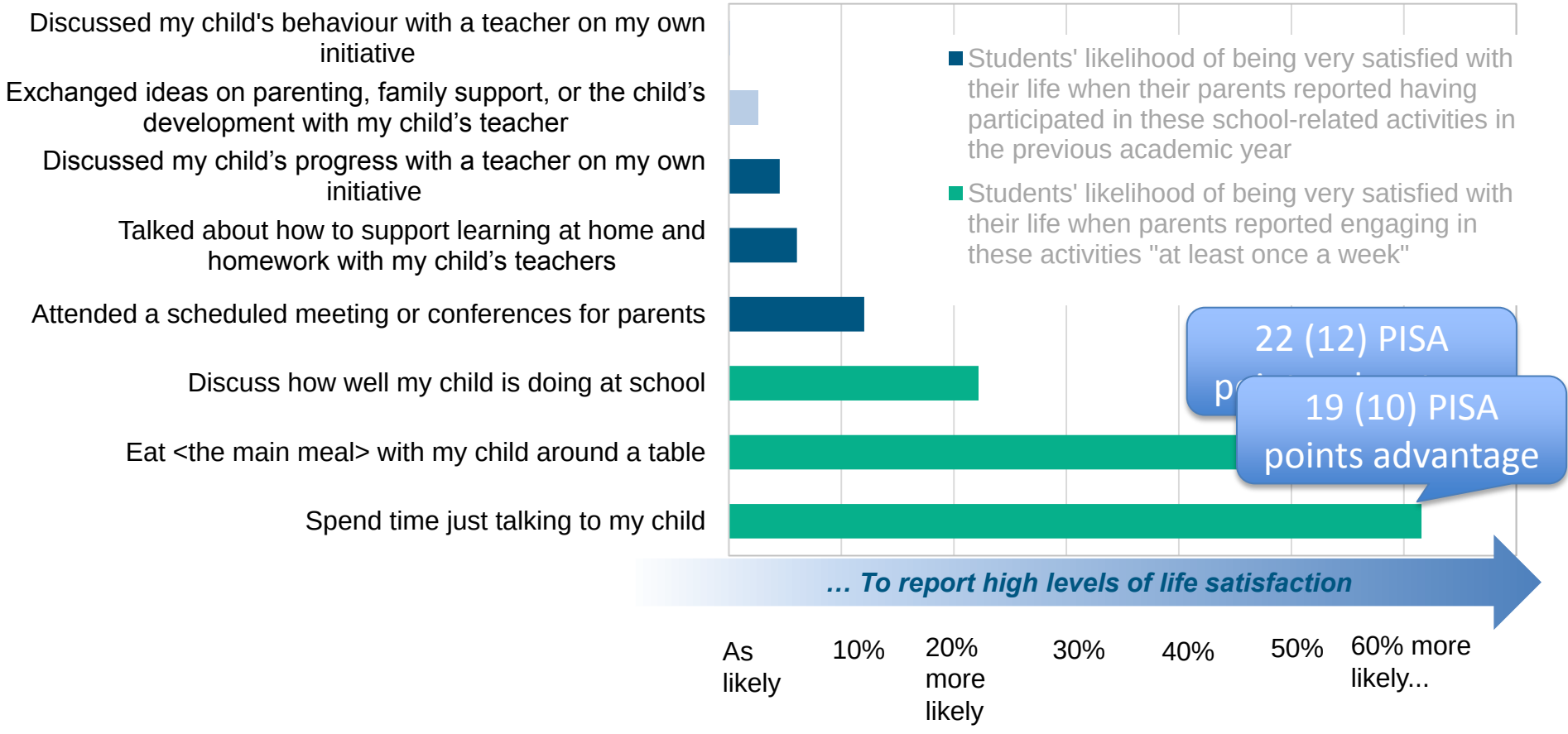
PISA generally observes no systematic net performance differences

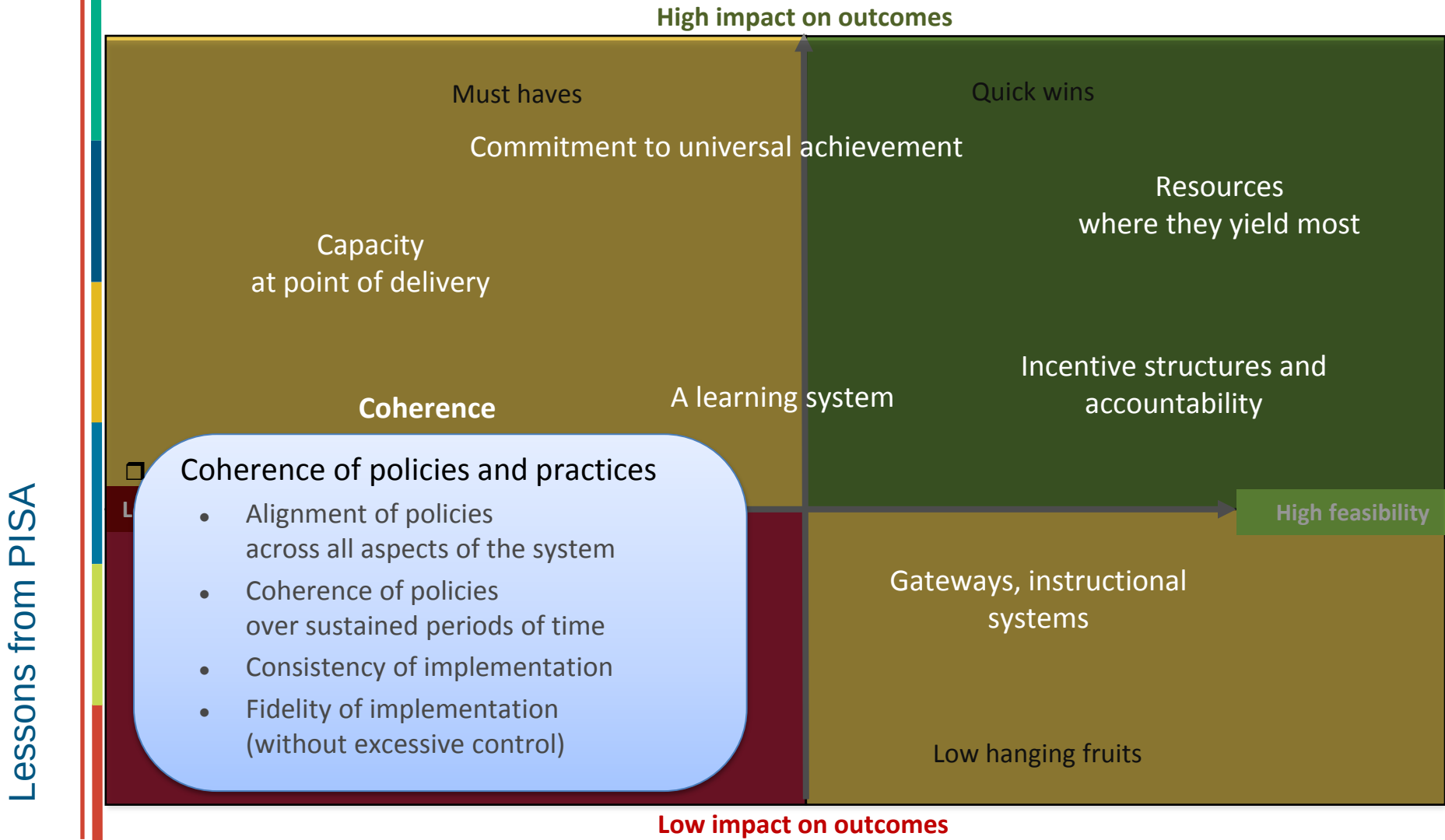
Science performance in public and private schools



Parents' activities and students' life satisfaction, Average-18

Figure III.9.4



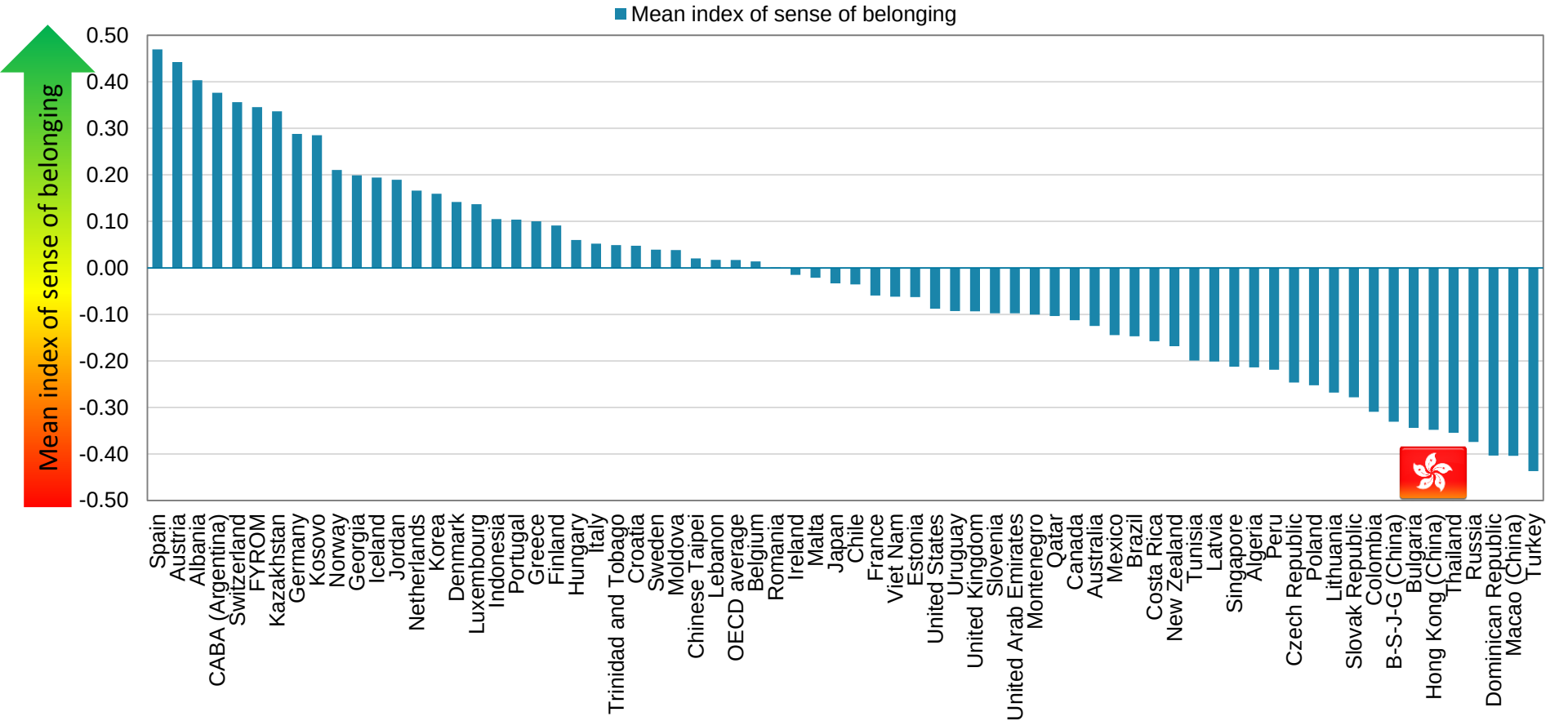

High impact on outcomes
Must haves
Quick wins
Commitment to universal achievement
Resources
where they yield most
Capacity
at point of delivery
Incentive structures and
accountability
A learning system
Coherence
Coherence of policies and practices
Alignment of policies
across all aspects of the system
Coherence of policies
over sustained periods of time
Consistency of implementation
Fidelity of implementation
(without excessive control)
High feasibility
Gateways, instructional
systems
Low hanging fruits
Low impact on outcomes
Lessons from PISA

One last thought

The well-being of students

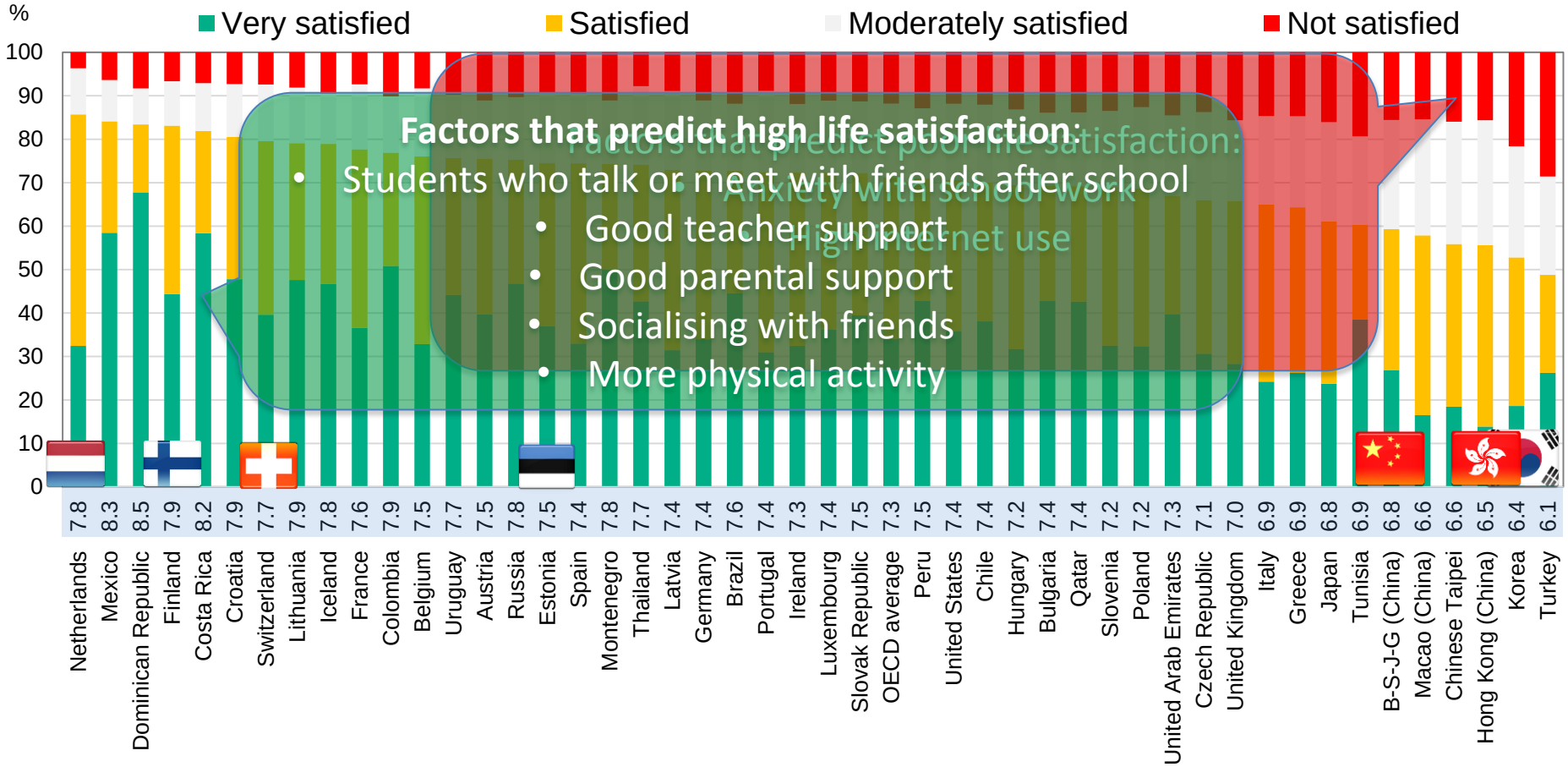
Student sense of belonging at school

Figure III.7.2



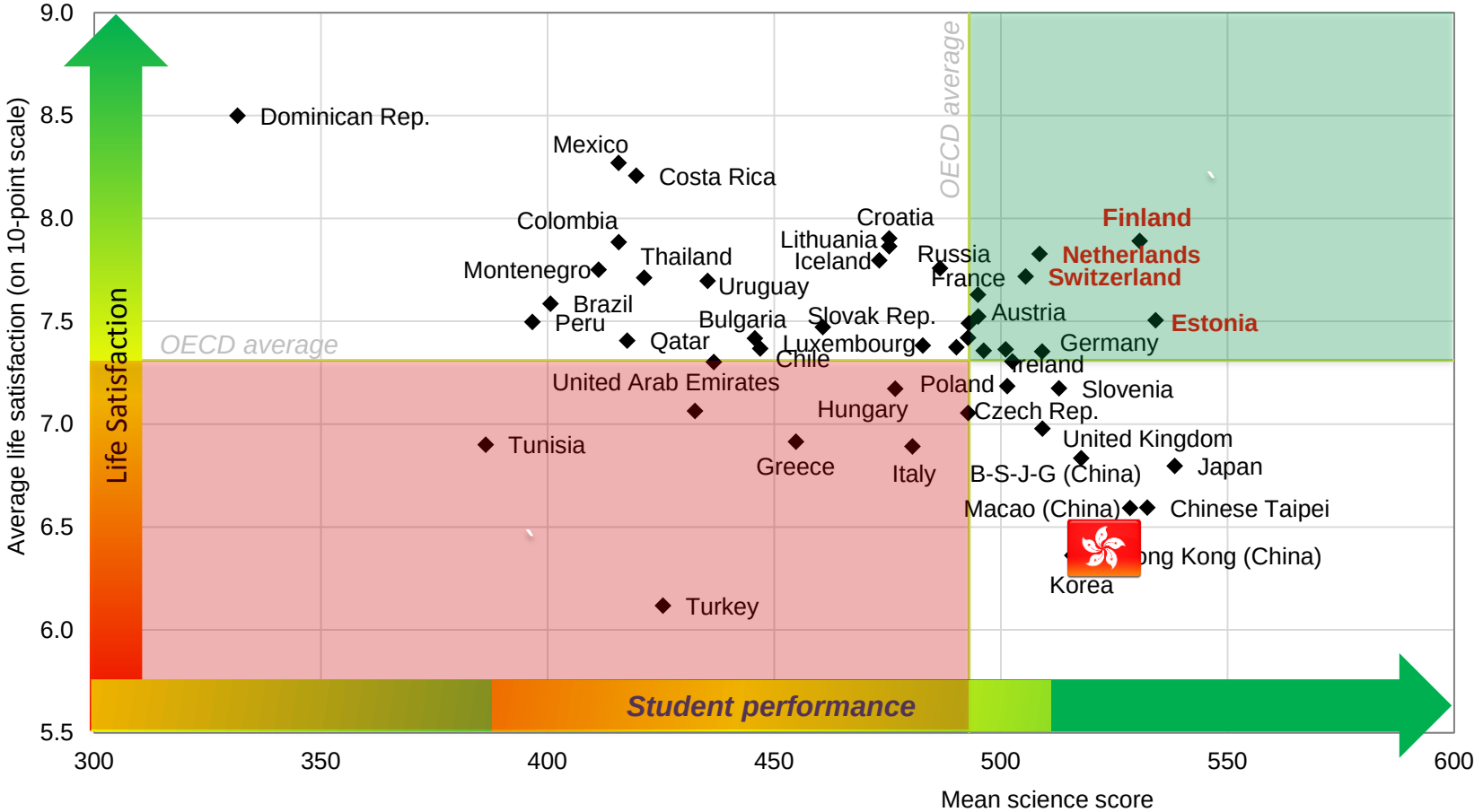
Life satisfaction among 15-year-old students

Figure III.3.1



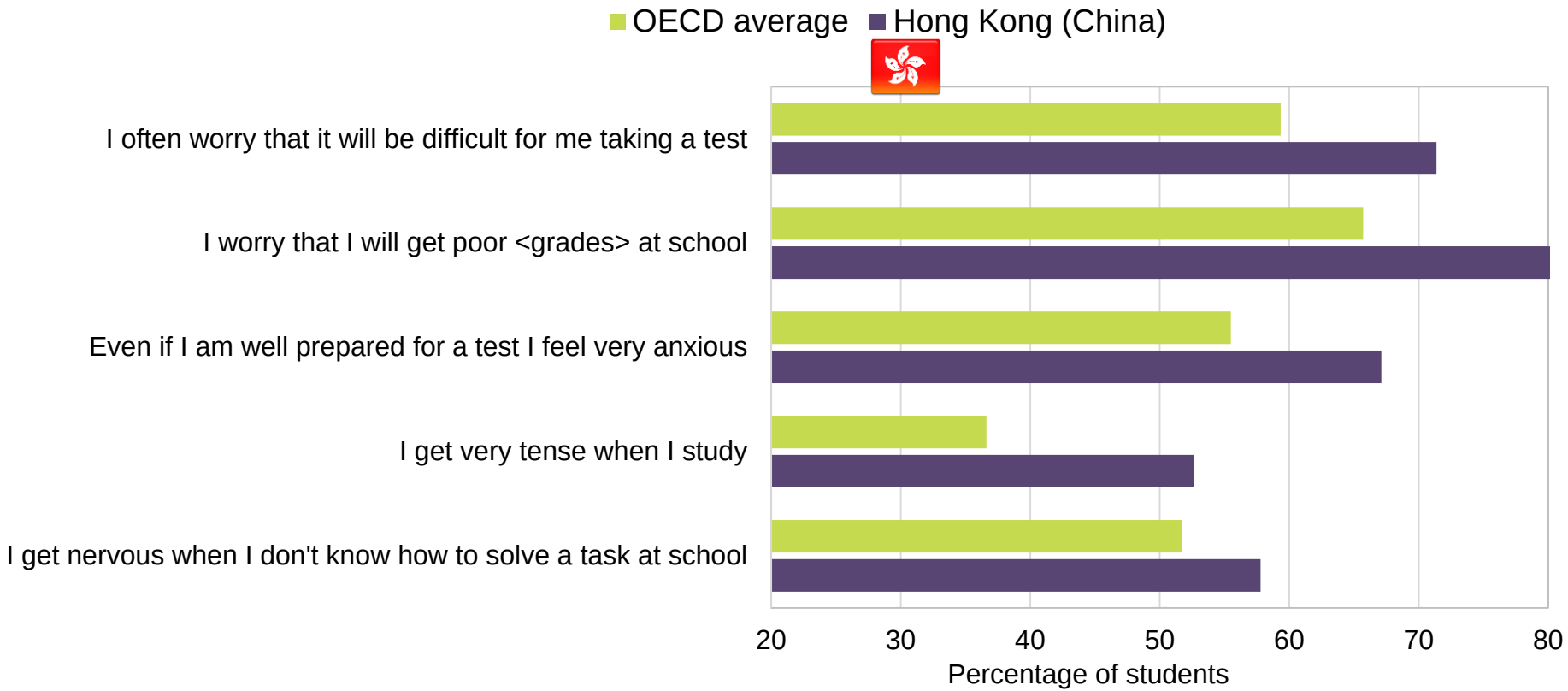
Life satisfaction and student performance can go together

Figure III.3.3



Prevalence of schoolwork-related anxiety

Figure III.4.1(1)



Schoolwork-related anxiety among students in the top and bottom quarters of science performance

Figure III.4.2

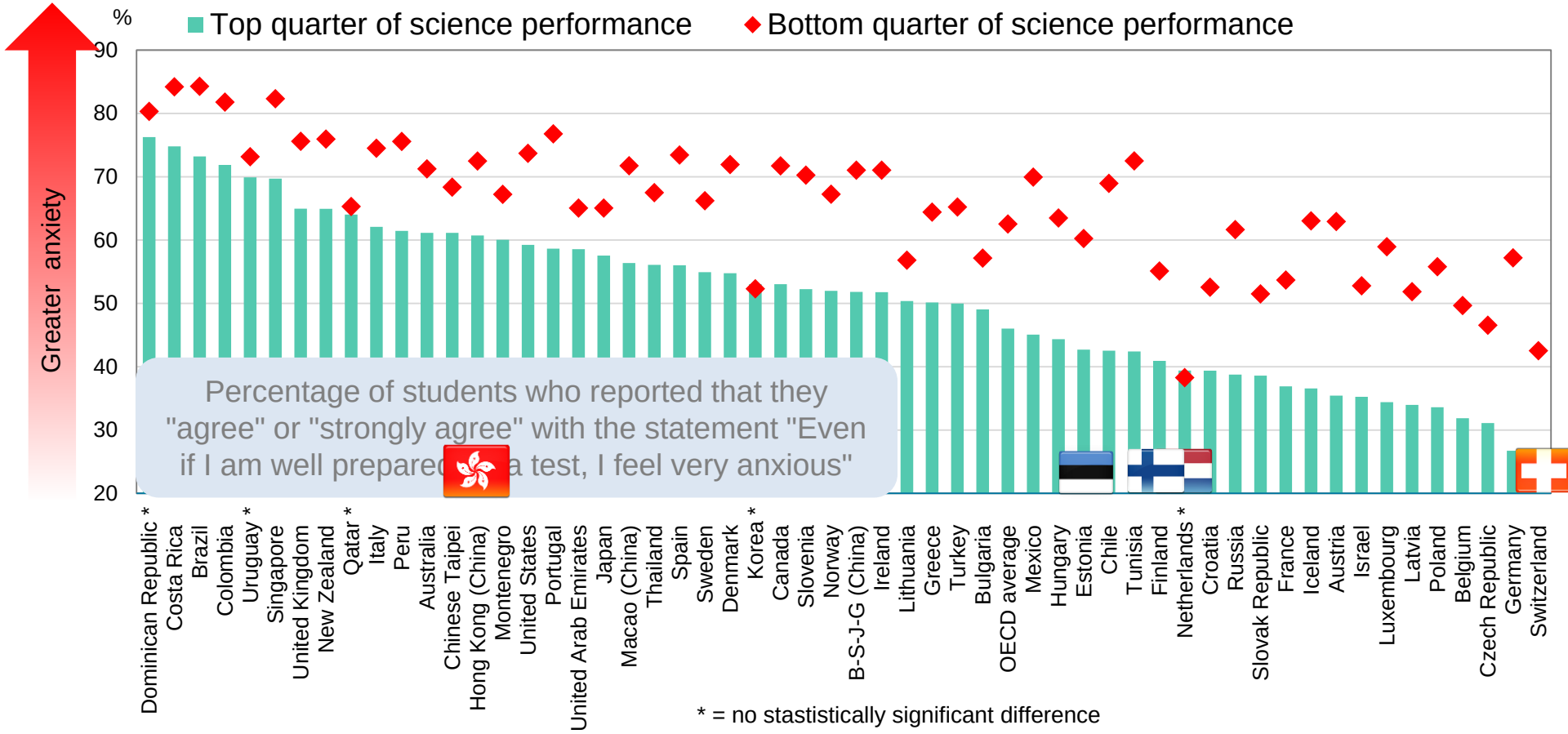
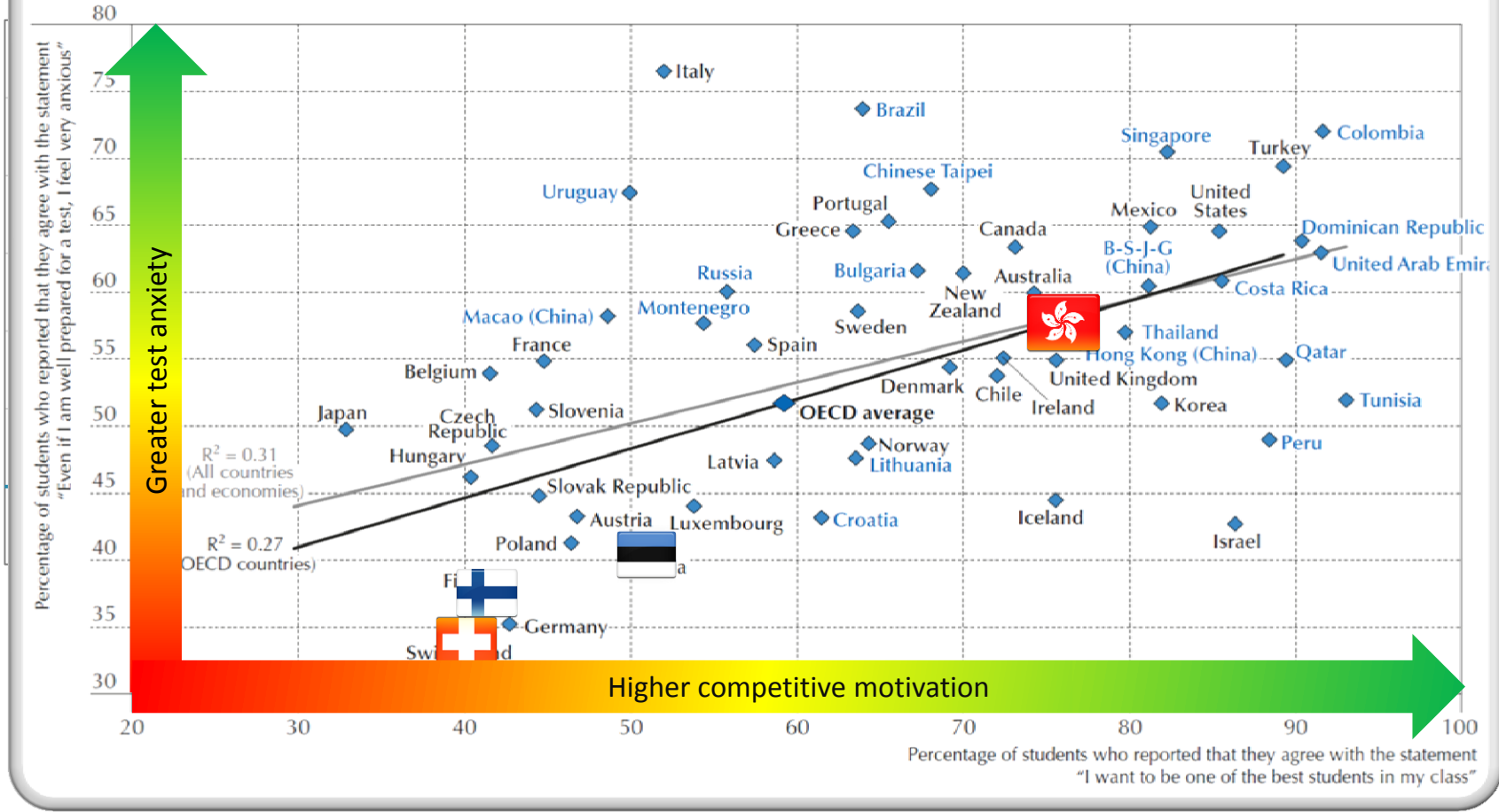


Figure III.5.5 ■ **Achievement motivation and anxiety, between countries**

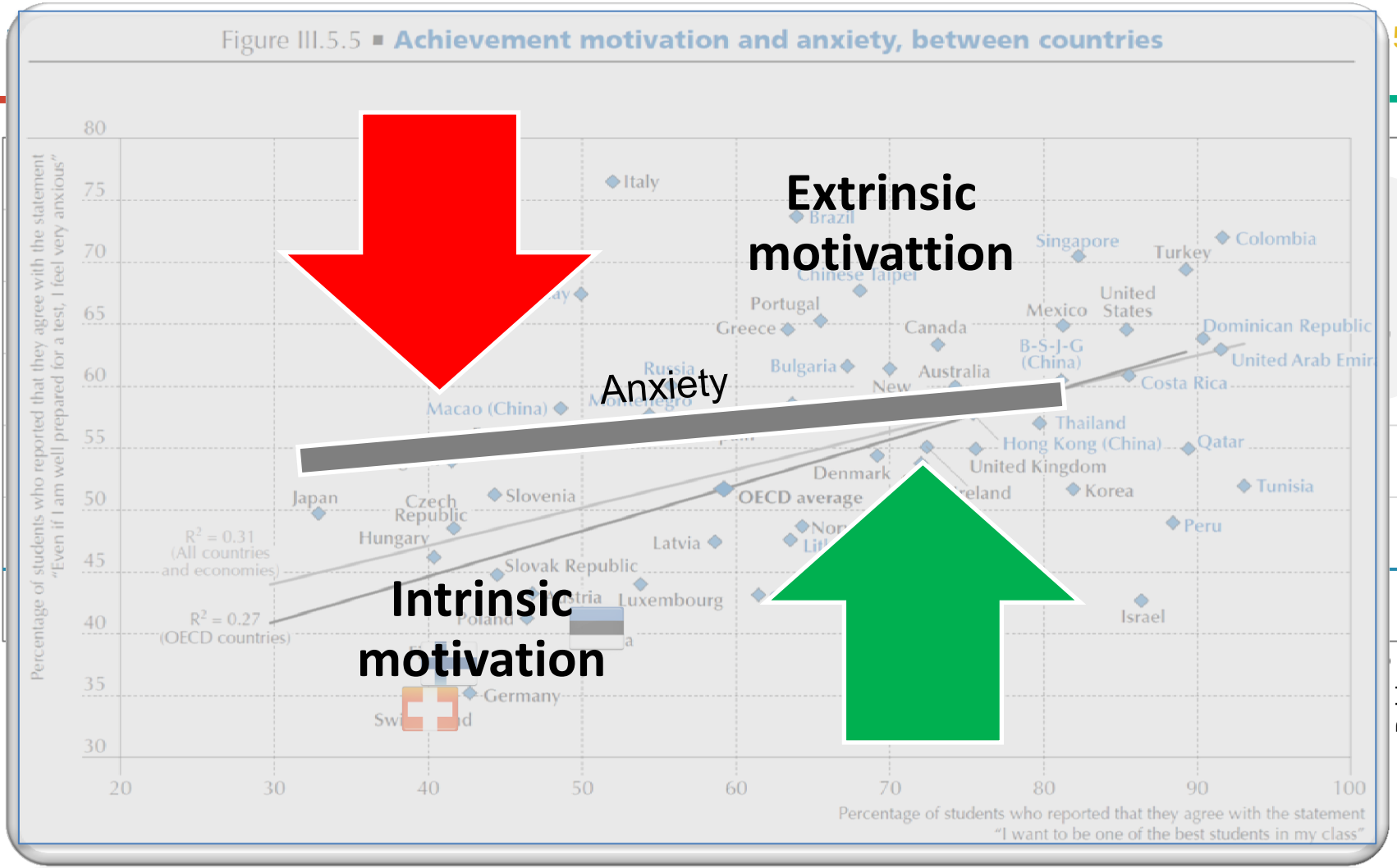


Difference in the index of achievement motivation

0.6
0.5
0.4
0.3
0.2
0.1
0.0
-0.1

Belgium

Figure III.5.5 ■ **Achievement motivation and anxiety, between countries**



System transformations

The old bureaucratic system		The modern enabling system
Some students learn at high levels (sorting)	Student inclusion	**All** students need to learn at high levels
Routine cognitive skills	Curriculum, instruction and assessment	Complex ways of thinking, complex ways of doing, collective capacity
Standardisation and compliance	Teacher quality	High-level professional knowledge workers
'Tayloristic', hierarchical	Work organisation	Flat, collegial
Primarily to authorities	Accountability	Primarily to peers and stakeholders

Thank you

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Twitter: **SchleicherOECD**

Wechat: **AndreasSchleicher**