What is scientific literacy ?

Have the scientific knowledge & skills needed for everyday life.

Use the key ideas in science to make informed decisions & participate in society.

OECD
PISA
OECD Programme for International Student Assessment
Monitoring Knowledge and Skills in the New Millennium

Scientific competencies to be assessed in PISA

Explaining Phenomena Scientifically

- Applying knowledge of science in a given situation.
- Describing or interpreting phenomena scientifically and predicting changes.
- Identifying appropriate descriptions, explanations, and predictions.

Scientific competencies to be assessed in PISA

Identifying Scientific Issues

- Recognising issues that it is possible to investigate scientifically.
- Identifying key words to search for scientific information.
- Recognising the key features of a scientific investigation.

Scientific competencies to be assessed in PISA

Using Scientific Evidence

- Interpreting scientific evidence and making and communicating conclusions.
- Identifying the assumptions, evidence and reasoning behind conclusions.
- Reflecting on the societal implications of science and technological developments.

Distribution of science assessment items in PISA studies

About half of the scores are assigned to Explaining phenomena scientifically

- Knowledge of science

Identifying scientific issues &
Using scientific evidence

- Knowledge about science

Questions based on realistic context

Closed items – MC & short-response Qs

Open-response questions

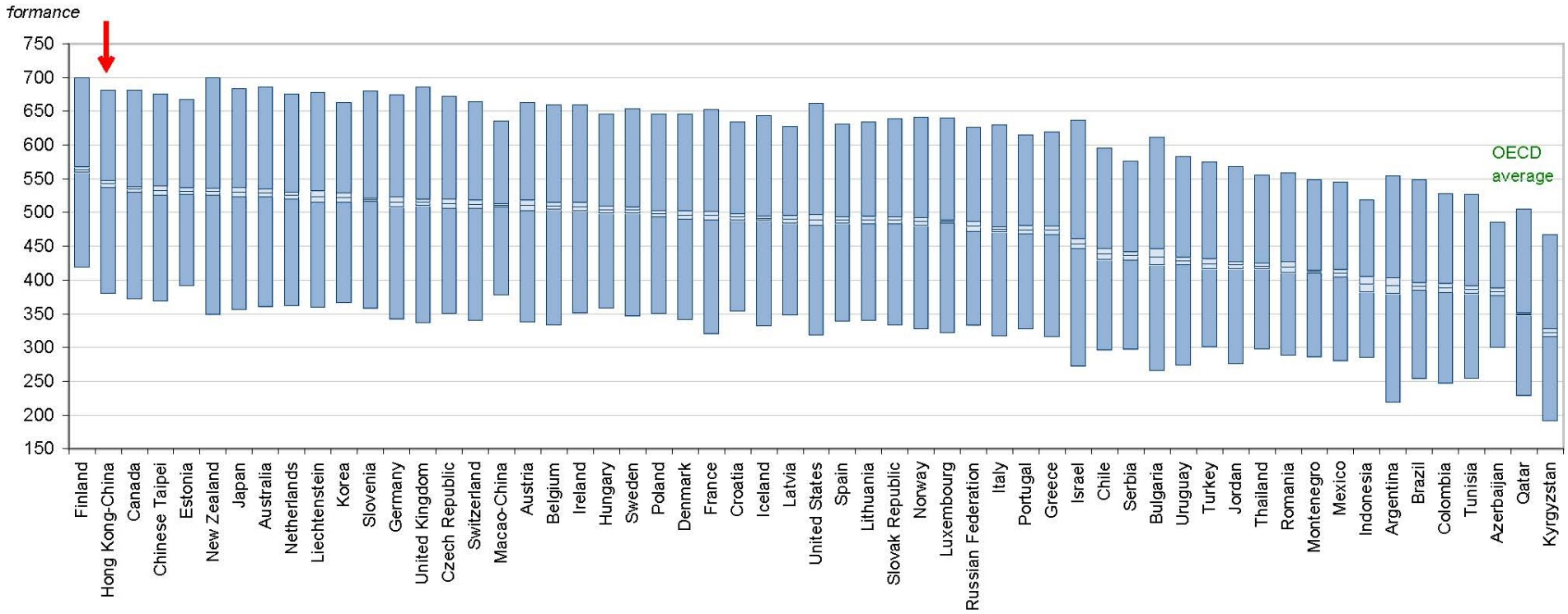
PISA-2006

- a much larger no. of items
- greater emphasis on explaining phenomena scientifically

Distribution of science assessment items in PISA studies

	PISA-2000				PISA-2003				PISA-2006			
Item format / Competency assessed	Closed items	Open items	Total	% score	Closed items	Open items	Total	% score	Closed items	Open items	Total	% score
Explaining phenomena scientifically	12 (13)	4 (4)	16 (17)	43	11 (11)	5 (6)	16 (17)	47	37 (37)	16 (16)	53 (53)	49
Identifying scientific issues	6 (6)	3 (4)	9 (10)	26	4 (4)	3 (3)	7 (7)	20	20 (20)	5 (5)	25 (25)	23
Using scientific evidence	5 (5)	5 (7)	10 (12)	31	6 (6)	5 (6)	11 (12)	33	16 (16)	15 (15)	31 (31)	28
	23 (24)	12 (15)	35 (39)		21 (21)	13 (15)	34 (36)		73 (73)	36 (36)	109 (109)	

Distribution of performance on the science scale



Countries are ranked in descending order of mean score.

Gradation bars extend from the 5th to the 95th percentiles

Mean score on the science scale

95% confidence interval around the mean score

[Table 5.1.1, p. 8]

Performance in different percentiles

Scientific literacy scores of students of OECD countries and Hong Kong in different ability ranges in PISA-2000

Percentiles	Hong Kong	OECD Countries	Difference in scores (HK – OECD)
5th	391	332	59*
10th	426	368	58*
25th	488	431	57*
50th	541	500	41*
75th	600	572	28*
90th	645	627	18*
`95th	671	657	14

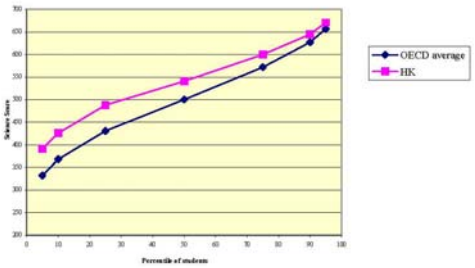
Scientific literacy scores of students of OECD countries and Hong Kong in different ability ranges in PISA-2003

Percentiles	Hong Kong	OECD Countries	Difference in scores (HK – OECD)
5th	373	324	49*
10th	412	362	50*
25th	478	427	51*
50th	539	500	39*
75th	608	575	33*
90th	653	634	19*
`95th	680	668	12

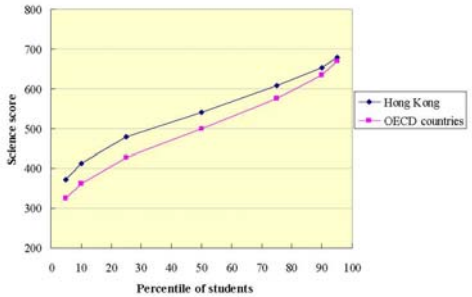
Scientific literacy scores of students of OECD countries and Hong Kong in different ability ranges in PISA-2006

Percentiles	Hong Kong	OECD Countries	Difference in scores (HK – OECD)
5th	380	340	40*
10th	418	375	43*
25th	482	434	47*
50th	542	500	42*
75th	609	568	41*
90th	655	622	33*
`95th	682	652	30*

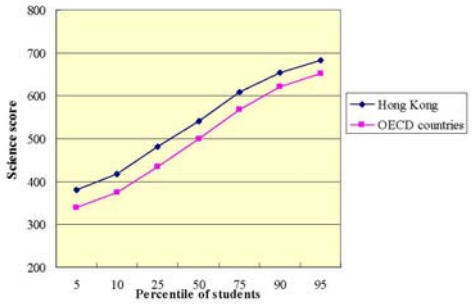
Mean scores of Hong Kong and OECD countries in scientific literacy at different percentiles in PISA-2000



Mean scores of Hong Kong and OECD countries in scientific literacy at different percentiles in PISA-2003



Mean scores of Hong Kong and OECD countries in scientific literacy at different percentiles in PISA-2006



Summary descriptions of 6 proficiency levels on the combined science scale

[Table 5.3.1, p. 11]

Released science questions in PISA 2006 – illustrate proficiency levels

[Acid rain - p. 44]

Individuals with high skills (Levels 5-6) generate relatively large externalities in knowledge creation and utilisation, compared to an "average" individual – suggests that investing in excellence may benefit all.

PISA, therefore, devotes significant attention to the assessment of students at the high end of the skill distribution.

OECD average: 1.3% reach Level 6
9.0% reach Level 5

Countries with large proportions of students in the highest two proficiency levels:
Finland (20.9%), New Zealand (17.4%), Australia (14.9%), Japan (14.8%), HK (16.0%).
These countries may be best placed to create a pool of talented scientists.
In contrast, countries with few students in the top two levels, may face future challenges in doing so.

Of the 57 countries, nearly half (26) have 5% or fewer of their 15-year-olds reaching Level 5 or Level 6.

6 countries have at least 15% (3x as many) with high science proficiency.

The no. of students at very low proficiency is also an important indicator – in terms of citizens' ability to participate fully in society and in the labour market. [Table 5.3.2, p.13]

溫總語特首 四方面加鞭

創新 知識 人才 環境

行政長官曾蔭權昨天在北京向國務院總理溫家寶述職時，溫家寶突然特別提到過去幾天訪問新加坡時，經常思考香港的競爭力問題，更即場提出四方面給曾蔭權參考，一是創新，包括體制和科技創新；二是知識，全民素質提高；三是人才；四是環境，不單要有好的法治環境，還要有好的生態環境。

曾蔭權在離京時向記者回應溫家寶的言論，說他完全認同總理的意見，值得香港深入思考。

[24-11-2007]

- Changes in scientific literacy across the 3 PISA studies?
- Difference in performance in different areas of competency across the 3 PISA studies?

2000+	541
2003	539
2006	542

[Table 5.2.1, p.9]

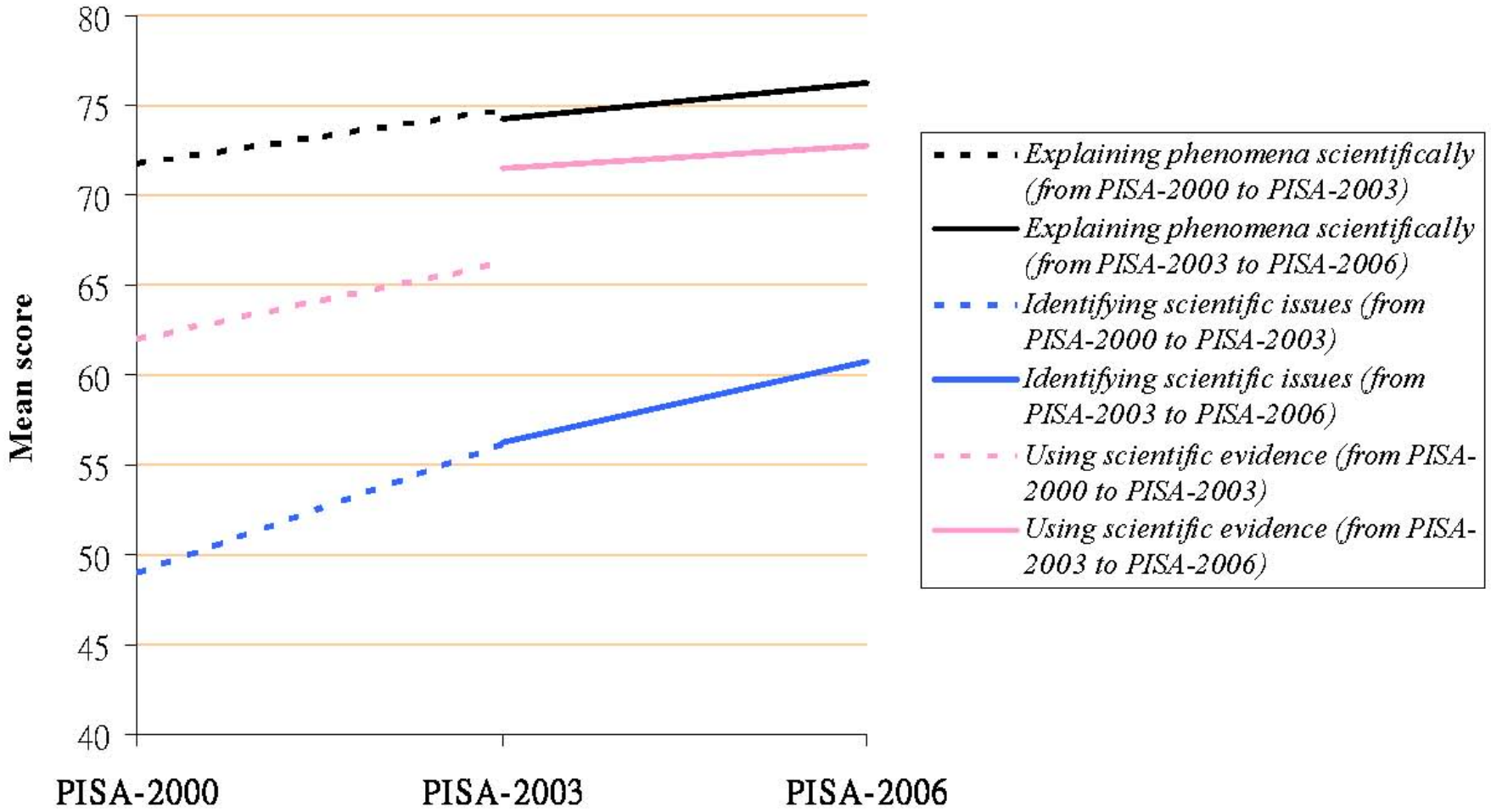
For S4 students,
the overall increase in score is significant between PISA-2003 & PISA-2000 (25 items) and between PISA-2006 & PISA-2003 (22 items)

Comparison of performance in different areas of competency

Trend of changes in scientific literacy from PISA-2000 to PISA-2006

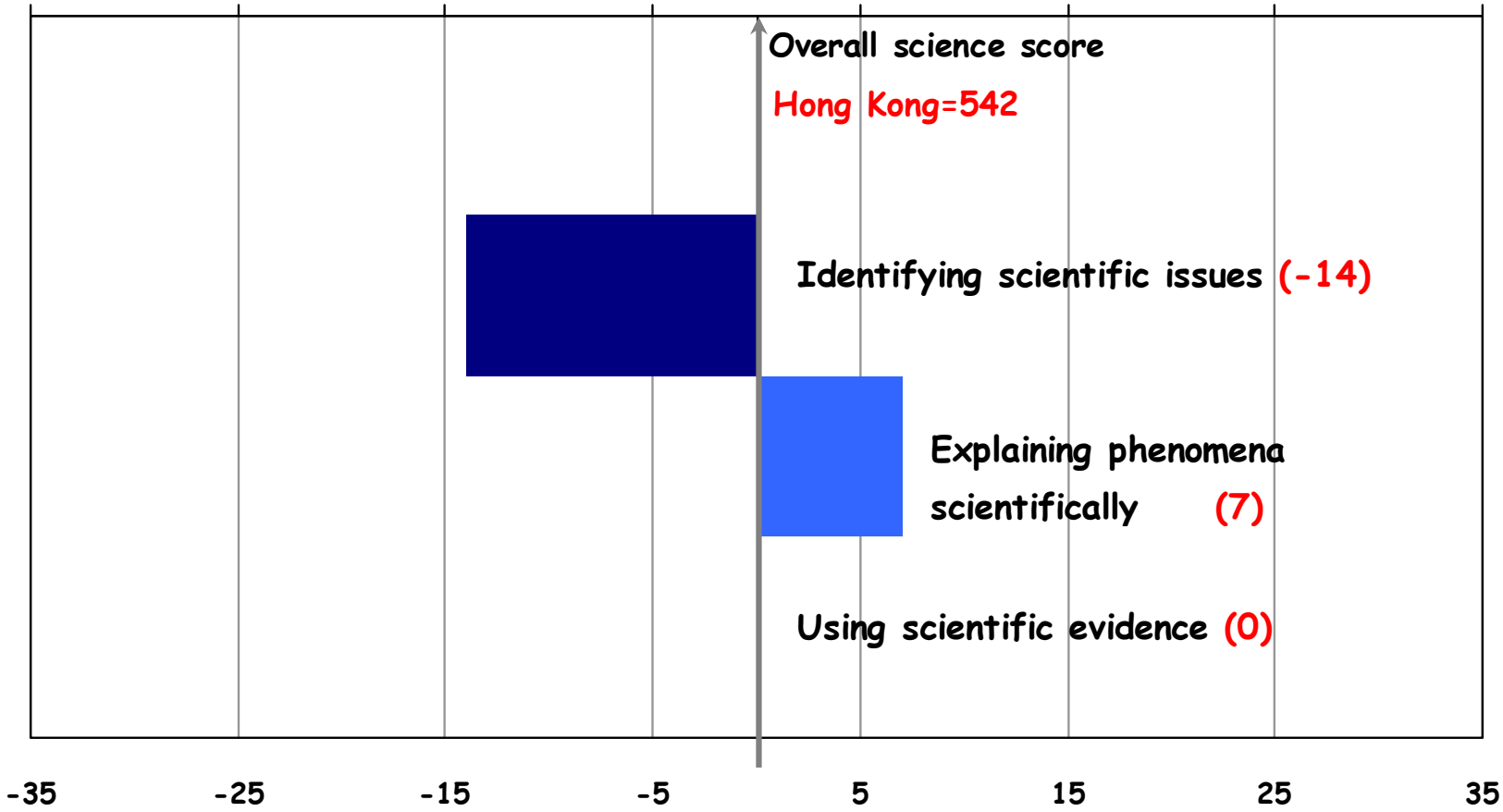
Figure 1
Mean scores of S4 students in different areas of competency between consecutive PISA studies

Mean scores of S4 students in different areas of competency between consecutive PISA studies

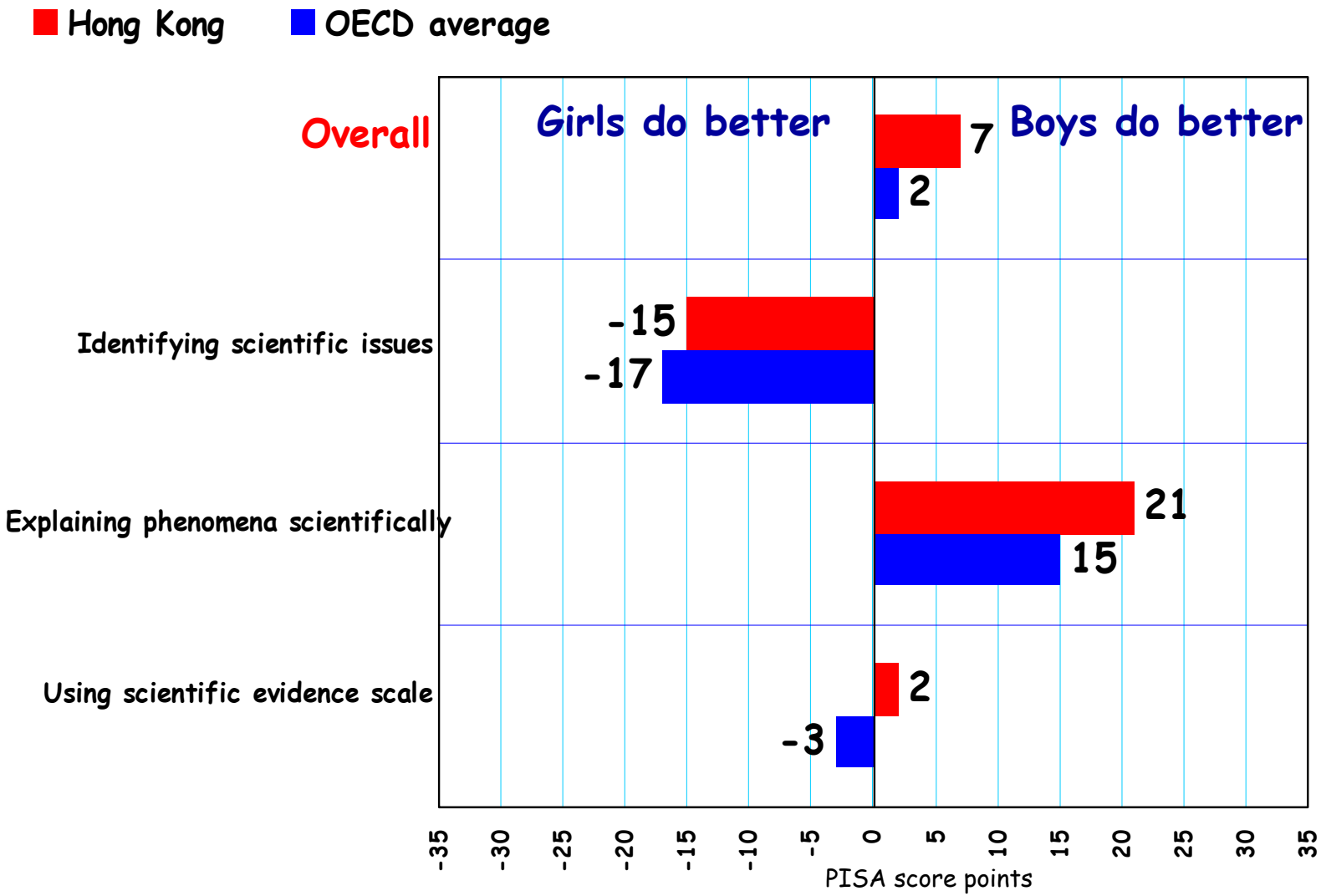


Strengths and Weaknesses of Hong Kong students in science

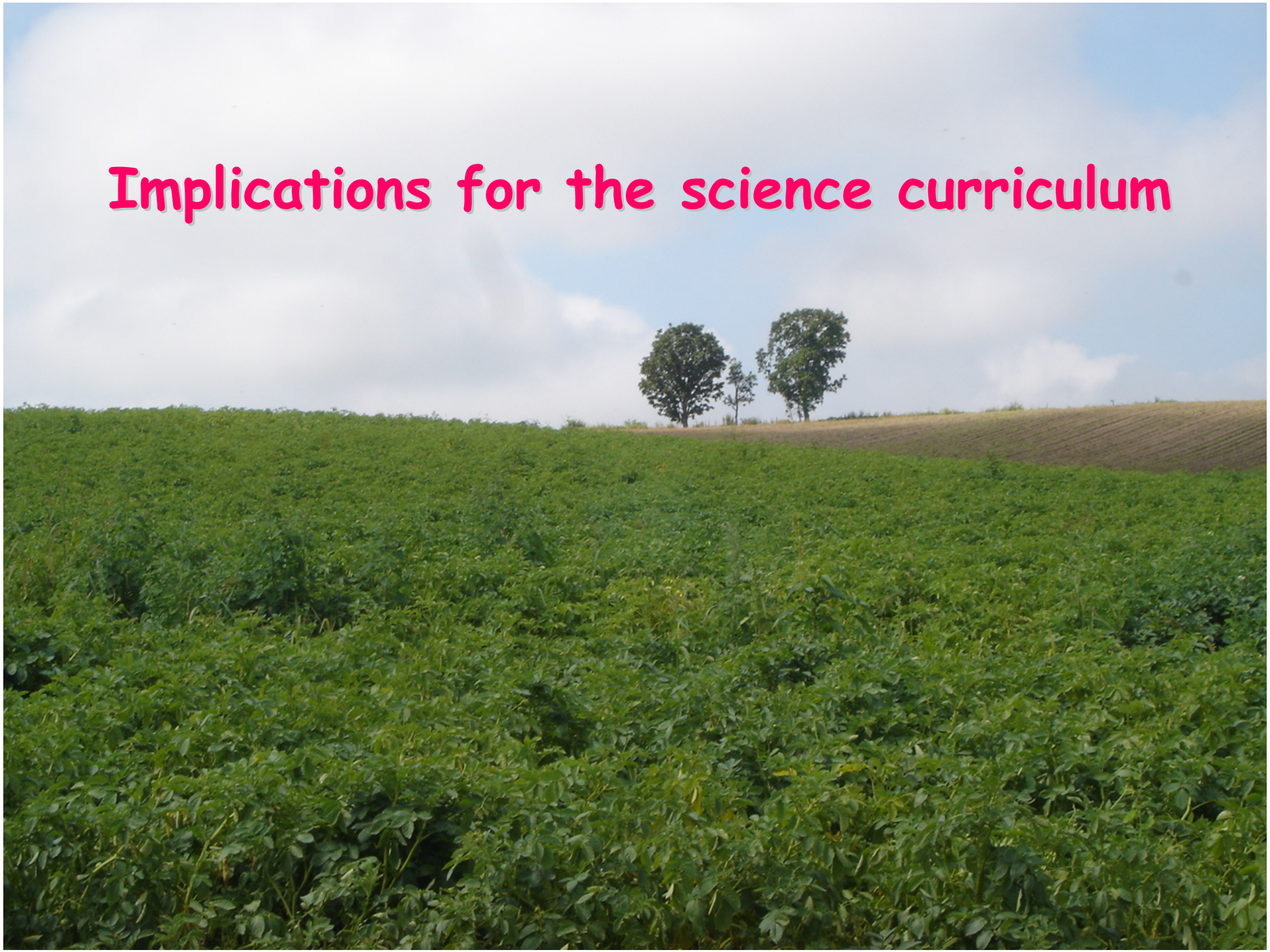
relative to their overall performance



Gender differences in science performance



Implications for the science curriculum



Hong Kong is consistently among the best-performing regions in science

Curriculum emphasis on knowledge of science and knowledge about science

Good support on science teaching, including lab facilities

A team of committed, professional science teachers

Weaker performance on identifying scientific issues

⇨ Analysing historical examples or current issues ⇨ Nature of science

⇩

Emphasis of NSS science curriculum

How to reduce the gap in learning and assessment of science between MOI?

* EMI facilitates the development of proficiency in English (a 2nd language)
* Disadvantage in learning & assessment for EMI students

Research informing practice:

- Matching English proficiency to cognitive demand of the curriculum

- Teaching strategies:
  - Active reading & writing strategies
  - Use of analogies, models & A-V aids
  - Making language of science intelligible

How do our students feel about their own competencies in science?

Impact on their performance, careers & economic development of society?