Results from HKPISA 2015

Collaborative Problem Solving:
Performance of Hong Kong students in PISA 2015

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Computer-based Assessment of Collaborative Problem Solving in PISA 2015

- In PISA 2015, 52 countries and economies participated in a computer-based assessment (CBA) of students' Collaborative Problem Solving competency

- PISA 2015: The first international test of students' ability to work with others to solve problems

Overview

- **Collaborative Problem Solving:** Definition and test design in PISA 2015

- **Quality**: Overall performance of Hong Kong students in computer-based assessment of Collaborative Problem Solving

- **Equality**: Distribution of CBA Collaborative Problem Solving performance by socio-economic status, gender and immigrant status

- **Attitudes towards Collaborative Problem Solving**

- **Factors** related to Collaborative Problem Solving performance and attitudes

I. Definition of Collaborative Problem Solving

...the capacity of an individual to effectively engage in a process whereby two or more agents attempts to solve a problem by sharing the understanding and effort required to come to a solution and pooling their knowledge, skills and efforts to reach that solution.

(OECD, 2017: *PISA 2015 Assessment and Analytical Framework*)

Definition of Collaborative Problem Solving

- *In addition to* individual problem solving competencies, there are **3 competencies specific to Collaborative Problem Solving**:

1) Establishing and maintaining shared understanding
2) Taking appropriate action to solve the problem
3) Establishing and maintaining team organisation

Test Design

- Test units are *interactive scenarios* that students must work through while interacting with programmed computer agents

- Students may be asked to:
  - Select one response out of possible options while in a conversation with the computer agent;
  - Provide a solution to a problem using information gathered with the other agents, by clicking on a region in the visual display area

- Students' actions will change the state of the problem

Test Design

Sample screenshot of a test unit

Test Design

- PISA 2015 includes 6 units of Collaborative Problem Solving, with a total of 117 items

- Sample items can be found in OECD/PISA website:

  ➢ *Released Field Trial item:*
  http://www.oecd.org/pisa/pisaproducts/PISA2015-Released-FT-Cognitive-Items.pdf

  ➢ *PISA in Focus:*
  http://dx.doi.org/10.1787/f21387f6-en

II. Quality: Overall Performance

MAJOR FINDINGS
- AVERAGE SCORE
- PROFICIENCY LEVELS

PISA 2015 Top 10 Countries/Economies in CBA Collaborative Problem Solving

Country/Economies	Mean	S.E.
Singapore	561	(1.2)
Japan	552	(2.7)
Hong Kong-China	**541**	**(2.9)**
Korea	538	(2.5)
Canada	535	(2.3)
Estonia	535	(2.5)
Finland	534	(2.6)
Macao-China	534	(1.2)
New Zealand	533	(2.4)
Australia	531	(1.9)

Performance of Hong Kong Students in CBA Collaborative Problem Solving

- Attain a mean score of 541

- Rank 3rd (3rd-7th) among the 52 participating countries/economies

- Of the top 10 countries/economies, Hong Kong students perform:

  - Significantly worse than Singapore (561) and Japan (522)
  - Not significantly different from Korea (538), Canada (535), Estonia (535) and Finland (534)
  - Significantly better than Macao (534), New Zealand (533) and Australia (531)

Distribution of Students at Each Proficiency Level of CBA Collaborative Problem Solving
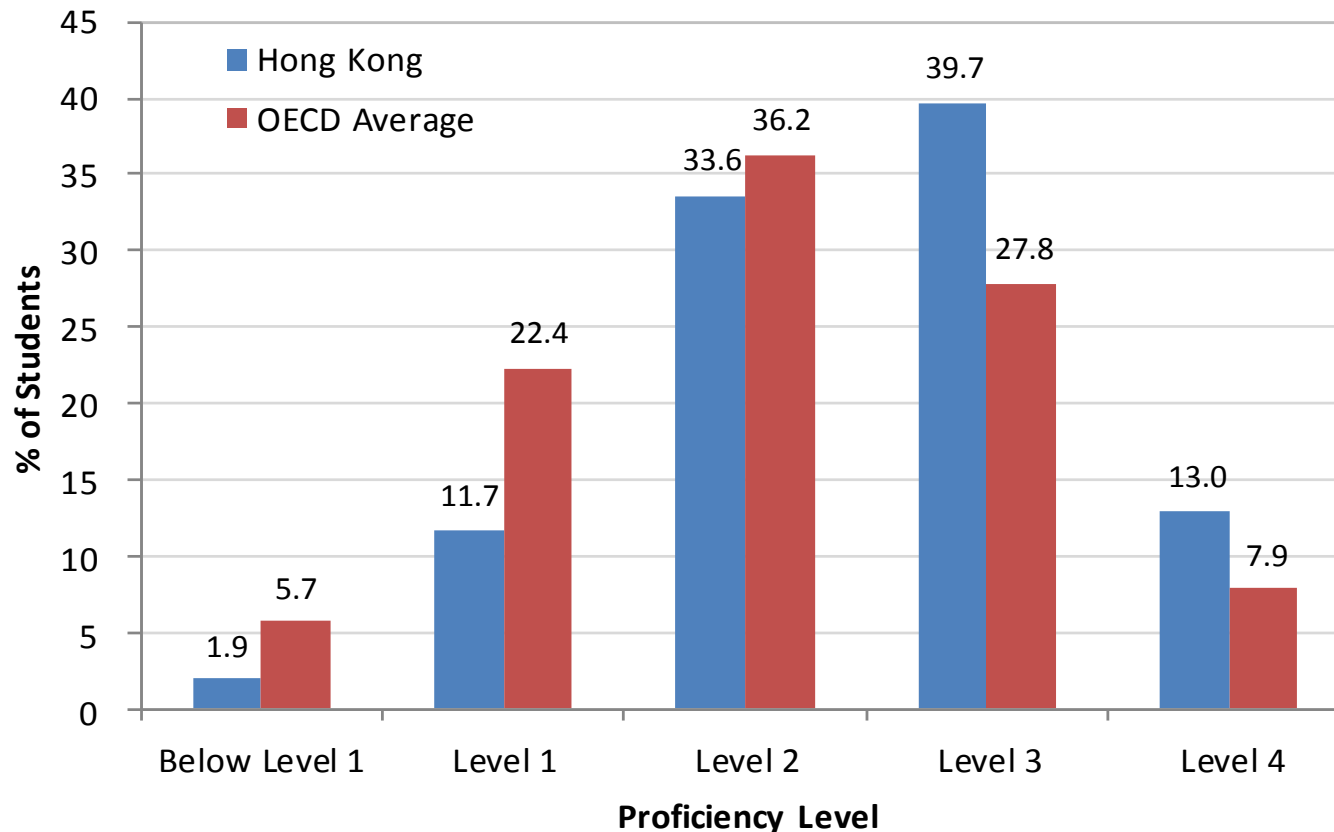
- Among the five levels of CBA Collaborative Problem Solving scale, level 4 is the top level while below level 1 is the lowest level
- There are more high achievers (attaining level 3 and 4) in Hong Kong than in OECD countries

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Percentage of Students at Level 4 in CBA Collaborative Problem Solving in Top 10 Countries/Economies
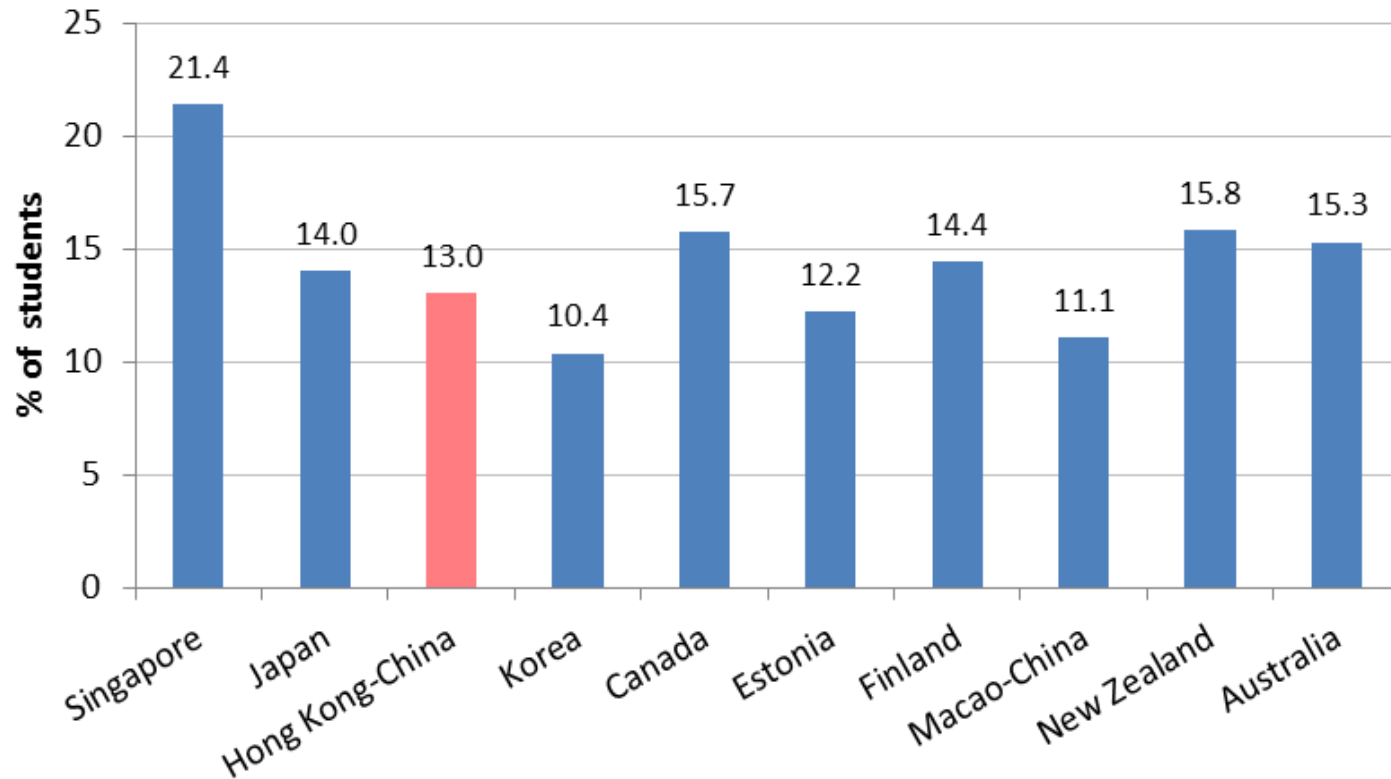
At the upper end, 13.0% of Hong Kong students reach level 4, outperforming the OECD average of 7.9%, but being outperformed by Singapore (21.4%) and Japan (14.0%)

Percentage of Students at Level 1 and below in CBA Collaborative Problem Solving in Top 10 Countries/Economies

% of students

Country/Economy	%
Singapore	11.4
Japan	10.1
Hong Kong-China	13.7
Korea	12.9
Canada	18.5
Estonia	15.2
Finland	18.1
Macao-China	14.9
New Zealand	19.7
Australia	19.9
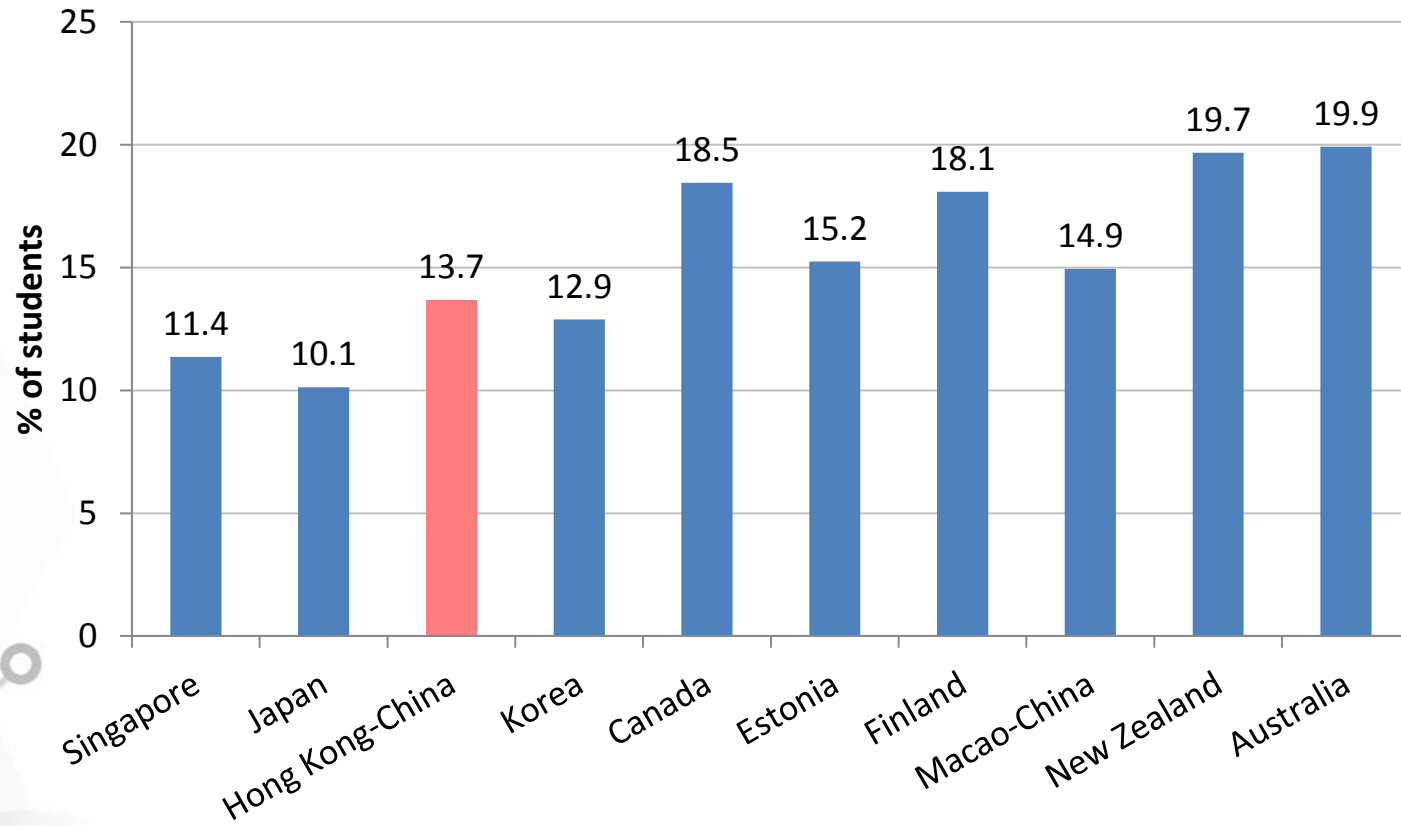
At the lower end, 13.7% of Hong Kong students perform at level 1 and below, which is lower than the OECD average of 28.1% but higher than Japan (10.1%) and Singapore (11.4%)

III. Equality: Student Characteristics and Family Factors Related to Hong Kong Students' Performance

MAJOR FINDINGS

- Socio-Economic Status

- Gender

- Immigrant status

1. CBA Collaborative Problem Solving Performance by Socio-Economic Status
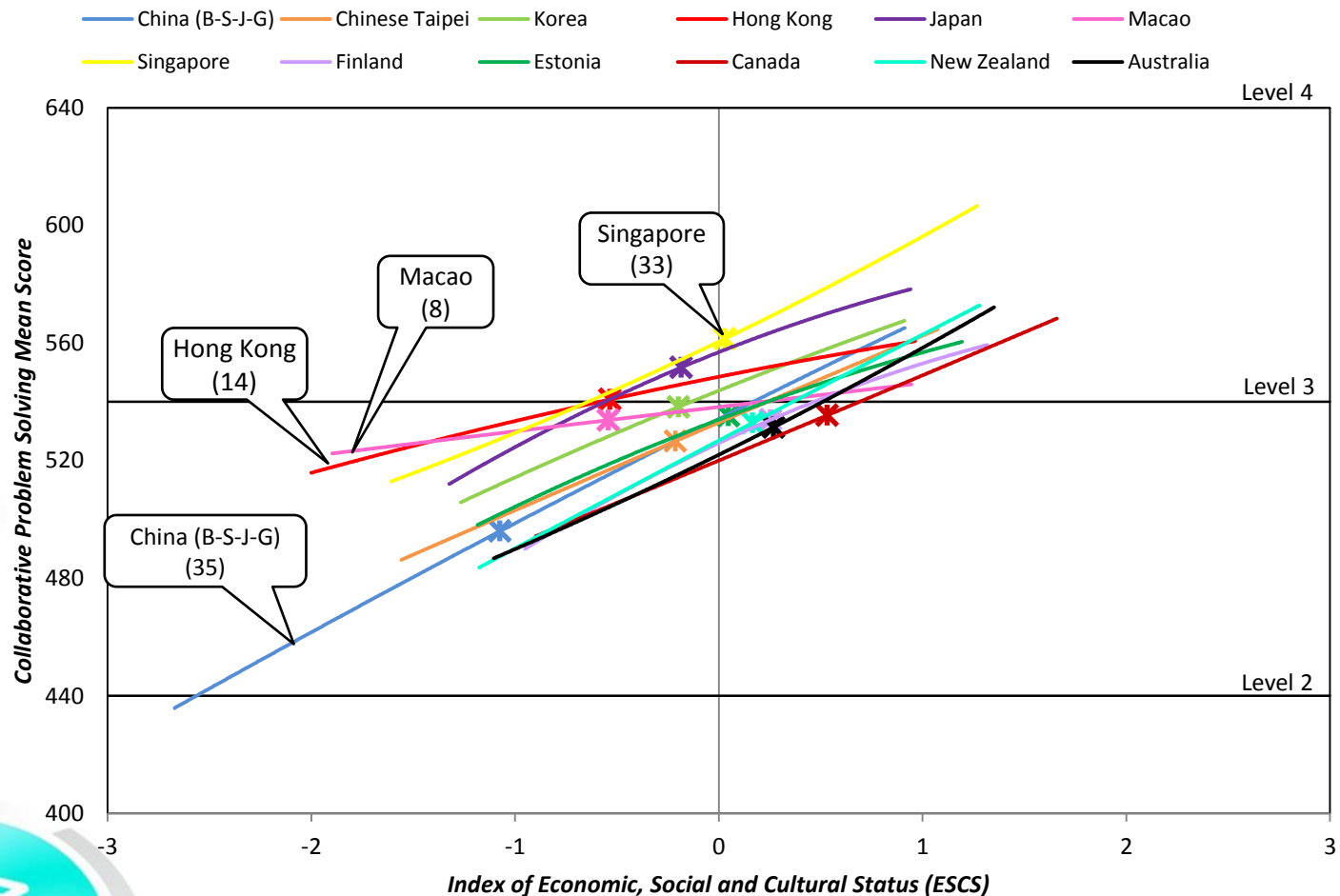
Socio-economic status of HK students has a relatively small impact on their performance (14) compared with OECD average (30)

CBA Collaborative Problem Solving Performance and the Impact of Socio-Economic Status

◆ Strength of the relationship between performance and socio-economic status is above the average

◇ Strength of the relationship between performance and socio-economic status is not statistically significantly different from the average

◆ Strength of the relationship between performance and socio-economic status is below the average
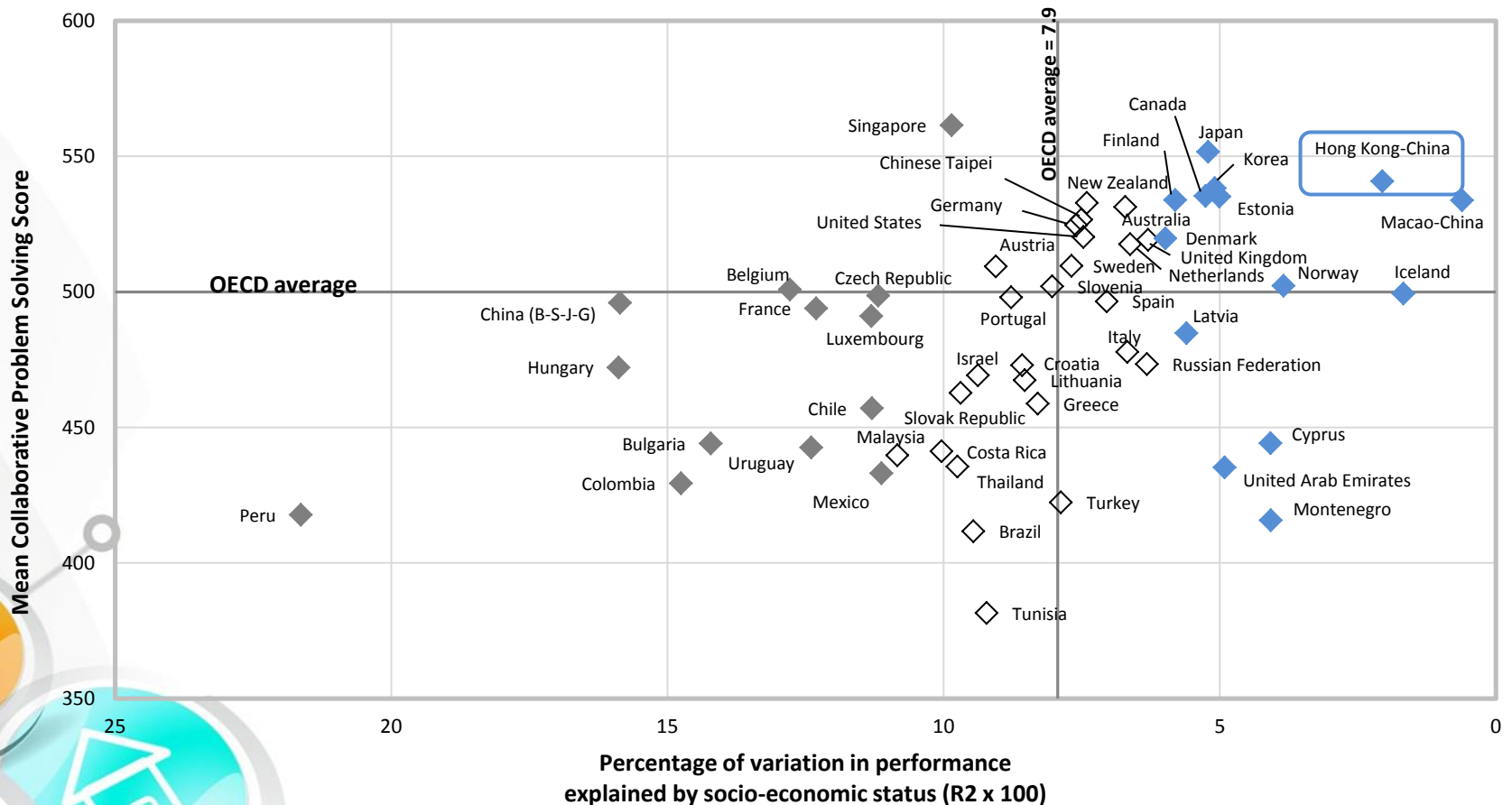
Hong Kong belongs to the group of "*high performance/ low socio-economic impact*" countries/economies (upper right quadrant)

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2. Gender Difference in CBA Collaborative Problem Solving Performance (Top 10 Countries/Economies)

Country/Region	Boys (B)		Girls (G)		Difference (B - G)[#]	
	Mean score	S.E.	Mean score	S.E.	Score dif.	S.E.
Singapore	552	(1.7)	572	(2.1)	**-20**	(2.9)
Japan	539	(3.6)	565	(2.6)	**-26**	(3.7)
Hong Kong-China	523	(3.7)	559	(3.4)	**-36**	(4.4)
Korea	522	(3.5)	556	(3.3)	**-33**	(4.4)
Canada	516	(2.8)	555	(2.4)	**-39**	(2.6)
Estonia	522	(2.9)	549	(2.7)	**-27**	(2.8)
Finland	511	(3.2)	559	(3.0)	**-48**	(3.6)
Macao-China	515	(1.9)	553	(2.0)	**-38**	(2.9)
New Zealand	513	(3.2)	553	(3.0)	**-41**	(3.8)
Australia	511	(2.5)	552	(2.5)	**-41**	(3.1)
OECD Average	486	(0.6)	515	(0.5)	**-29**	(0.6)

Values that are statistically significant are indicated in bold.
The minor discrepancy in the difference is due to rounding of numbers.

HK girls' advantage (36) is greater than the average gender gap of OECD (29)

3. CBA Collaborative Problem Solving Performance by Immigrant Status
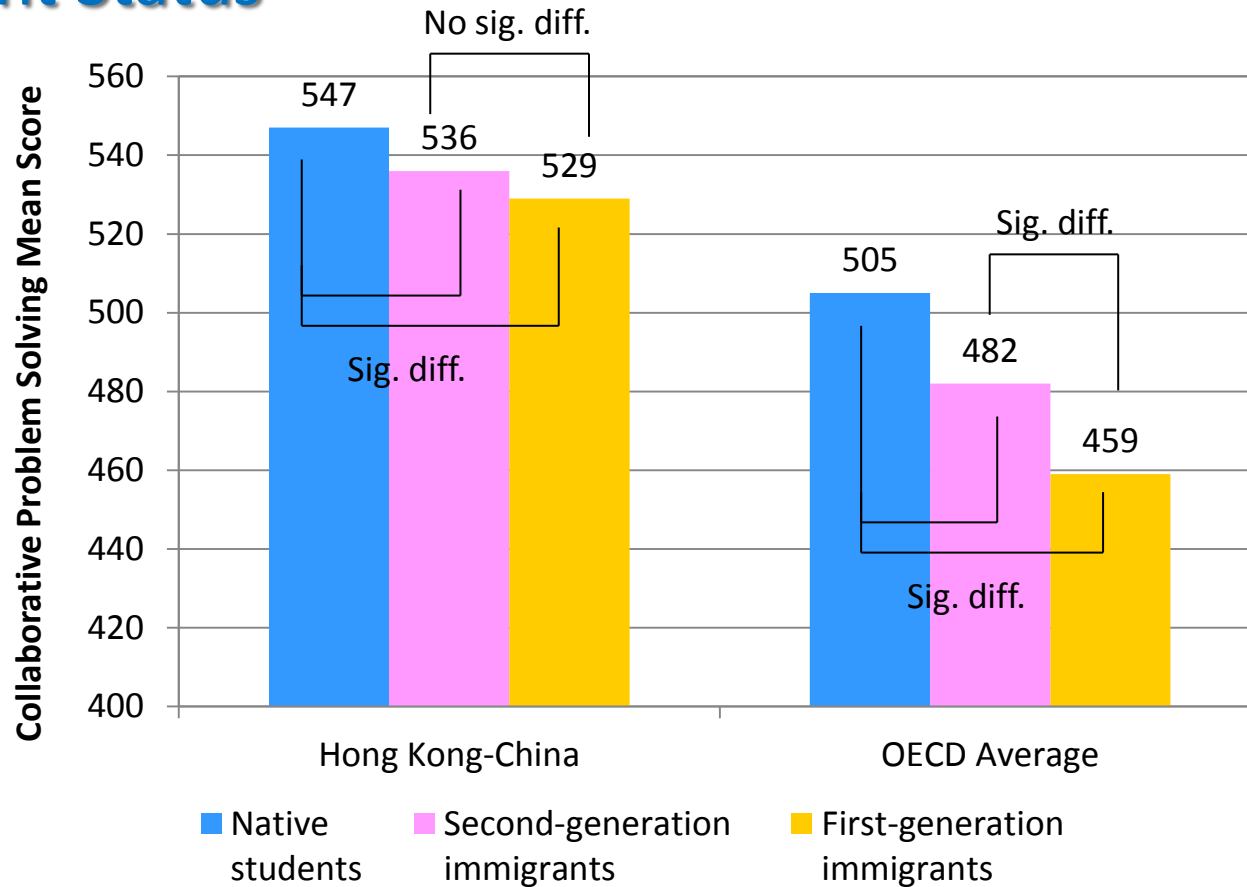
- Second-generation immigrants: Students who are born in the country of assessment but both of their parents are foreign-born
- First-generation immigrants: Students whose parents and they themselves are not born in the country of assessment

IV. Attitudes towards Collaborative Problem Solving

MAJOR FINDINGS

1. Attitudes towards Collaborative Problem Solving

- "Valuing **relationships**" index (重視關係)
  - ➤ Altruistic attitude held by a student when engaging in collaborative activities not for his or her own benefit
  - ➤ Students were asked to report to what extent they disagreed or agreed with each of the 4 statements about themselves:
  1) I enjoy considering different perspectives.
  2) I am a good listener.
  3) I take into account what others are interested in.
  4) I enjoy seeing my classmates be successful.

      - Coded as: 1 for "Strongly disagree"; 2 for "Disagree"; 3 for "Agree" and 4 for "Strongly agree".
      - Items are coded and scaled such that higher scores on this index mean a higher level of valuing relationships.

Attitudes towards Collaborative Problem Solving

- "Valuing **teamwork**" index (重視團隊)
  - ➢ Emphasis put on what teamwork, as opposed to working alone, can produce
  - ➢ Students were asked to report to what extent they disagreed or agreed with each of the 4 statements about themselves:
  1) I enjoy cooperating with peers.
  2) I find that teams make better decisions than individuals.
  3) I find that teamwork raises my own efficiency.
  4) I prefer working as part of a team to working alone.

    - Coded as: 1 for "Strongly disagree"; 2 for "Disagree"; 3 for "Agree" and 4 for "Strongly agree".
    - Items are coded and scaled such that higher scores on this index mean a higher level of valuing teamwork.

Attitudes towards Collaborative Problem Solving of Hong Kong Students (% of Agree or Strongly Agree)
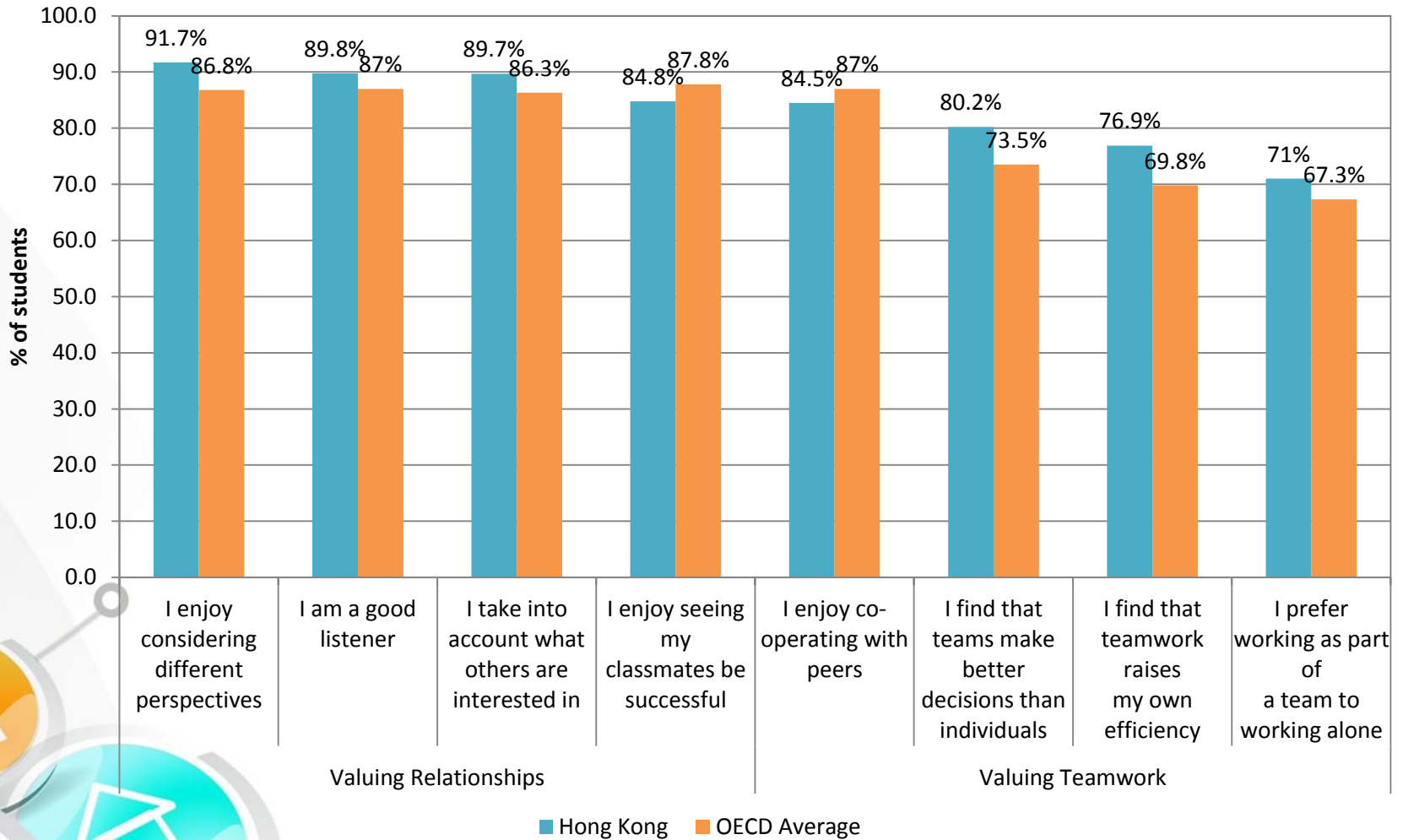
Indices of Attitudes towards Collaborative Problem Solving of Students in East Asian Societies
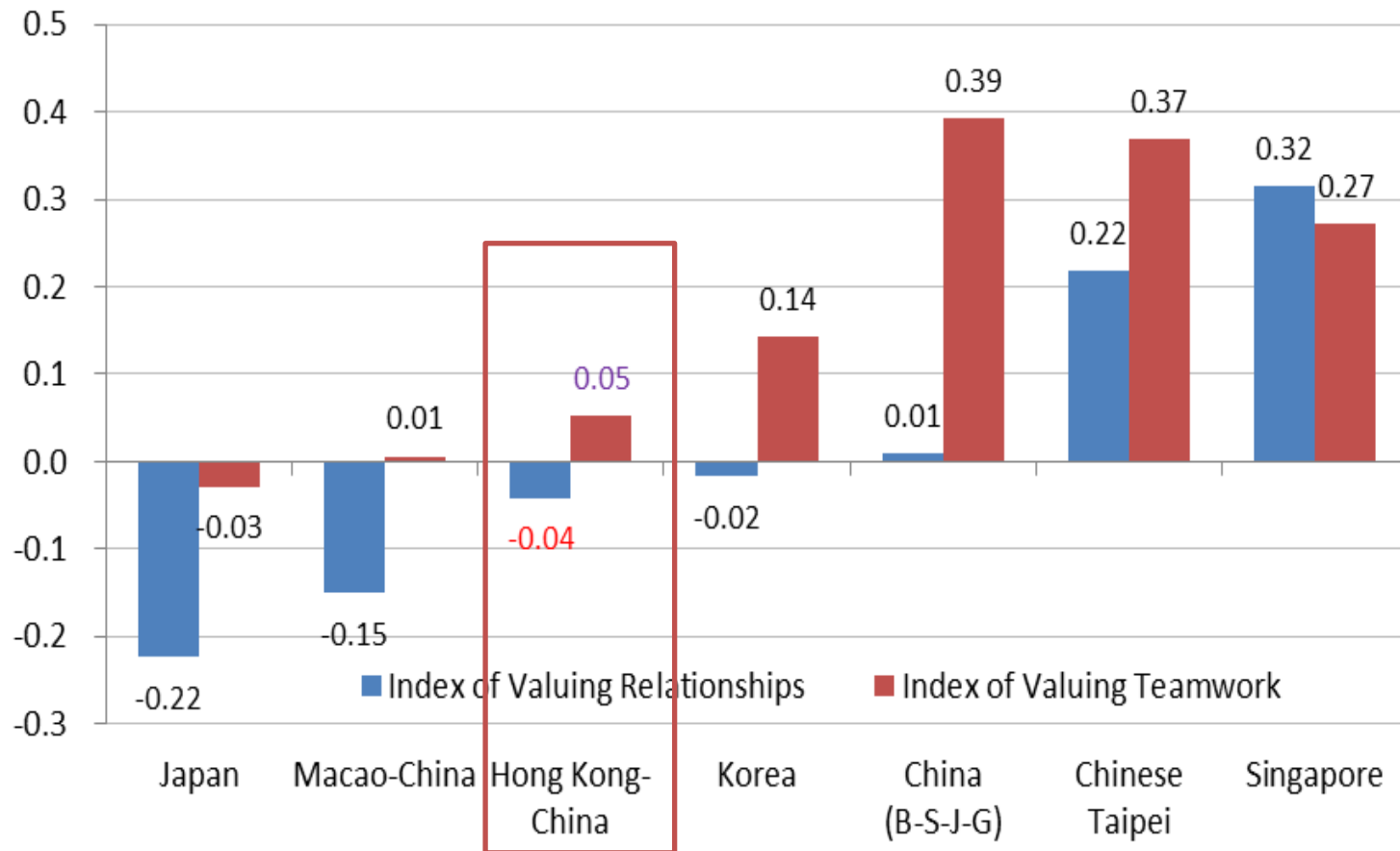
OECD average = 0.00

Hong Kong students' indices of attitudes towards Collaborative Problem Solving are similar to OECD average

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Table V.5.4a

Index of Valuing Relationships, by Gender

Table V.5.4b
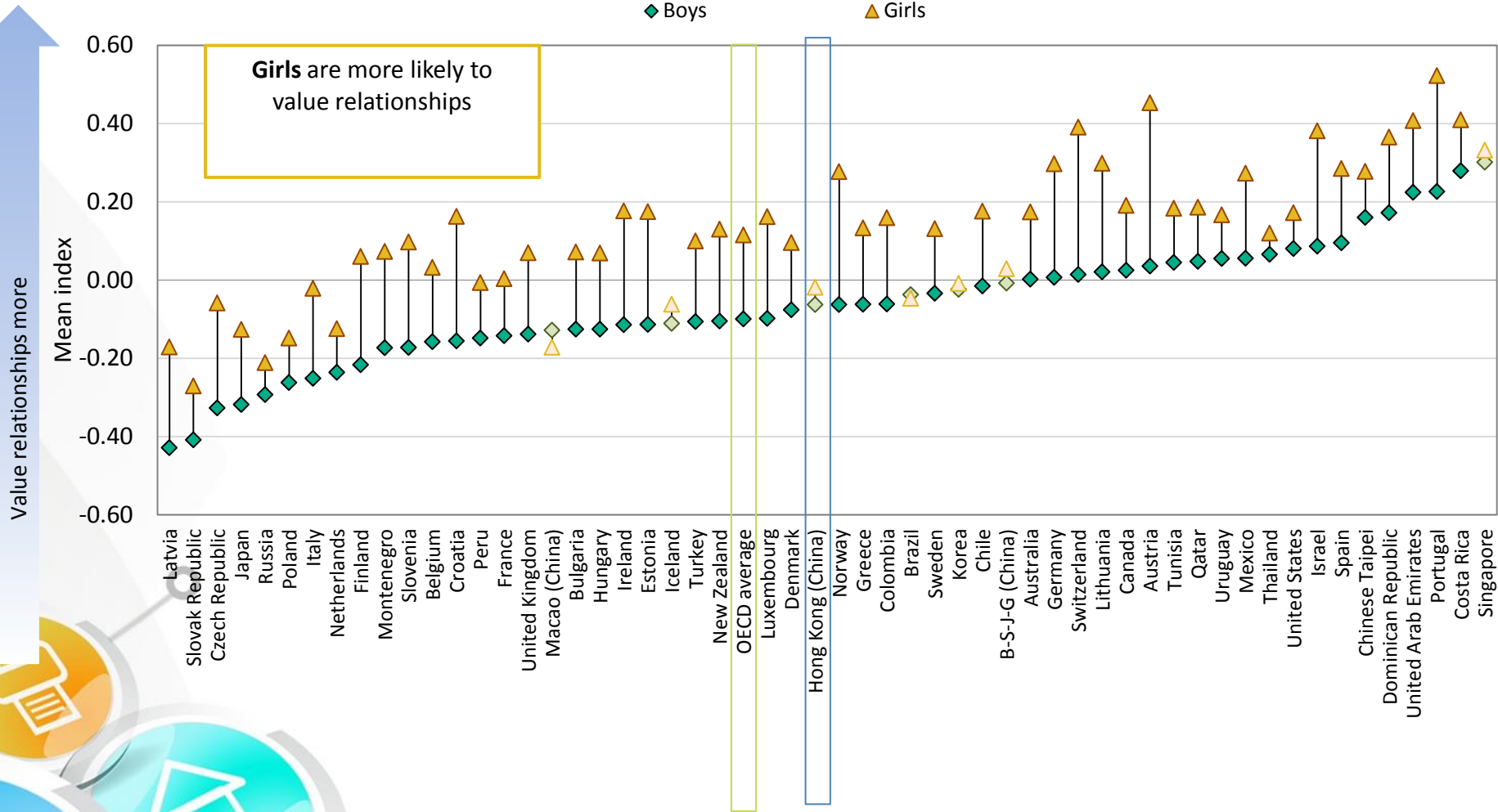
Index of Valuing Teamwork, by Gender
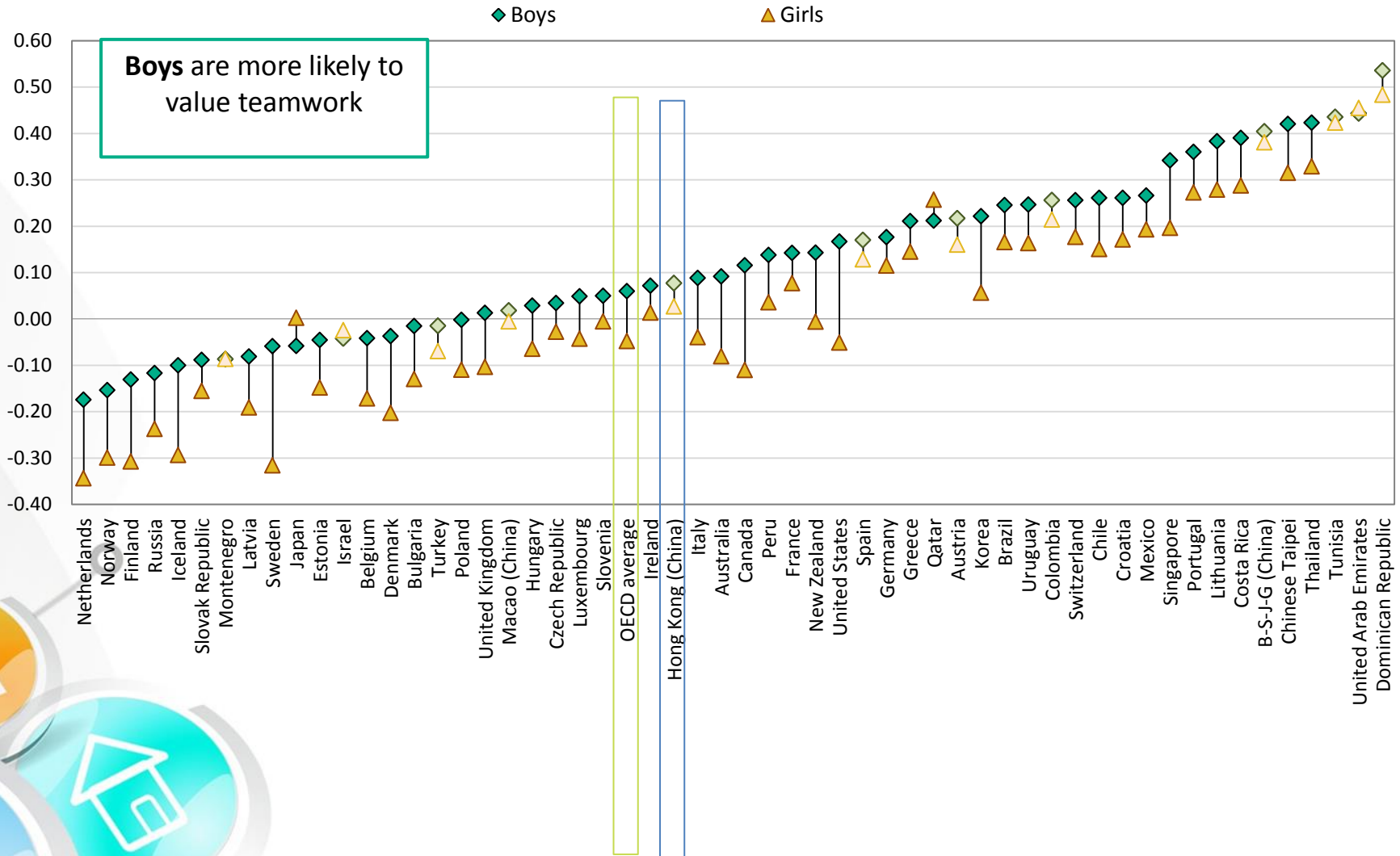
Relationship between Attitudes towards Collaborative Problem Solving and Student Performance in Hong Kong
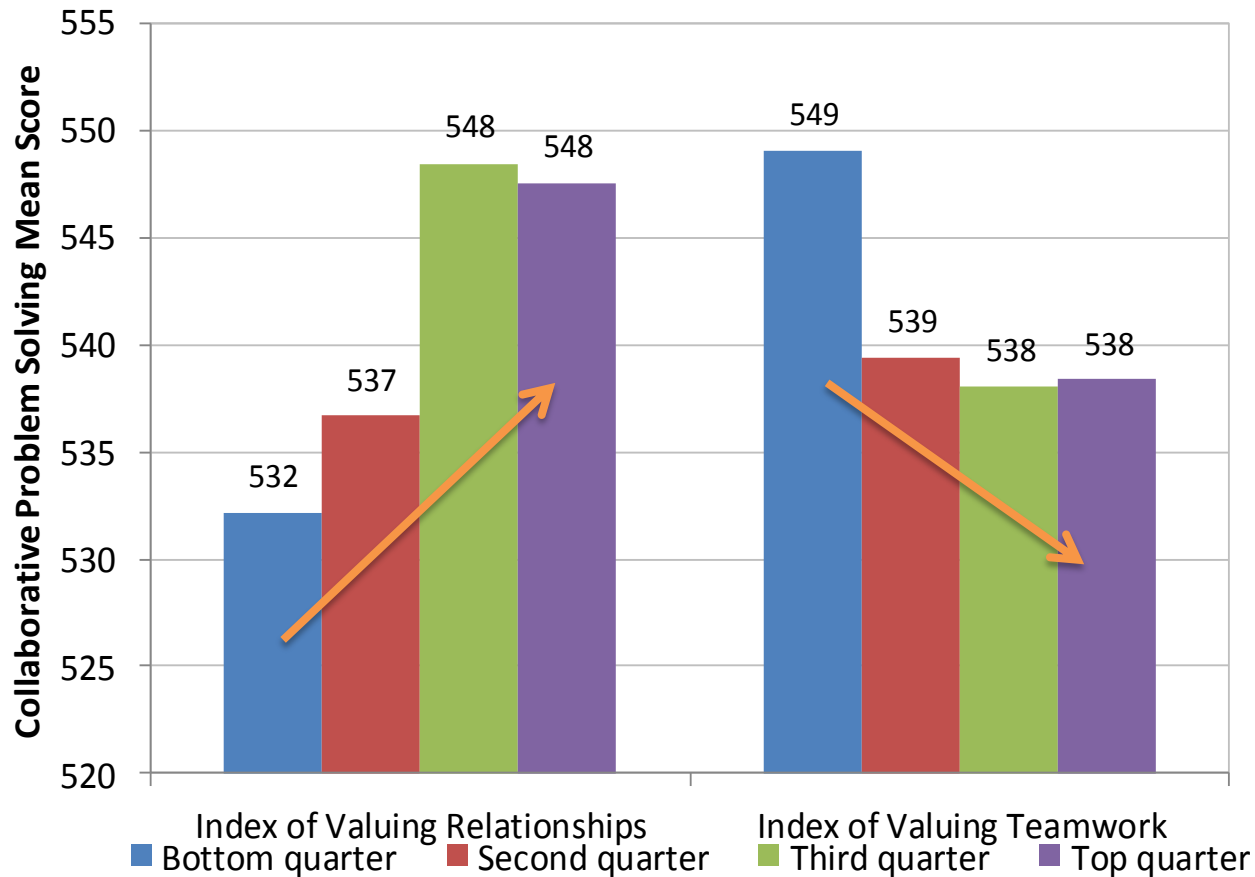
HK students' attitude of valuing relationships has a positive relationship, but their attitude of valuing teamwork has a negative relationship with Collaborative Problem Solving performance

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V. Factors related to Collaborative Problem Solving Performance and Attitudes

MAJOR FINDINGS

- ICT RESOURCES IN FAMILY;
- ONLINE ACTIVITIES IN AND OUTSIDE SCHOOL;
- LEARNING ENVIRONMENT IN CLASS;
- DISCIPLINARY ENVIRONMENT IN SCHOOL;
- PARENTAL INVOLVEMENT

1. ICT Resources in Family and Student Performance in Hong Kong
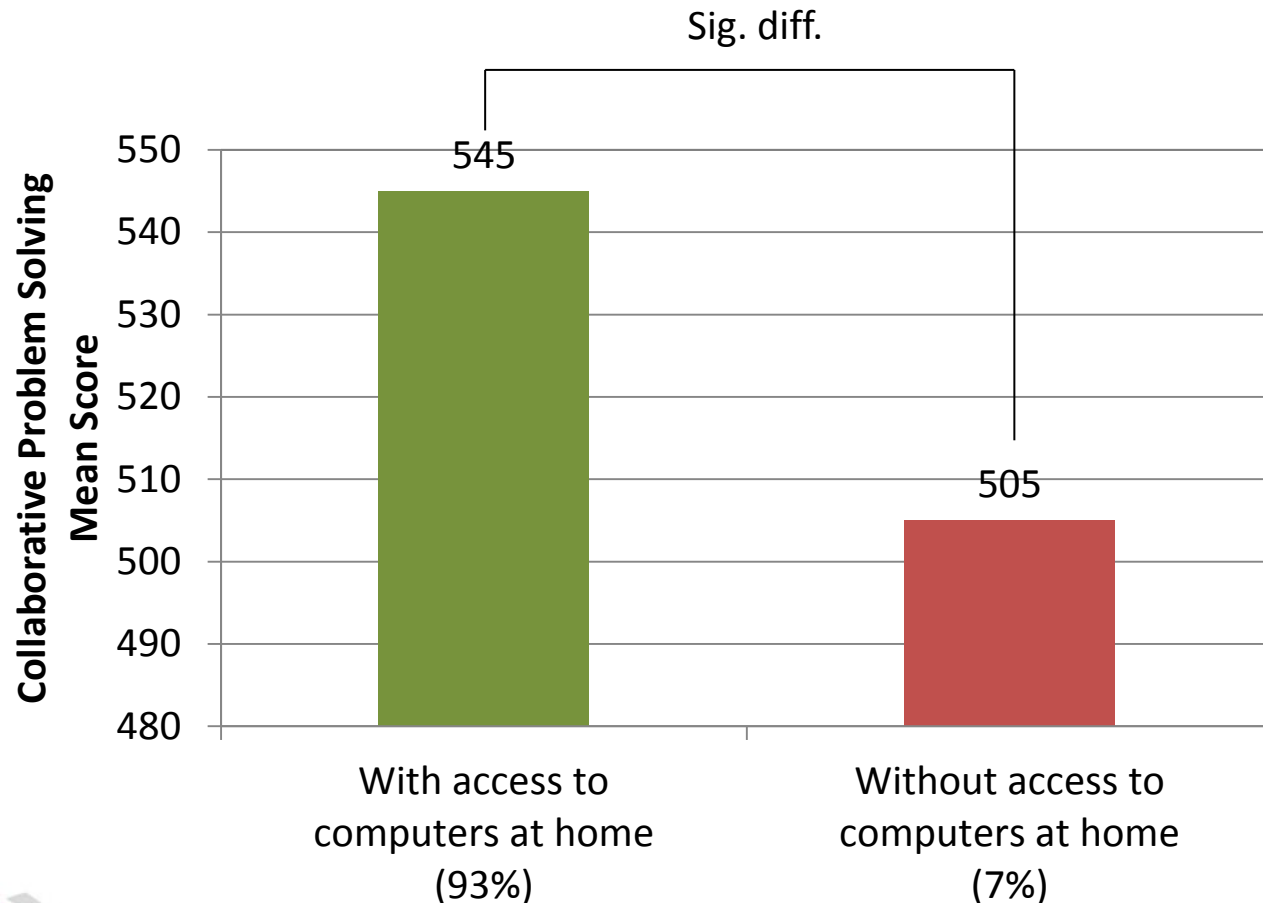
HK students having access to computers at home outperform significantly those without by 40 points in CBA Collaborative Problem Solving

2. Online Activities in and outside School

- In Hong Kong, moderate users of ICT (once or twice a week or a month) *outside school* tend to have *better* performance of CBA Collaborative Problem Solving than frequent users (every day) or non-users

- However, use of ICT *in school* has a *negative* relationship with Collaborative Problem Solving performance
  - ➢ Students who need to use ICT in school may be the disadvantaged students who cannot afford ICT facilities at home

Relationship between Online Activities in and outside School and CBA Collaborative Problem Solving Performance (Hong Kong)

Mean Collaborative Problem Solving Score

Legend:
- Never or hardly ever
- Once or twice a month
- Once or twice a week
- Almost every day/Every day

Browsing the Internet for schoolwork (e.g. for preparing an essay or presentation):
- Never or hardly ever: 495
- Once or twice a month: 542
- Once or twice a week: 557
- Almost every day/Every day: 536

Browsing the Internet to follow up lessons (e.g. for finding explanations):
- Never or hardly ever: 519
- Once or twice a month: 547
- Once or twice a week: 553
- Almost every day/Every day: 533

Obtaining practical information from the Internet:
- Never or hardly ever: 525
- Once or twice a month: 550
- Once or twice a week: 554
- Almost every day/Every day: 538

Reading news on the Internet (e.g. current affairs):
- Never or hardly ever: 519
- Once or twice a month: 540
- Once or twice a week: 550
- Almost every day/Every day: 547

Using email at school:
- Never or hardly ever: 550
- Once or twice a month: 551
- Once or twice a week: 530
- Almost every day/Every day: 488

Doing homework on a school computer:
- Never or hardly ever: 552
- Once or twice a month: 551
- Once or twice a week: 525
- Almost every day/Every day: 487

Using ICT and Digital Devices in School and Collaborative Problem Solving Performance

Figure V.3.12

Index of ICT use at school: ● Top quarter ◆ Third quarter — Second quarter ◆ Bottom quarter

In most countries/ economies, use of ICT in school has a negative relationship with Collaborative Problem Solving performance

Performance difference between top and bottom quarters of the index of ICT use at school
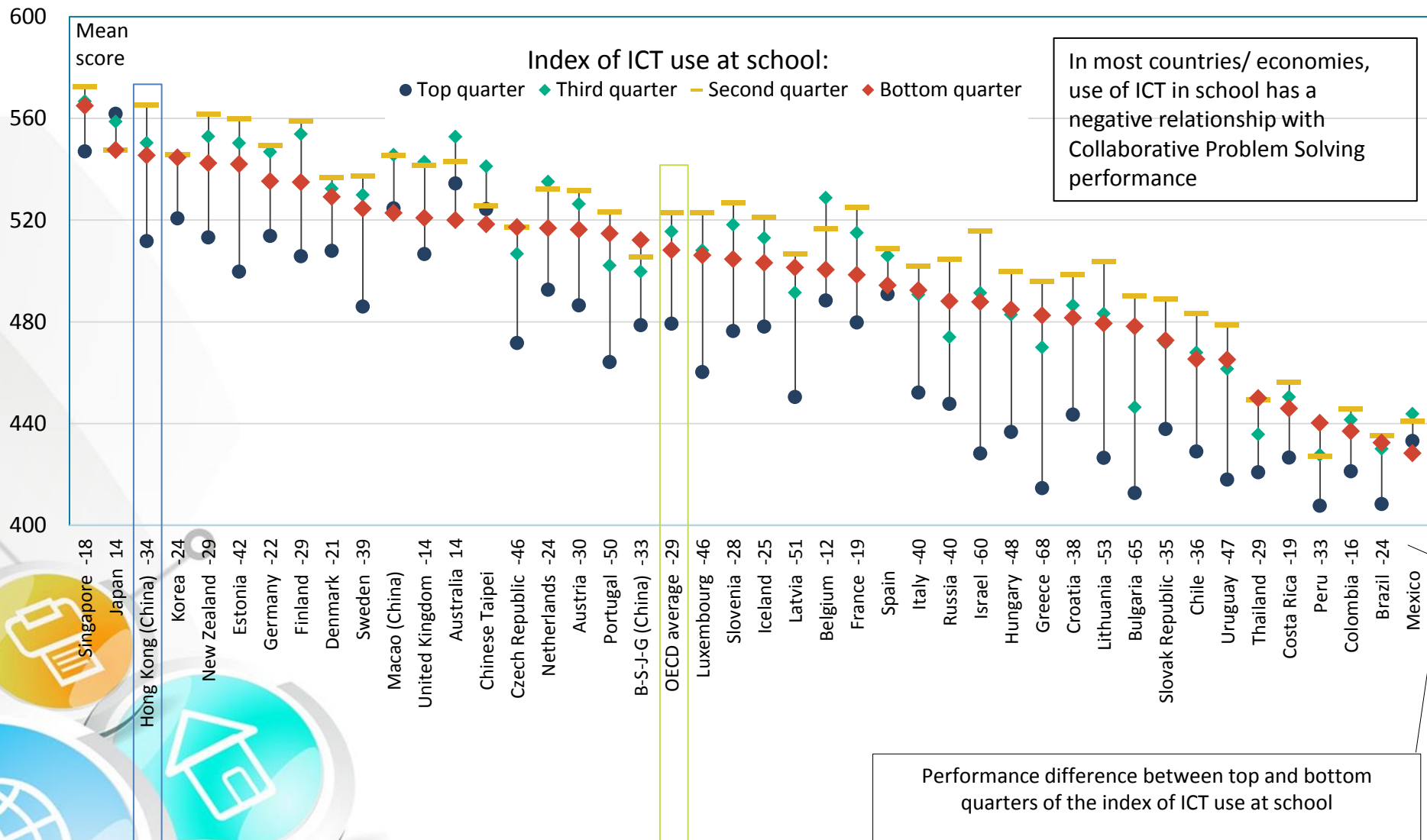
3. Learning Environment in Science Class

PISA asked students about how often they engage in communication-intensive activities such as
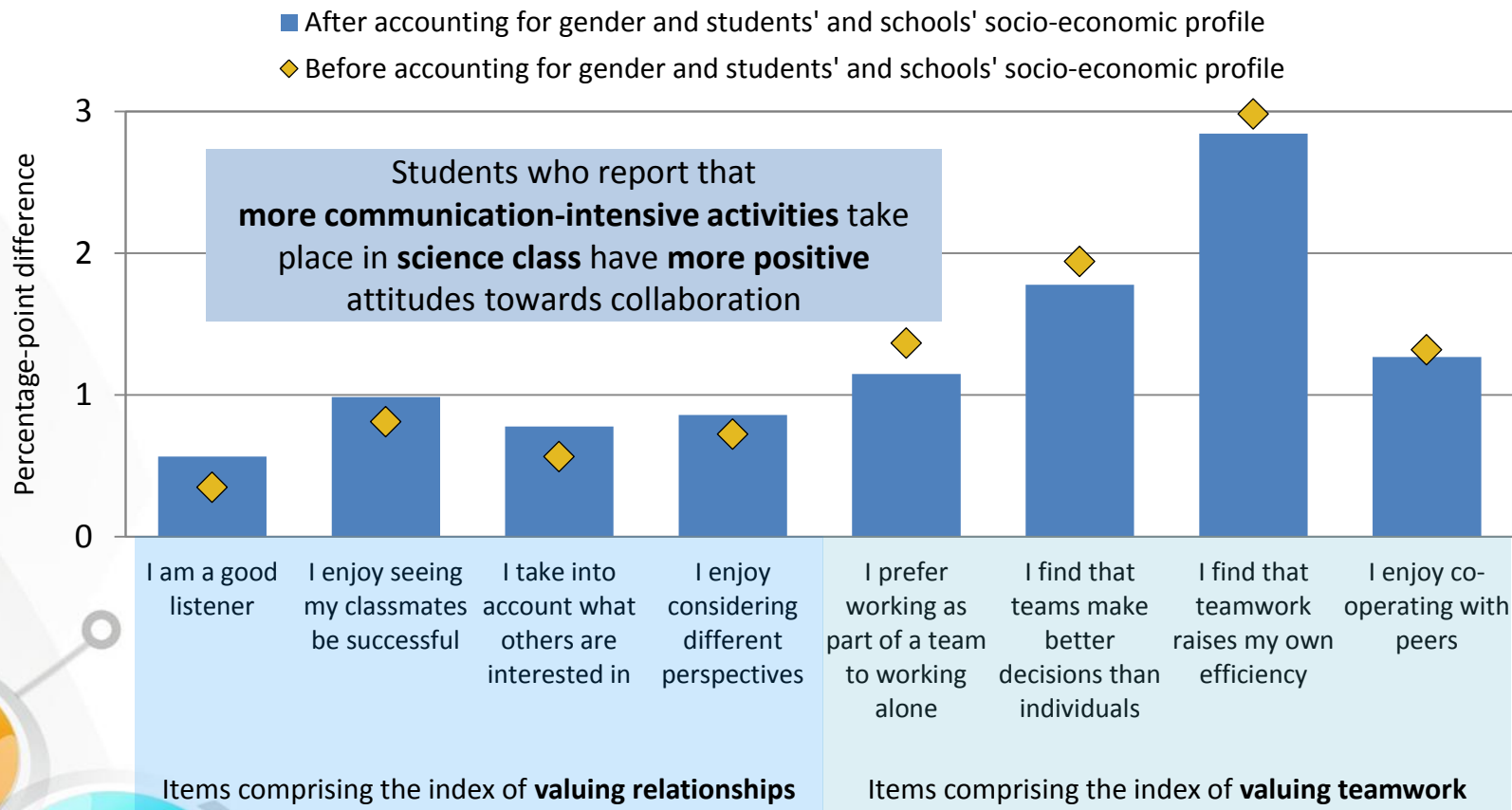
- explaining one's ideas in science class;

- spending time in the laboratory doing practical experiments;

- arguing about science questions; and

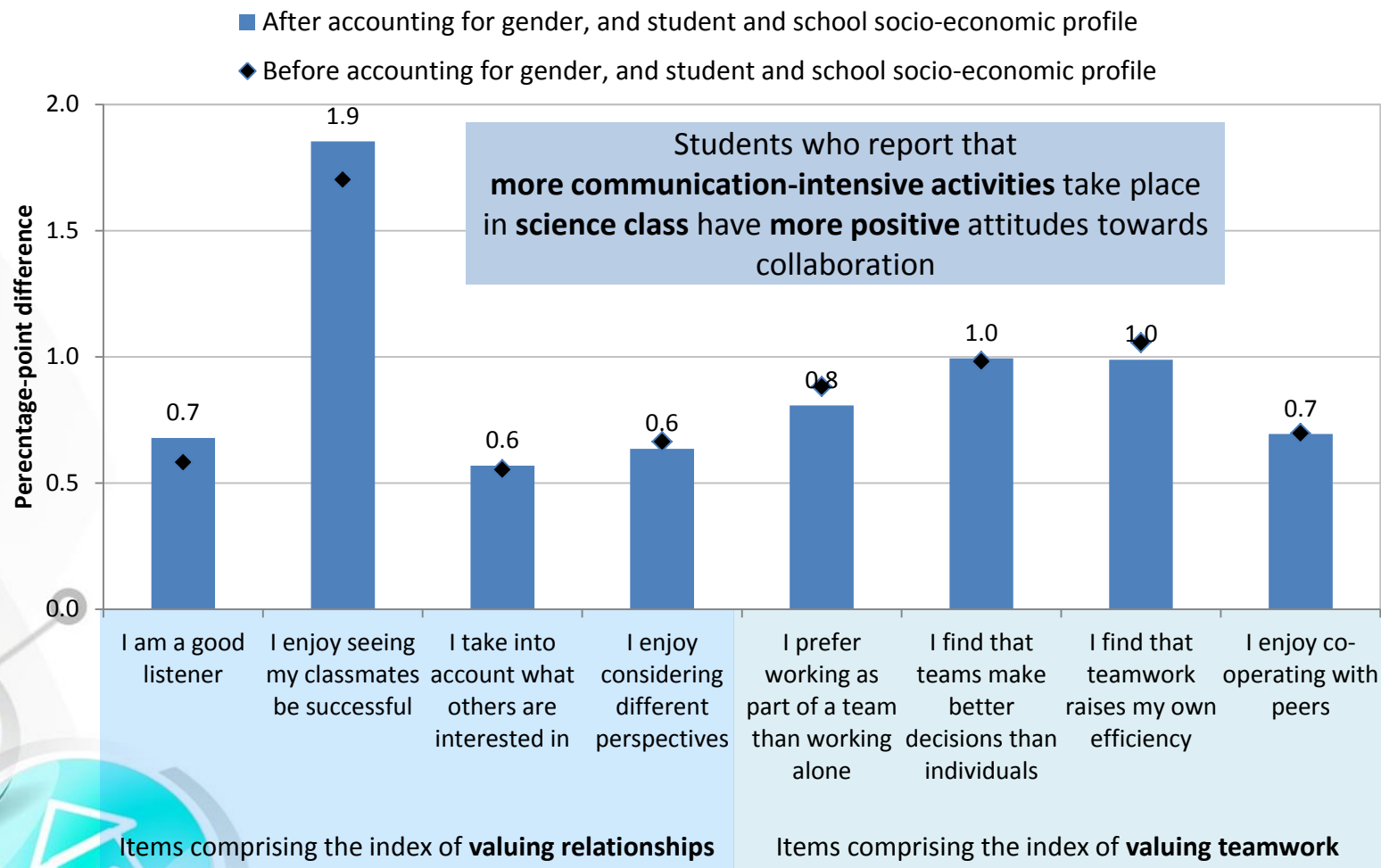- taking part in class debates about investigations.

Positive relationship between these activities and attitudes towards collaboration

Figure V.6.9

Student Interaction in Science Class and Attitudes towards Collaboration (OECD Countries)

- ■ After accounting for gender and students' and schools' socio-economic profile
- ◇ Before accounting for gender and students' and schools' socio-economic profile

Students who report that **more communication-intensive activities** take place in **science class** have **more positive** attitudes towards collaboration

Percentage-point difference

| I am a good listener | I enjoy seeing my classmates be successful | I take into account what others are interested in | I enjoy considering different perspectives | I prefer working as part of a team to working alone | I find that teams make better decisions than individuals | I find that teamwork raises my own efficiency | I enjoy co-operating with peers |

Items comprising the index of **valuing relationships**

Items comprising the index of **valuing teamwork**

Figure V.6.9

Student Interaction in Science Class and Attitudes towards Collaboration (Hong Kong)

4. Disciplinary Environment in School
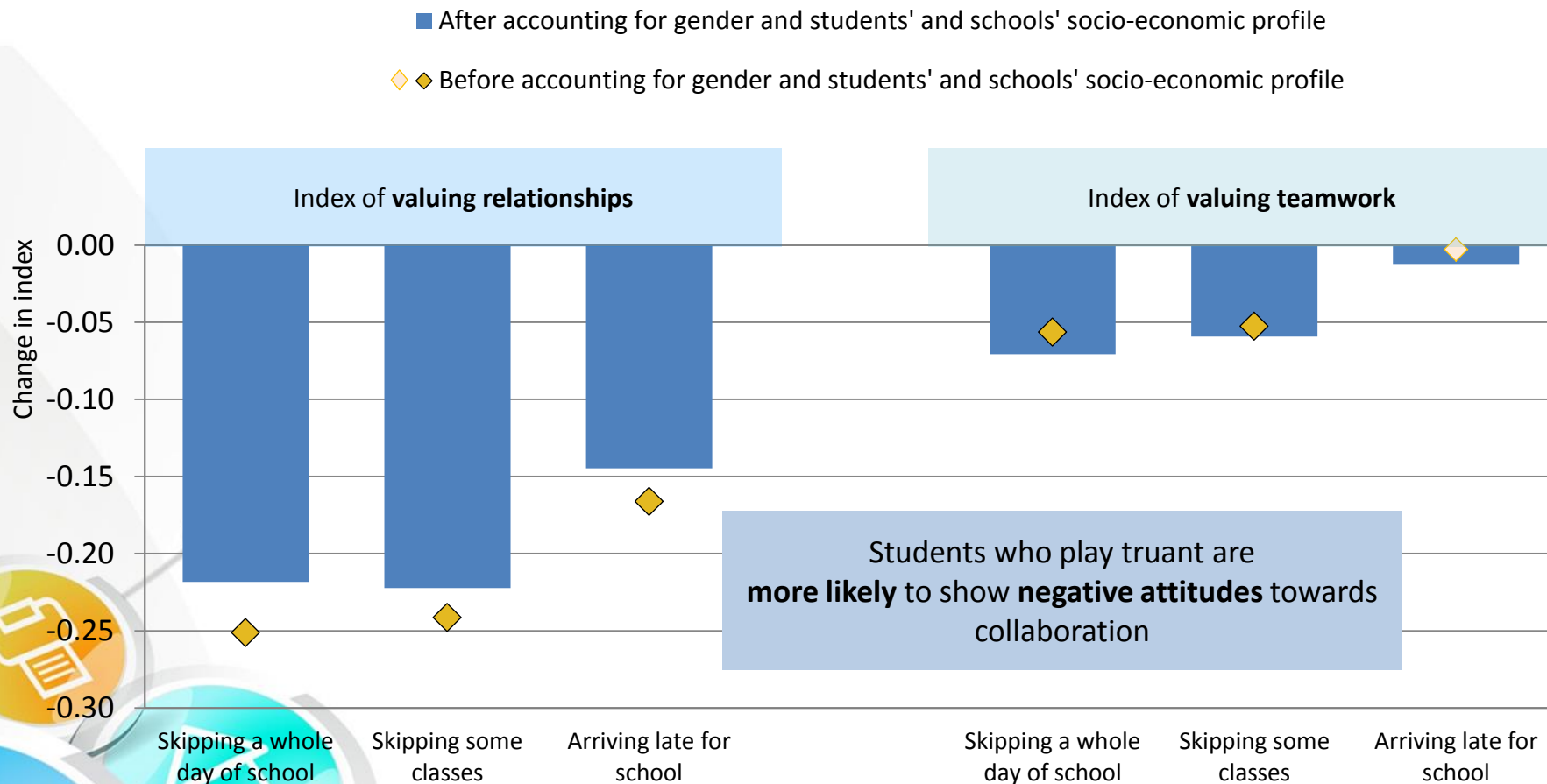
PISA asked students about

- Being Bullied: e.g. being threatened by other students;

- Truancy: e.g. skipping a school day, some classes or arriving late for school.

Negative relationship between these disciplinary problems and CPS performance and attitudes towards collaboration

Student Truancy and Attitudes towards Collaboration (OECD Countries)

Figure V.6.7

■ After accounting for gender and students' and schools' socio-economic profile

◇◆ Before accounting for gender and students' and schools' socio-economic profile

Index of **valuing relationships**

Index of **valuing teamwork**

Change in index

0.00

-0.05

-0.10

-0.15

-0.20

-0.25

-0.30

Skipping a whole day of school

Skipping some classes

Arriving late for school

Skipping a whole day of school

Skipping some classes

Arriving late for school

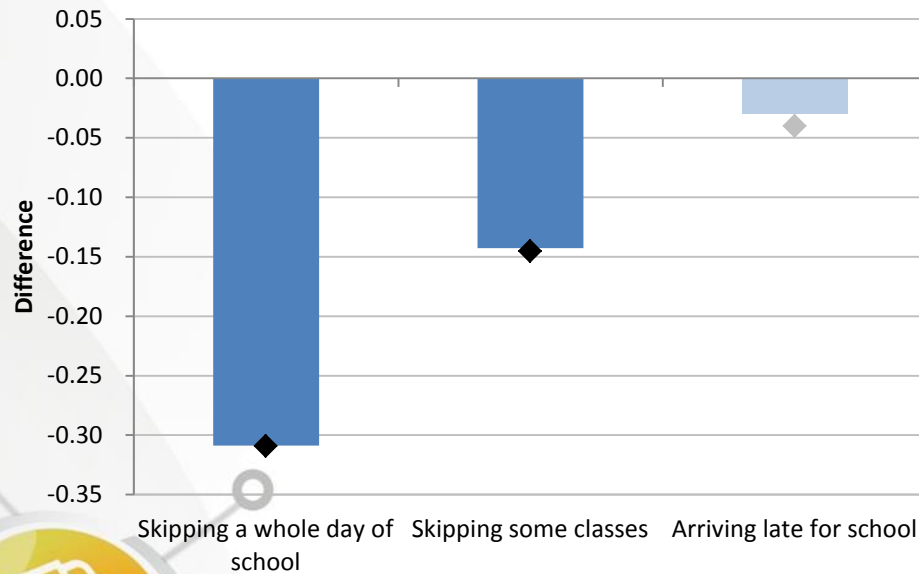Students who play truant are **more likely** to show **negative attitudes** towards collaboration

Student Truancy and Attitudes towards Collaboration (Hong Kong)
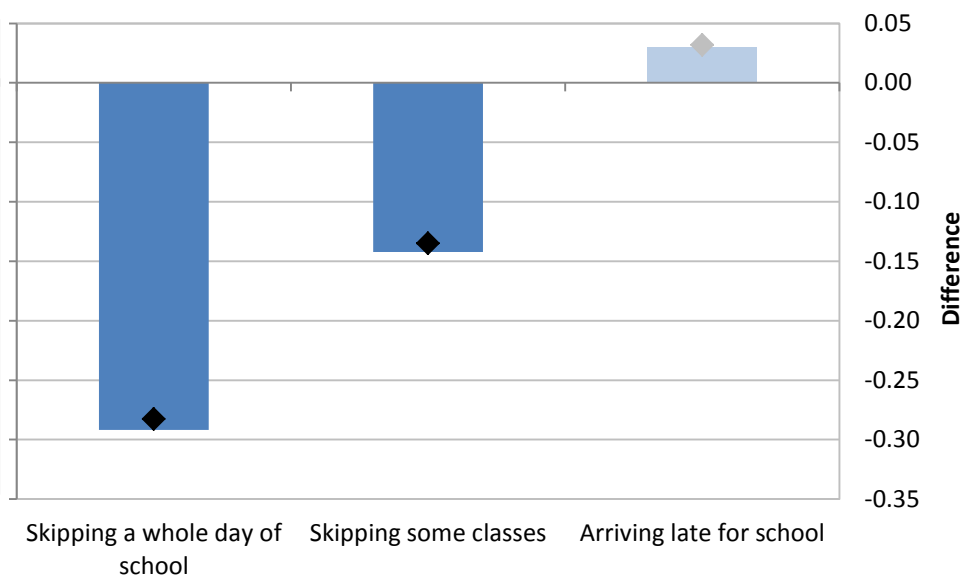
Figure V.6.7

◇ ◆ Before accounting for gender and students' and schools' socio-economic profile
◻ ◼ After accounting for gender and students' and schools' socio-economic profile
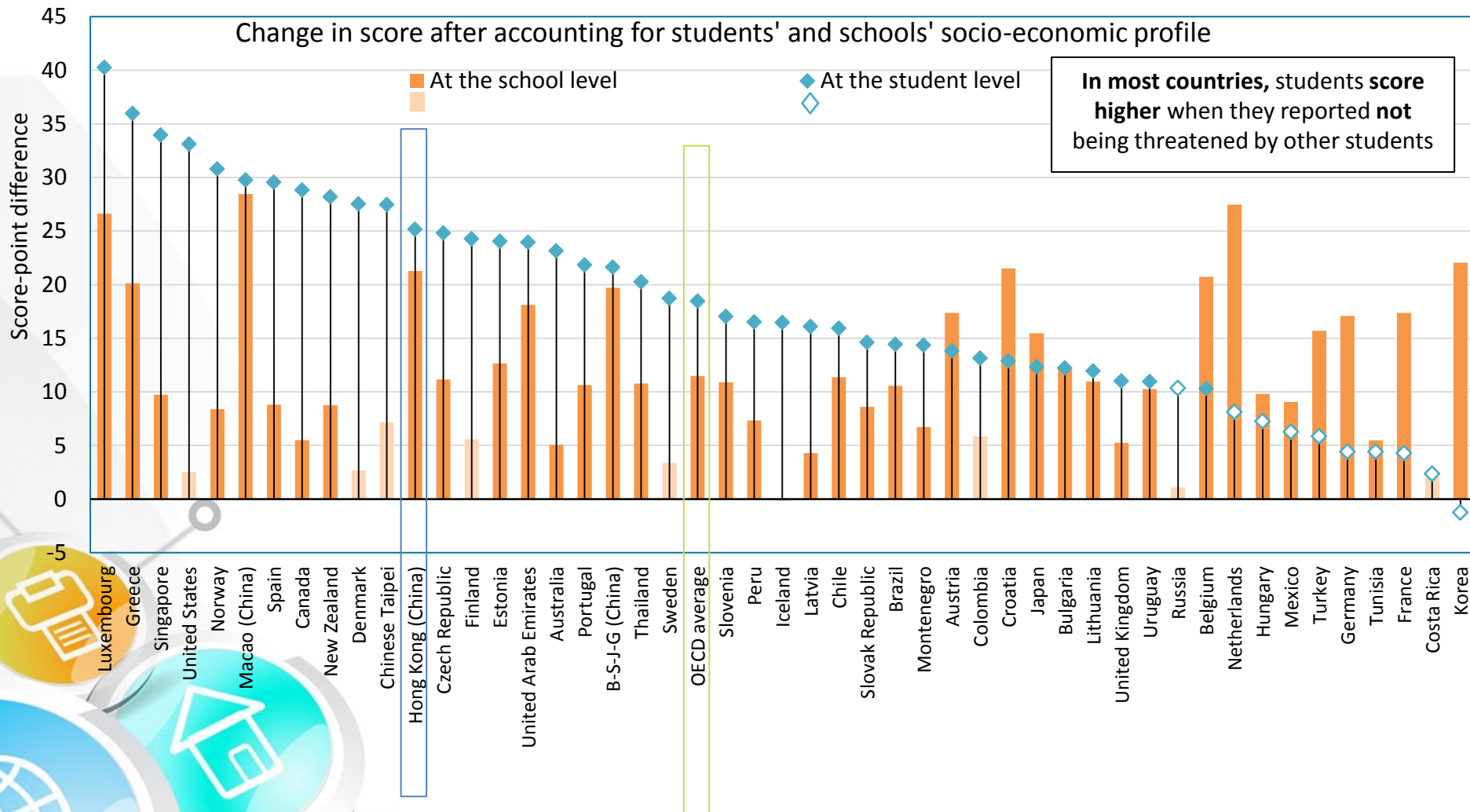

**Index of valuing relationships**

Index of valuing teamwork

Students who play truant are
**more likely** to show **negative attitudes** towards collaboration

Figure V.7.3

Being Bullied: Students Being Threatened by Other Students and Collaborative Problem Solving Performance

Being Bullied: Percentage of Hong Kong is Higher Than OECD Average

Percentage of students reported psychological bullied in school (PISA2015)
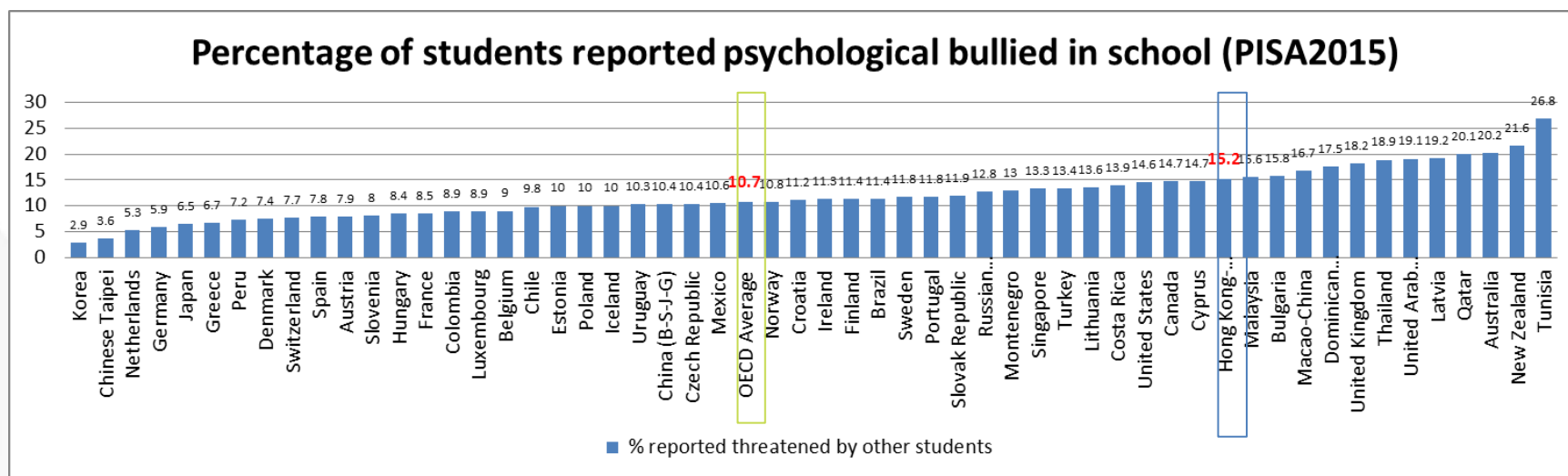
Percentage of students reported physically bullied in school (PISA2015)
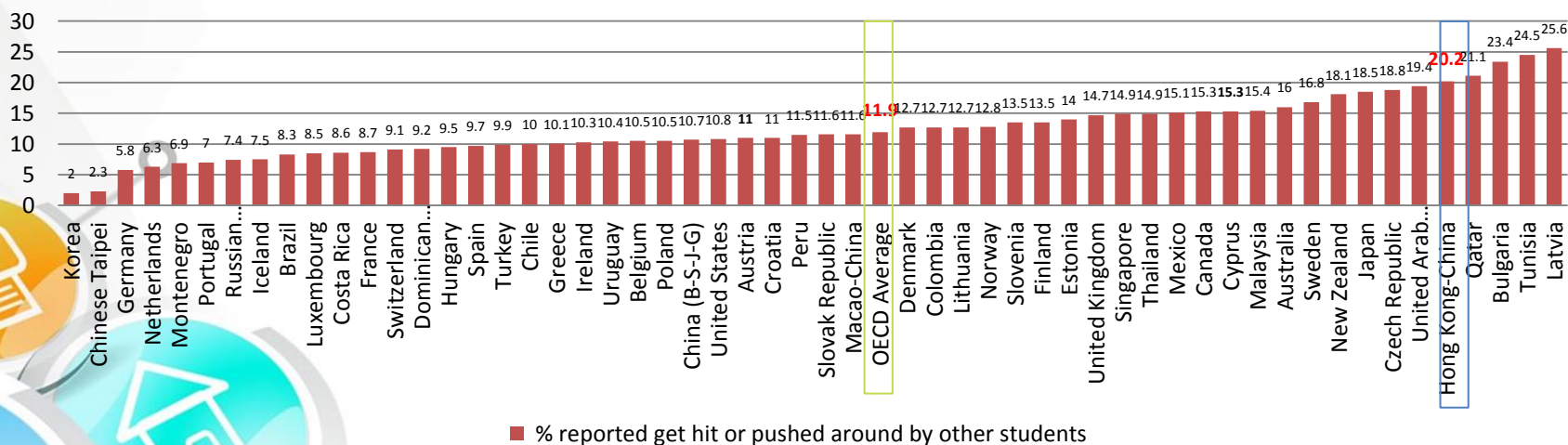
5. Parent Factors

Parental Involvement

- Science activity

- Academic communication

- Social communication

Emotional Support

- Emotional support (student report)

- Emotional support (parent report)

Items for Science Activity, Academic and Social Communication

PISA asked parents about their child's engagement in science activities at about age 10 such as:

- Watching TV programmes about science
- Reading books on scientific discoveries

PISA asked parents about their academic communication with their child. Examples are:
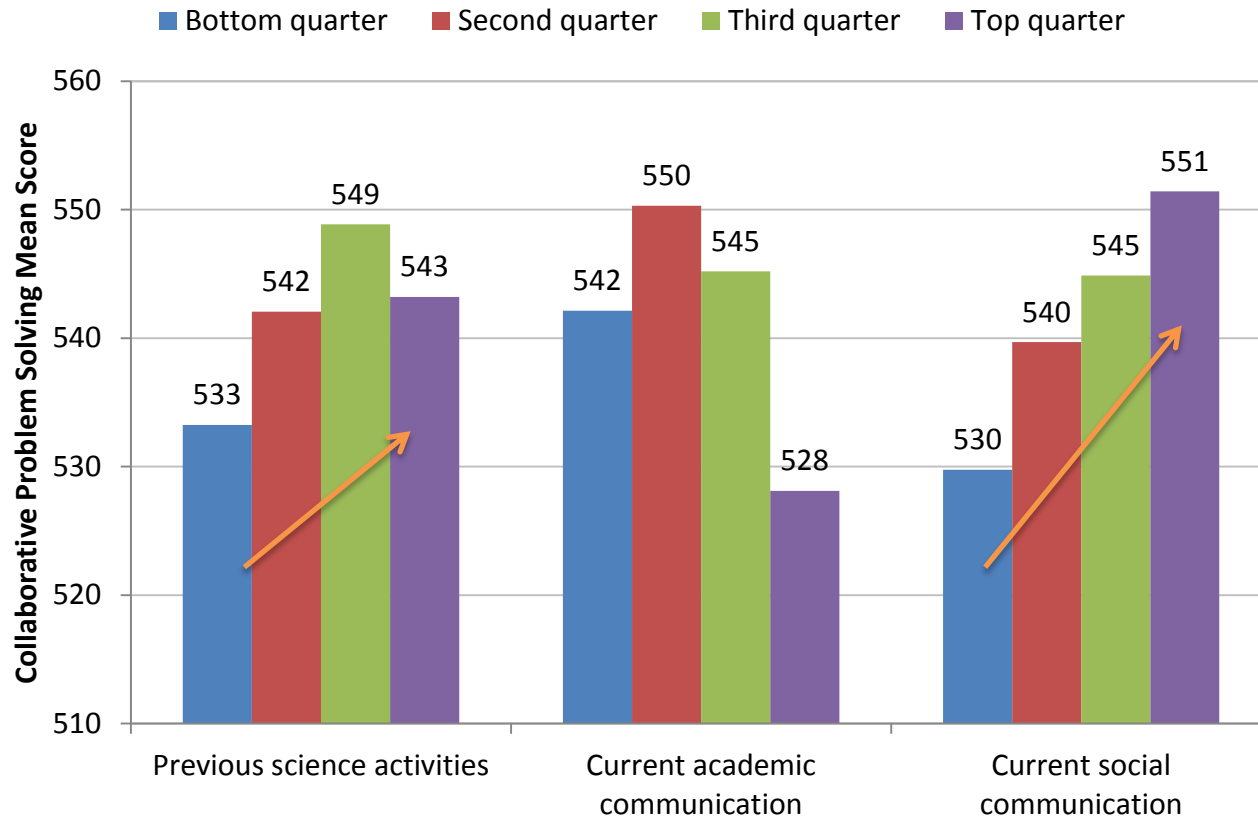
- Helping my child with his/her science homework
- Asking how my child is performing in science class

PISA asked parents about their social communication with their child. Examples are:

- Eating dinner with my child around a table
- Spending time just talking to my child

Parental Involvement Indices and Collaborative Problem Solving Performance (Hong Kong)

Parental social communication is the most important!

Items for Emotional Support

PISA asked parents about their emotional support for their child. Examples are:
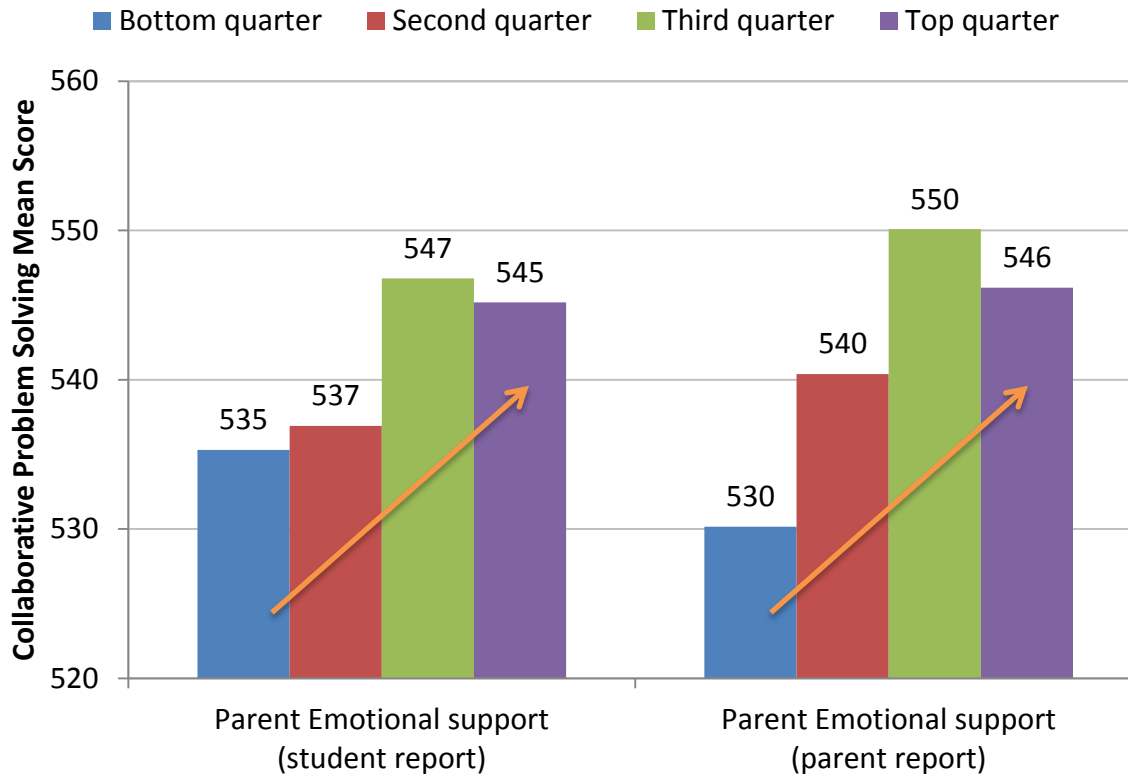
- I am interested in my child's school activities

- I encourage my child to be confident

PISA asked students about their parents' emotional support for them. Examples are:

- My parents are interested in my school activities

- My parents encourage me to be confident

Parental Support Indices and Collaborative Problem Solving Performance (Hong Kong)

Legend: ■ Bottom quarter ■ Second quarter ■ Third quarter ■ Top quarter

Y-axis: Collaborative Problem Solving Mean Score (520–560)

Parent Emotional support (student report): 535, 537, 547, 545

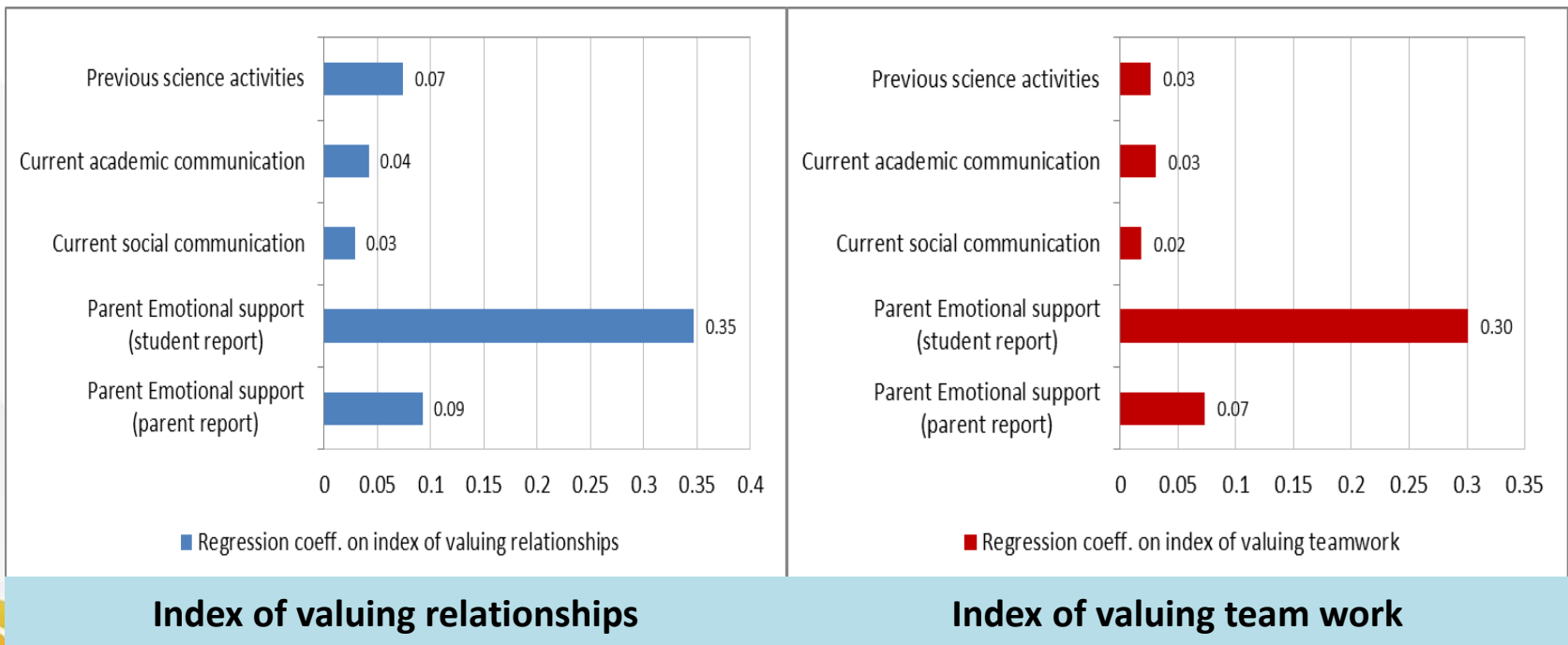Parent Emotional support (parent report): 530, 540, 550, 546

Parental emotional support is the most important!

Parent Factors and Collaborative Problem Solving Performance (Hong Kong)
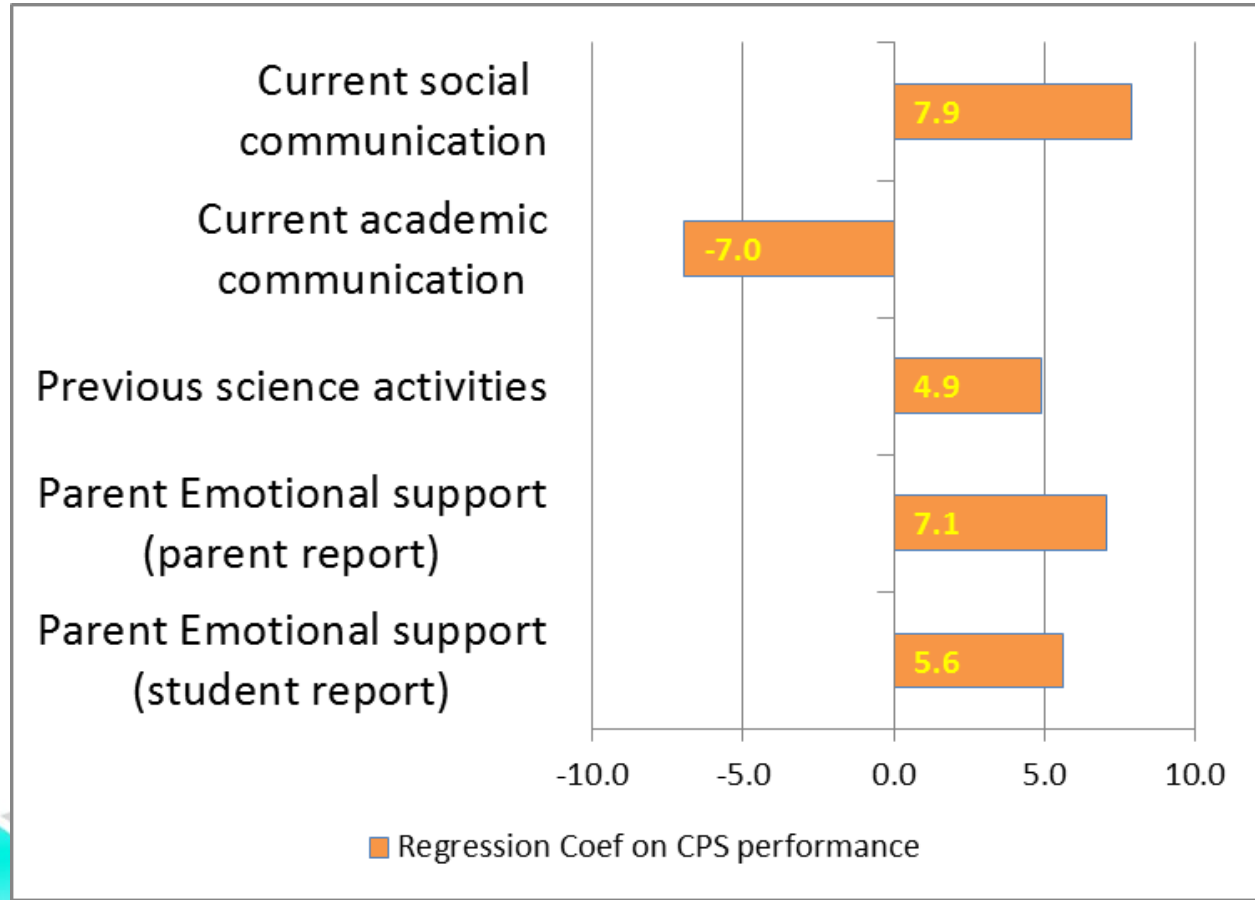
Parental Factors and
Attitudes towards Collaboration (Hong Kong)

Index of valuing relationships

Index of valuing team work

Parental emotional support (student report) is the most important!

Conclusions

1) Hong Kong students' performance in CBA Collaborative Problem Solving

   ➢ Similar to their performances in CBA science, reading and mathematics in PISA 2015, Hong Kong students' performance in Collaborative Problem Solving are among the top 10 of all participating countries and economies

2) Low impact of SES on CBA Collaborative Problem Solving performance

   ➢ Socio-economic status of Hong Kong students has a relatively small impact on their Collaborative Problem Solving performance

   ➢ Among all participating countries and economies, Hong Kong belongs to the group of high performance/ low socio-economic impact countries and economies

Conclusions

3) Gender gap in CBA Collaborative Problem Solving

   ➢ Hong Kong girls outperform boys in Collaborative Problem Solving

4) Immigrant students' disadvantage in CBA Collaborative Problem Solving

   ➢ Similarly to CBA science, reading and mathematics, immigrant students in Hong Kong perform significantly more poorly than native students in Collaborative Problem Solving

5) Attitudes towards Collaborative Problem Solving

   ➢ Hong Kong students' attitudes of "valuing relationships" and "valuing teamwork" are near to international average

   ➢ Students' attitude of "valuing relationships" has a positive relationship whereas attitude of "valuing teamwork" has a negative relationship with Collaborative Problem Solving performance

Conclusions

6) ICT resources in Family

 ➢ A great majority of Hong Kong students (93%) have access to computers and internet at home

 ➢ Students having access to computers at home perform better than those without in Collaborative Problem Solving

7) Online activities

 ➢ Moderate users of ICT at home perform better than frequent users or non-users in Collaborative Problem Solving

8) Learning environment in class and in school

 ➢ Positive relationship between interactive science activities and attitudes towards collaboration

 ➢ Negative association between truancy and attitudes towards collaboration

 ➢ Negative association between bullying and Collaborative Problem Solving performance

9) Family factors

 ➢ Social communication and emotional support have positive relationships with Collaborative Problem Solving performance and attitudes

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Thank you!

For further information:

OECD/PISA

Website: http://www.oecd.org/pisa/

Email: edu.pisa@oecd.org

HKCISA Centre

Website: www.fed.cuhk.edu.hk/~hkcisa

Email: estherho@cuhk.edu.hk