

HKPISA HKPISA HKPISA HKPISA



# The Sixth HKPISA Report PISA 2015

From PISA 2000

To PISA 2015

## *Executive Summary*



**MONITORING THE QUALITY AND EQUALITY  
OF EDUCATION IN HONG KONG  
FROM AN INTERNATIONAL PERSPECTIVE**

**從國際視野監察香港教育的質素與均等**

香港中文大學

The Chinese University of Hong Kong

教育局委辦

Commissioned by Education Bureau

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## FOREWORD

The OECD (Organisation for Economic Co-operation and Development) Programme for International Student Assessment (PISA) has been providing Hong Kong with valuable information to enable examination of the quality and equality of our education system from an international perspective since the first cycle of PISA. In PISA 2015, we attempt to address the extent to which our students have acquired the basic competencies essential for meeting the challenges of the twenty-first century. Since the major domain of assessment in PISA 2015 is science, we compared the results with PISA 2006 when science was also the major domain, asking: How has the performance of our students changed over the past ten years? Have the various aspects of science self-efficacy and learning motivation improved since then? To what extent have the parental, teacher and school factors affected our students' learning?

Premised on the findings in the previous five HKPISA Reports of PISA 2000+, PISA 2003, PISA 2006, PISA 2009 and PISA 2012, this report extends our understanding of how well our education system is performing by providing, in science in particular, an international perspective. It is hoped that it can provide: (i) researchers with the opportunity for examining the current state of affairs in our education system and the outcome of education reforms over time; (ii) policy makers with the information needed for formulating policies that are responsive to students' needs and the global development; and (iii) teachers and parents with a broader view of their children's learning beyond the local context. With the vision of a better future for all children regardless of their social background, we hope that stakeholders can find in this report, a clear "rationale" and robust "evidence" supportive of their decisions and actions.

The success of this project is due to the contribution of stakeholders from various sectors of the education community and I would like to thank all the students, parents, teachers and principals participating in this project. The data in this survey would not be available without their generous cooperation. I would also like to thank the Education Bureau of the Hong Kong Special Administrative Region Government for commissioning us to conduct the PISA 2015 project. Thanks are especially due to the Chairperson of the Regional Advisory Committee, Professor Kai-ming Cheng, and its members, Ms. Suk-han Poon and Mr. Wing-kei Wong, for their valuable advice given and time committed. Among the working team, I am grateful for our project advisor, Professor Douglas Willms, the project leaders, Professor Yue-ping Chung, Professor Wing-kwong Tsang and Professor Hin-wah Wong, and HKCISA Centre advisors, Mr. Kai-lok Tso and Dr. King-chee Pang, for their insight and invaluable guidance. I would also like to thank my colleagues in the research team who committed their time and expertise in the front line tasks of researching and reporting. Thanks are also due to the Centre staff, Terence, Thomas, Eric, Kwok Wing and Grace. Without their sustained assistance, the project would not be a success.

*Esther Sui-chu HO*

Esther Sui-chu HO

Director

HKCISA Centre

HKIER, CUHK

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## OVERVIEW OF PISA

1. The Programme for International Student Assessment (PISA) is a project initiated and coordinated by the Organisation for Economic Co-operation and Development (OECD). The primary goal of this international study is to assess how well 15-year-old students near the completion of compulsory education have acquired the knowledge and skills essential for meeting the challenges of our society. It then develops educational indicators to help governmental bodies and policy makers examine, evaluate, and monitor the effectiveness of the education system at both national and school levels.
2. The PISA assessment takes place every three years starting from 2000, and covers the three domains of reading, mathematical, and scientific literacy with a major focus on one. PISA 2015 is the sixth cycle of this assessment, and the major focus is on scientific literacy.
3. In PISA 2015, about 510,000 students from 72 countries/economies took part in a two-hour test. Among them, 57 countries/economies including Hong Kong conducted the test in computer-based mode, and the remaining 15 countries/economies delivered the test in pencil and paper mode.

**Table 1 Participating Countries/Economies of PISA 2015**

| OECD Countries |             |                 | Partner Countries (Non-OECD Countries/Economies) |                 |                       |
|----------------|-------------|-----------------|--|-----------------|-----------------------|
| Australia      | Iceland     | Portugal        | Albania *  | Georgia *       | Peru                  |
| Austria        | Ireland     | Slovak Republic | Algeria *  | Hong Kong-China | Qatar                 |
| Belgium        | Israel      | Slovenia        | Argentina *                                      | Indonesia *     | Romania †             |
| Canada         | Italy       | Spain           | Brazil   | Jordan *        | Russian Federation    |
| Chile          | Japan       | Sweden          | China (B-S-J-G) <sup>1</sup>                     | Kazakhstan *    | Singapore             |
| Czech Republic | Korea       | Switzerland     | Bulgaria   | Kosovo *        | Thailand              |
| Denmark        | Latvia      | Turkey          | Chinese Taipei                                   | Lebanon *       | Trinidad and Tobago * |
| Estonia        | Luxembourg  | United Kingdom  | Colombia   | Lithuania       | Tunisia               |
| Finland        | Mexico      | United States   | Costa Rica                                       | Macao-China     | United Arab Emirates  |
| France         | Netherlands |                 | Croatia  | Malaysia        | Uruguay               |
| Germany        | New Zealand |                 | Cyprus   | Malta *         | Viet Nam *            |
| Greece         | Norway      |                 | Dominican Republic                               | Moldova *       |                       |
| Hungary        | Poland      |                 | Republic of Macedonia *                          | Montenegro      |                       |

Note: 1. China (B-S-J-G) refers to the four participating China provinces or cities: Beijing, Shanghai, Jiangsu and Guangdong.

2. The 15 countries/economies conducting the PISA test in pencil and paper mode are marked with an asterisk.

4. PISA has developed a framework describing the scope and dimensions of the assessment in each of the three domains of literacy. Each domain has three dimensions: the *content* knowledge that students should acquire, the *processes* that need to be performed, and the *context* in which knowledge and skills are applied or drawn on. In addition to the assessment of the three domains, PISA 2015 requires students and school principals to complete questionnaires. In Hong Kong, PISA also complements the perspectives of students and school principals by including additional parent and teacher questionnaires. These data provide an outlook on parental involvement in children's education, teaching practices adopted by teachers, and cognitive and affective aspects of student performance.

5. The main study of PISA 2015 in Hong Kong was conducted from April to May 2015. A two-stage stratified sampling design is used. In the first stage, schools are stratified based on the type of school (government, aided and independent – international and those under Direct Subsidy Scheme) and student academic intake<sup>1</sup> (high, medium and low ability). Schools from each stratum are systematically sampled with probabilities proportional to their enrolment size. The resulting school participation rate is 90.2% which meets the OECD standard. The distribution of participating schools is shown in Table 2.

**Table 2 Number of Participating Schools of the PISA 2015 Main Study in Hong Kong**

| Explicit Strata          | Implicit Strata             | Total Number of Schools | Number of Participating Schools |
|--------------------------|-----------------------------|-------------------------|---------------------------------|
| Government               | High Ability                | 15                      | 6                               |
|                          | Medium Ability              | 7                       | 2                               |
|                          | Low Ability                 | 8                       | 2                               |
| Aided                    | High Ability                | 119                     | 45                              |
|                          | Medium Ability              | 115                     | 37                              |
|                          | Low Ability                 | 124                     | 28                              |
|                          | Not Applicable <sup>3</sup> | 1                       | 1                               |
| Independent <sup>1</sup> | Local (DSS <sup>2</sup> )   | 59                      | 17                              |
|                          | International               | 33                      | 0                               |
| <b>Total</b>             |                             | <b>481</b>              | <b>138</b>                      |

Note: 1. There is no academic ability stratification for independent schools.  
 2. DSS refers to schools under the Direct Subsidy Scheme.  
 3. One school is without S1 student intake information because it only recruits students from S4 to S6.

6. In the second stage, 42 students of age 15 are randomly selected from each school in the sample. A total of 5,359 students from 138 schools are accepted for final analysis according to the OECD sampling standard. Table 3 shows the grade distribution of the sampled students in Hong Kong.

**Table 3 Distribution of Participating Students of PISA 2015 Main Study in Hong Kong**

| Grade/Form   | Number of Participating Students | Proportion (%) <sup>*</sup> |
|--------------|----------------------------------|-----------------------------|
| 7/S1         | 59                               | 1.1                         |
| 8/S2         | 286                              | 5.3                         |
| 9/S3         | 1384                             | 25.8                        |
| 10/S4        | 3612                             | 67.4                        |
| 11/S5        | 18                               | 0.3                         |
| <b>Total</b> | <b>5359</b>                      | <b>100</b>                  |

<sup>\*</sup> The minor discrepancy in the total percentage is due to rounding of numbers.

<sup>1</sup> Student academic intake denotes the academic ability of Secondary 1 students admitted by school.

### Quality and Equality

7. The findings derived from PISA 2015 shed light on both the *quality* and *equality* of Hong Kong's education system. Quality refers to the effectiveness of the education system in fostering students' literacy skills. Equality refers to the benefit from education received by all students regardless of their socio-economic background.
8. In terms of overall quality, Hong Kong students perform well. From PISA 2000<sup>2</sup> to PISA 2015, Hong Kong continues to rank among the top ten in the three assessment domains. In PISA 2015, Hong Kong ranks ninth in science, and second in reading and mathematics. Hong Kong's mean performances are significantly above the OECD averages.<sup>3</sup> Taking statistical significance into account, Hong Kong's science score of 523 is only significantly lower than those of Singapore (first: 556), Japan (second: 538), Estonia (third: 534), Chinese Taipei (fourth: 532) and Finland (fifth: 531). It is not significantly different from those of Macao (sixth: 529), Canada (seventh: 528), Viet Nam (eighth: 525), China (B-S-J-G) (tenth: 518) and Korea (eleventh: 516). In reading, Hong Kong gets a mean score of 527; only Singapore (first: 535) performs significantly better than Hong Kong. There is no statistical difference between Hong Kong, Canada (third: 527), Finland (fourth: 526) and Ireland (fifth: 521). In mathematics, Hong Kong gets a mean score of 548, which is significantly lower than Singapore's (first: 564), similar to Macao's (third: 544) and Chinese Taipei's (fourth: 542), but higher than those of all other participating countries/economies (see Appendix I).
9. As far as equality in the education system of Hong Kong is concerned, in PISA 2015, the disparities between high (95th percentile) and low (5th percentile) achievers in science and reading are relatively small (i.e. smaller than the OECD averages), while the disparity between high and low achievers in mathematics is slightly greater than the OECD average. This suggests that Hong Kong students benefit fairly equally from quality education in Hong Kong regardless of their academic ability. Furthermore, economic, social and cultural status (ESCS) has only a relatively small impact on the performance of Hong Kong students. The impact of socio-economic background on academic performance is expressed as "socio-economic gradient" in PISA.<sup>4</sup> The slope of the gradient line is an indicator of the extent of inequality in student performance attributable to socio-economic background. The modest slope of Hong Kong suggests that Hong Kong students perform equally well regardless of their socio-economic background (see Appendix II).

<sup>2</sup> The first cycle of PISA, PISA 2000, was conducted in 2000. Thirty-two countries/economies participated. Hong Kong and 10 other countries/economies joined in PISA 2000+, which was conducted in February 2002.

<sup>3</sup> In PISA 2015, the OECD averages are 493 in both science and reading, and 490 in mathematics, with standard deviations of 100.

<sup>4</sup> A steeper gradient indicates a greater impact of socio-economic background on student performance, which suggests more inequality.

10. The variation in science performance between secondary schools in Hong Kong has decreased from PISA 2006 to PISA 2015. This indicates that the academic segregation between schools reduced during the past decade. The within-school variance in science performance has also decreased during this period, which may signify an improvement in school inclusiveness.<sup>5</sup> The decrease in both between- and within-school variances in science performance could also be related to the decrease in the proportion of students studying all three major science subjects and the decrease in the proportion of top achievers under the implementation of the New Senior Secondary (NSS) curriculum.

### *Student Achievement in Scientific Literacy*

11. The science performance of Hong Kong students in PISA 2015 (523) is significantly lower than those in PISA 2006 (542), PISA 2009 (549) and PISA 2012 (555).<sup>6</sup> In comparison to their OECD counterparts, Hong Kong students score significantly higher at all percentile points. In terms of science competency subscales, Hong Kong students have achieved a good balance between *explaining phenomena scientifically, evaluating and designing scientific enquiry* and *interpreting data and evidence scientifically*. In terms of science knowledge subscales, they are relatively stronger in *content knowledge* than in *procedural and epistemic knowledge*.

12. Regarding the science proficiency scale, the percentage of Hong Kong students attaining Level 5 and 6 (7.4%) is lower than that of the OECD average (7.7%). However, at the other end of the scale, about 90.6% of Hong Kong students are able to reach Level 2, the baseline level of scientific literacy, and this is higher than the OECD average of 78.8%.

13. In Hong Kong, gender difference in the overall scientific literacy score is not statistically significant.. Furthermore, boys perform less satisfactorily than girls in *evaluating and designing scientific enquiry* but better in *explaining phenomena scientifically*.

14. In PISA 2015, students' self-related cognition in science and engagement in science activities were assessed to provide a better understanding of how various students' affective outcomes relate to their science performance. Among the four indices of self-related cognition<sup>7</sup>, Hong Kong students have a higher level of interest in and enjoyment of learning science and a higher level of instrumental motivation than the OECD average, and their self-efficacy in science is around the OECD average. Students who reported higher levels of these four self-related cognition indices and engagement in science activities were found to perform better in science. Compared with PISA 2006, PISA 2015 indicates a significant drop in Hong Kong students' science self-efficacy and enjoyment of science, but a significant increase in their instrumental motivation.

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<sup>5</sup> From PISA 2006 to PISA 2015, the between-school variance in Hong Kong science performance decreased from 3059 to 1987, and the within-school variance decreased from 5230 to 4459.

<sup>6</sup> As science was the major domain in PISA 2006 for the first time, direct comparisons between PISA 2015 and those cycles before PISA 2006, that is, PISA 2000+ and PISA 2003, are not possible.

<sup>7</sup> The self-related cognition assessed in PISA 2015 comprises four indices, namely interest in science, enjoyment of science, instrumental motivation of learning science and science self-efficacy.



### *Student Achievement in Reading Literacy*

15. In reading literacy, Hong Kong students achieve a mean score of 527 in PISA 2015, which is significantly higher than the score in PISA 2003 (510) but lower than that in PISA 2012 (545). They outperform their fellows in OECD countries significantly at all percentile points. The lowered reading performance of Hong Kong students from PISA 2012 to PISA 2015 is due to a significant drop in performance of students at all but the 5th percentile.
16. Regarding gender difference among Hong Kong students, girls perform significantly better than boys in reading, and the 28-point gender gap is close to the OECD average of 27 points. Furthermore, the gender gap of Hong Kong students in PISA 2015 is smaller when compared with those in PISA 2003, PISA 2006 and PISA 2009 (32, 31 and 33 points respectively), but larger than those in PISA 2000+ and PISA 2012 (16 and 25 points respectively).

### *Student Achievement in Mathematical Literacy*

17. Hong Kong students perform well in mathematics (548) in PISA 2015. Their performance is similar to that in PISA 2003 (550), PISA 2006 (547) and PISA 2009 (555), but significantly lower than that in PISA 2012 (561). When compared with the OECD average, Hong Kong students outperform their OECD fellows at all percentile points.
18. Hong Kong shows no significant gender difference in overall mathematics performance. However, gender difference exists at the 90th percentile, where boys perform significantly better than girls.

### *Parental, Teacher, and School Factors*

19. For parental investment, Hong Kong students whose families are rich in educational, cultural, material, and information and communication technology (ICT) resources, tend to perform better in science. For parental involvement, Hong Kong students whose parents were more involved in arranging science-related activities when their child was about 10 years old tend to perform better. Social communication between parents and students, and emotional support for students, show significant positive associations with science performance. However, Hong Kong students with better science performance have a moderate level of academic communication with their parents. Students with medium science performance have a higher level of academic communication and students with lower science performance have a lower level of academic communication with their parents.
20. Considering teaching practices, the use of teacher-directed instruction, adaptive instruction and enquiry-based instruction, and the feedback provided for students by Hong Kong science teachers are higher than those provided by teachers from OECD countries. While only teacher-directed instruction and adaptive instruction are evidenced to have positive effects on science performance in Hong Kong, all these types of teaching practices might have an impact on students' affective outcome of learning science, which might in turn make an indirect contribution to their science performance.
21. Regarding school climate, schools in Hong Kong have a more desirable level of disciplinary climate than the OECD average, and a similar level of teacher support as the OECD average. While students who perceive a higher level in either of these two kinds of school climate tend to perform better in science, the positive association of disciplinary climate and science performance is stronger than that of teacher support in Hong Kong.

### *For Policy Makers*

22. Overall, Hong Kong students consistently perform well in all three assessment domains. It can be posited that the Hong Kong education system is effective in developing students' literacy without sacrificing equality. All students, regardless of their socio-economic background, can benefit from the education system. While a reduction in between- and within-school variances in student performance may be interpreted as a successful approach a more equal basic education system in Hong Kong, it may also be related to the change in the proportion of high achievers, which deserves further investigation.
  
23. Since the implementation of the New Senior Secondary (NSS) system in 2009, the proportion of Hong Kong students studying all three major science subjects, namely Physics, Chemistry and Biology, has decreased substantially. Although there are more senior secondary students taking at least one science or combined science subject than before, the content knowledge learnt has been decreased on average, and the depth and extensiveness of science learning may also be reduced. As a result, policy makers need to take a fuller account of the changes brought about by the NSS system. In particular, faced with a more diverse student body with greater variation in basic science knowledge and learning motivation, teachers need more support, resources and time to accommodate the wider individual differences.
  
24. In line with the context-based science-technology-society (STS) instruction approach implemented by many countries in the last two decades, the recent Science (Secondary 1-3) Curriculum Framework and Senior Secondary Curriculum and Assessment Guides of Hong Kong have put a greater emphasis on the science-technology-society-environment connections, the process of scientific inquiry, and the nature and history of science. While that is a laudable direction which is more conducive to the development of scientific literacy, the amount of scientific knowledge which can be covered in the science curricula may be reduced. Therefore, curriculum developers need to investigate how to enhance further the teaching and learning of scientific inquiry and nature of science within the current science curricula.
  
25. The outstanding performance of Hong Kong students is indisputable. Despite the fact that Hong Kong girls and boys perform equally well in science and mathematics, the considerable gender difference in reading performance persists with boys lagging behind girls. Therefore, helping boys to do better in reading should be on the agenda for further improvement in students' literacy.

### *For Educators & Parents*

26. The survey on students' self-related beliefs indicates that a wide array of students' affective factors, namely enjoyment of science, interest in broad science topics, instrumental motivation of learning science, and science self-efficacy, are positively associated with science performance in Hong Kong. It can be reasonably proposed that the cognitive and affective domains are inter-related and interact with each other with both being important elements in nurturing scientifically literate citizens.
27. Traditionally, the science taught in Hong Kong secondary schools has tended to focus on developing students' cognitive abilities and treats affective development as secondary, if not irrelevant. However, the nurture of affective abilities warrants immediate attention as they are influential factors which can raise students' science performance. Science teachers may help to improve students' interest and enjoyment in science by bringing more hands-on laboratory experiences and projects with real life context into daily lessons. As for enhancing students' instrumental motivation of learning science, careers teachers may help to deliver accurate information about science-related professions and career prospects to students. They may also encourage students to consider science-related careers by increasing their exposure to science-related experiences such as visits to university science laboratory and science careers exhibitions.
28. The findings in Hong Kong support the notion that, regardless of parents' socio-economic status, the early provision of science-related activities for children is a promising avenue to enhance children's science performance. Apart from encouraging their children to participate more in science-related activities, parents can act as a positive science role model and teach their children science by reading science literature to their children, watching or listening to science programmes with their children, and discussing what they learn from these activities.
29. Professional associations of teachers, governmental bodies such as The Curriculum Development Institute, and tertiary institutions should seek more collaboration to reap the rich harvest available from the PISA research to improve curriculum and instruction.

### *For Future Research*

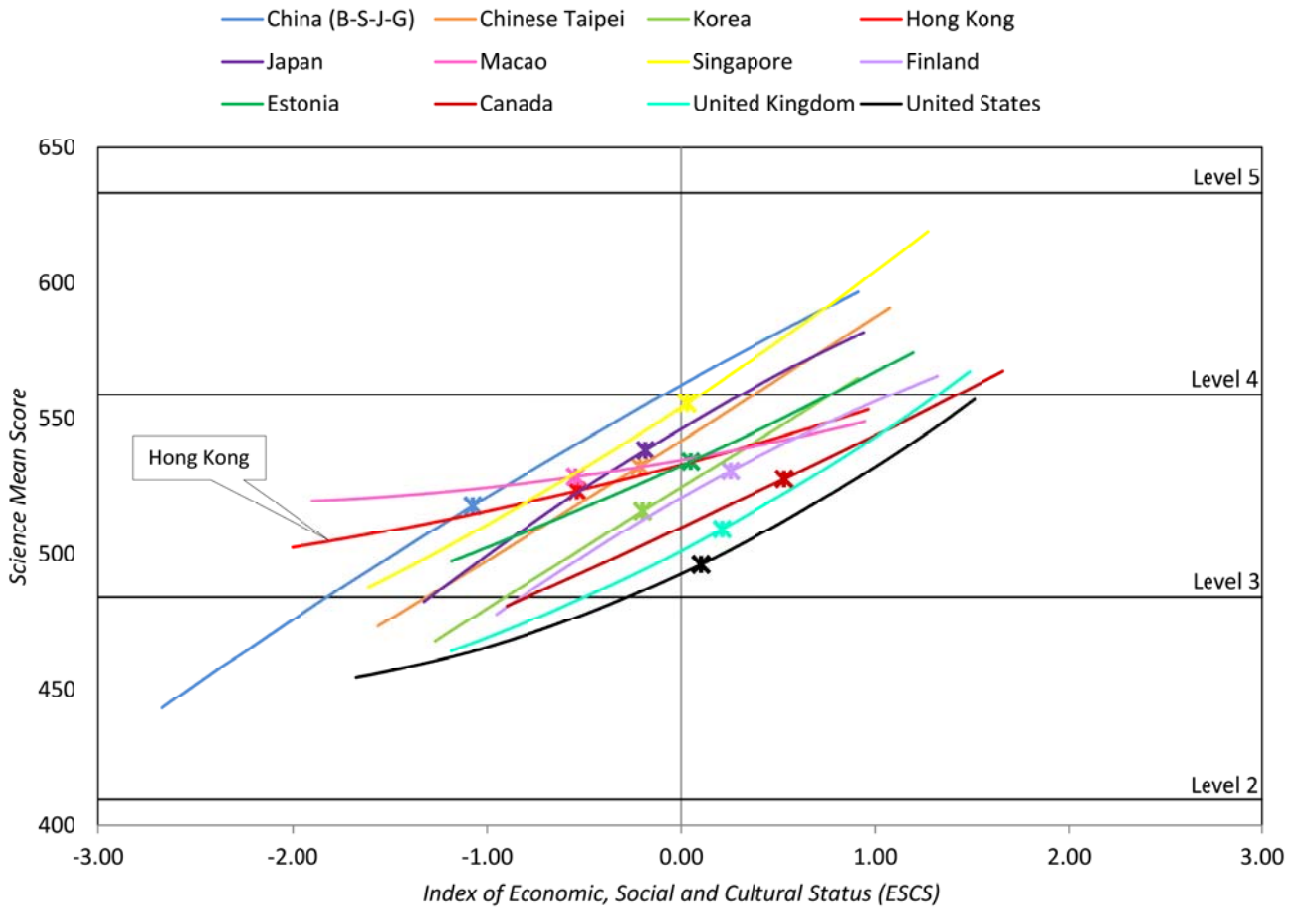
30. In PISA 2015, Hong Kong students have performed less well in science, reading and mathematics when compared with PISA 2012. In general terms, the performance decline is greater among high achievers than low achievers, and among boys than girls. How this decline has happened is worth investigating. The findings will be a valuable reference for efforts targeting further improvement in science curriculum and pedagogies and student learning.
31. PISA 2015 provides useful information about students' academic performance and various contextual factors. By way of example, three of these factors are students' immigrant status, out-of-school learning time, and educational and career aspiration. All these contextual themes are worthy of further investigation, and the relative contribution of different individual, familial, teacher and school factors should be explored in the future.
32. The findings concerning the reduced measure of students' science self-efficacy and enjoyment of science, notwithstanding Hong Kong students' outstanding science performance, suggest a need for further investigation. Given that these self-related beliefs are positively associated with science performance, longitudinal study and action research are recommended to identify ways to enhance students' confidence and enjoyment in learning science.
33. In PISA 2015, Hong Kong students were tested using computer-based mode. This mode of assessment is aligned with the current trend of using Information and Communication Technology (ICT) in education in Hong Kong. Future research and development may examine how to make best use of ICT in schools to support curriculum innovation in the "digital world".

## Appendix I Performance of 15-Year-Old Students in Scientific, Reading and Mathematical Literacy in PISA 2015

| Science                |            |              | Reading                |            |              | Mathematics            |            |              |
|------------------------|------------|--------------|------------------------|------------|--------------|------------------------|------------|--------------|
| Countries/Economies    | Mean       | S.E.         | Countries/Economies    | Mean       | S.E.         | Countries/Economies    | Mean       | S.E.         |
| Singapore              | 556        | (1.2)        | Singapore              | 535        | (1.6)        | Singapore              | 564        | (1.5)        |
| Japan                  | 538        | (3.0)        | <b>Hong Kong-China</b> | <b>527</b> | <b>(2.7)</b> | <b>Hong Kong-China</b> | <b>548</b> | <b>(3.0)</b> |
| Estonia                | 534        | (2.1)        | Canada                 | 527        | (2.3)        | Macao-China            | 544        | (1.1)        |
| Chinese Taipei         | 532        | (2.7)        | Finland                | 526        | (2.5)        | Chinese Taipei         | 542        | (3.0)        |
| Finland                | 531        | (2.4)        | Ireland                | 521        | (2.5)        | Japan                  | 532        | (3.0)        |
| Macao-China            | 529        | (1.1)        | Estonia                | 519        | (2.2)        | China (B-S-J-G)        | 531        | (4.9)        |
| Canada                 | 528        | (2.1)        | Korea                  | 517        | (3.5)        | Korea                  | 524        | (3.7)        |
| Viet Nam               | 525        | (3.9)        | Japan                  | 516        | (3.2)        | Switzerland            | 521        | (2.9)        |
| <b>Hong Kong-China</b> | <b>523</b> | <b>(2.5)</b> | Norway                 | 513        | (2.5)        | Estonia                | 520        | (2.0)        |
| China (B-S-J-G)        | 518        | (4.6)        | New Zealand            | 509        | (2.4)        | Canada                 | 516        | (2.3)        |
| Korea                  | 516        | (3.1)        | Germany                | 509        | (3.0)        | Netherlands            | 512        | (2.2)        |
| New Zealand            | 513        | (2.4)        | Macao-China            | 509        | (1.3)        | Denmark                | 511        | (2.2)        |
| Slovenia               | 513        | (1.3)        | Poland                 | 506        | (2.5)        | Finland                | 511        | (2.3)        |
| Australia              | 510        | (1.5)        | Slovenia               | 505        | (1.5)        | Slovenia               | 510        | (1.3)        |
| United Kingdom         | 509        | (2.6)        | Netherlands            | 503        | (2.4)        | Belgium                | 507        | (2.4)        |
| Germany                | 509        | (2.7)        | Australia              | 503        | (1.7)        | Germany                | 506        | (2.9)        |
| Netherlands            | 509        | (2.3)        | Sweden                 | 500        | (3.5)        | Poland                 | 504        | (2.4)        |
| Switzerland            | 506        | (2.9)        | Denmark                | 500        | (2.5)        | Ireland                | 504        | (2.1)        |
| Ireland                | 503        | (2.4)        | France                 | 499        | (2.5)        | Norway                 | 502        | (2.2)        |
| Belgium                | 502        | (2.3)        | Belgium                | 499        | (2.4)        | Austria                | 497        | (2.9)        |
| Denmark                | 502        | (2.4)        | Portugal               | 498        | (2.7)        | New Zealand            | 495        | (2.3)        |
| Poland                 | 501        | (2.5)        | United Kingdom         | 498        | (2.8)        | Viet Nam               | 495        | (4.5)        |
| Portugal               | 501        | (2.4)        | Chinese Taipei         | 497        | (2.5)        | Russian Federation     | 494        | (3.1)        |
| Norway                 | 498        | (2.3)        | United States          | 497        | (3.4)        | Sweden                 | 494        | (3.2)        |
| United States          | 496        | (3.2)        | Spain                  | 496        | (2.4)        | Australia              | 494        | (1.6)        |
| Austria                | 495        | (2.4)        | Russian Federation     | 495        | (3.1)        | France                 | 493        | (2.1)        |
| France                 | 495        | (2.1)        | China (B-S-J-G)        | 494        | (5.1)        | United Kingdom         | 492        | (2.5)        |
| Sweden                 | 493        | (3.6)        | Switzerland            | 492        | (3.0)        | Czech Republic         | 492        | (2.4)        |
| Czech Republic         | 493        | (2.3)        | Latvia                 | 488        | (1.8)        | Portugal               | 492        | (2.5)        |
| Spain                  | 493        | (2.1)        | Czech Republic         | 487        | (2.6)        | Italy                  | 490        | (2.8)        |
| Latvia                 | 490        | (1.6)        | Croatia                | 487        | (2.7)        | Iceland                | 488        | (2.0)        |
| Russian Federation     | 487        | (2.9)        | Viet Nam               | 487        | (3.7)        | Spain                  | 486        | (2.2)        |
| Luxembourg             | 483        | (1.1)        | Austria                | 485        | (2.8)        | Luxembourg             | 486        | (1.3)        |
| Italy                  | 481        | (2.5)        | Italy                  | 485        | (2.7)        | Latvia                 | 482        | (1.9)        |
| Hungary                | 477        | (2.4)        | Iceland                | 482        | (2.0)        | Malta                  | 479        | (1.7)        |
| Lithuania              | 475        | (2.7)        | Luxembourg             | 481        | (1.4)        | Lithuania              | 478        | (2.3)        |
| Croatia                | 475        | (2.5)        | Israel                 | 479        | (3.8)        | Hungary                | 477        | (2.5)        |
| Iceland                | 473        | (1.7)        | Lithuania              | 472        | (2.7)        | Slovak Republic        | 475        | (2.7)        |
| Israel                 | 467        | (3.4)        | Hungary                | 470        | (2.7)        | Israel                 | 470        | (3.6)        |
| Malta                  | 465        | (1.6)        | Greece                 | 467        | (4.3)        | United States          | 470        | (3.2)        |
| Slovak Republic        | 461        | (2.6)        | Chile                  | 459        | (2.6)        | Croatia                | 464        | (2.8)        |
| Kazakhstan             | 456        | (3.7)        | Slovak Republic        | 453        | (2.8)        | Kazakhstan             | 460        | (4.3)        |
| Greece                 | 455        | (3.9)        | Malta                  | 447        | (1.8)        | Greece                 | 454        | (3.8)        |
| Chile                  | 447        | (2.4)        | Cyprus                 | 443        | (1.7)        | Malaysia               | 446        | (3.3)        |
| Bulgaria               | 446        | (4.4)        | Uruguay                | 437        | (2.5)        | Romania                | 444        | (3.8)        |
| Malaysia               | 443        | (3.0)        | Romania                | 434        | (4.1)        | Bulgaria               | 441        | (4.0)        |
| United Arab Emirates   | 437        | (2.4)        | United Arab Emirates   | 434        | (2.9)        | Cyprus                 | 437        | (1.7)        |
| Uruguay                | 435        | (2.2)        | Bulgaria               | 432        | (5.0)        | United Arab Emirates   | 427        | (2.4)        |
| Romania                | 435        | (3.2)        | Malaysia               | 431        | (3.5)        | Chile                  | 423        | (2.5)        |
| Cyprus                 | 433        | (1.4)        | Turkey                 | 428        | (4.0)        | Turkey                 | 420        | (4.1)        |
| Argentina              | 432        | (2.9)        | Costa Rica             | 427        | (2.6)        | Moldova                | 420        | (2.5)        |
| Moldova                | 428        | (2.0)        | Trinidad and Tobago    | 427        | (1.5)        | Uruguay                | 418        | (2.5)        |
| Albania                | 427        | (3.3)        | Kazakhstan             | 427        | (3.4)        | Montenegro             | 418        | (1.5)        |
| Turkey                 | 425        | (3.9)        | Montenegro             | 427        | (1.6)        | Trinidad and Tobago    | 417        | (1.4)        |
| Trinidad and Tobago    | 425        | (1.4)        | Argentina              | 425        | (3.2)        | Thailand               | 415        | (3.0)        |
| Thailand               | 421        | (2.8)        | Colombia               | 425        | (2.9)        | Albania                | 413        | (3.4)        |
| Costa Rica             | 420        | (2.1)        | Mexico                 | 423        | (2.6)        | Argentina              | 409        | (3.1)        |
| Qatar                  | 418        | (1.0)        | Moldova                | 416        | (2.5)        | Mexico                 | 408        | (2.2)        |
| Colombia               | 416        | (2.4)        | Thailand               | 409        | (3.3)        | Georgia                | 404        | (2.8)        |
| Mexico                 | 416        | (2.1)        | Jordan                 | 408        | (2.9)        | Qatar                  | 402        | (1.3)        |
| Montenegro             | 411        | (1.0)        | Brazil                 | 407        | (2.8)        | Costa Rica             | 400        | (2.5)        |
| Georgia                | 411        | (2.4)        | Albania                | 405        | (4.1)        | Lebanon                | 396        | (3.7)        |
| Jordan                 | 409        | (2.7)        | Qatar                  | 402        | (1.0)        | Colombia               | 390        | (2.3)        |
| Indonesia              | 403        | (2.6)        | Georgia                | 401        | (3.0)        | Peru                   | 387        | (2.7)        |
| Brazil                 | 401        | (2.3)        | Peru                   | 398        | (2.9)        | Indonesia              | 386        | (3.1)        |
| Peru                   | 397        | (2.4)        | Indonesia              | 397        | (2.9)        | Jordan                 | 380        | (2.7)        |
| Lebanon                | 386        | (3.4)        | Tunisia                | 361        | (3.1)        | Brazil                 | 377        | (2.9)        |
| Tunisia                | 386        | (2.1)        | Dominican Republic     | 358        | (3.1)        | Republic of Macedonia  | 371        | (1.3)        |
| Republic of Macedonia  | 384        | (1.2)        | Republic of Macedonia  | 352        | (1.4)        | Tunisia                | 367        | (3.0)        |
| Kosovo                 | 378        | (1.7)        | Algeria                | 350        | (3.0)        | Kosovo                 | 362        | (1.6)        |
| Algeria                | 376        | (2.6)        | Kosovo                 | 347        | (1.6)        | Algeria                | 360        | (3.0)        |
| Dominican Republic     | 332        | (2.6)        | Lebanon                | 347        | (4.4)        | Dominican Republic     | 328        | (2.7)        |
| <i>OECD Average</i>    | 493        | (0.4)        | <i>OECD Average</i>    | 493        | (0.5)        | <i>OECD Average</i>    | 490        | (0.4)        |

Note: Shaded area indicates scores significantly different from those of Hong Kong. The four participating regions of Mainland China are Beijing, Shanghai, Jiangsu, and Guangdong.

## Appendix II Relationship between Student Performance in Science and ESCS in Twelve Countries/Economies



Note: The ESCS index for PISA 2015 is derived from three variables related to family background: parental education, parental occupation, and number and type of home possessions related to education. The four participating regions of Mainland China are Beijing, Shanghai, Jiangsu, and Guangdong.

## PISA 概述

1. 學生能力國際評估計劃(PISA)由經濟合作與發展組織(OECD)發起及統籌，旨在評估接近完成普及教育的十五歲學童，對社會所需知識與技能掌握的情況，並建立教育指標，讓各國政府及政策制訂者審視、評價和監察國家和學校層面的教育成效。
2. PISA 自 2000 年起每三年舉行一次，研究涵蓋閱讀、數學及科學素養三大範疇，每屆均以其中一項為重點評估範疇。PISA 2015 是第六屆評估計劃，重點評估科學素養。
3. 在 PISA 2015，有來自 72 個國家和經濟體系約 510,000 名學生參加了兩小時的測試，當中 57 個國家和經濟體系（包括香港）以電腦進行測試，其餘 15 個國家和經濟體系以紙筆進行測試。

表一 PISA 2015 的參與國家和經濟體系

| OECD 成員國家 |      |         | 夥伴 (非 OECD 成員) 國家/經濟體系 |         |            |
|-----------|------|---------|------------------------|---------|------------|
| 澳洲        | 冰島   | 葡萄牙     | 阿爾巴尼亞 *                | 格魯吉亞 *  | 秘魯         |
| 奧地利       | 愛爾蘭  | 斯洛伐克共和國 | 阿爾及利亞 *                | 中國香港    | 卡塔爾        |
| 比利時       | 以色列  | 斯洛文尼亞   | 阿根廷 *                  | 印度尼西亞 * | 羅馬尼亞 *     |
| 加拿大       | 意大利  | 西班牙     | 巴西                     | 約旦 *    | 俄羅斯聯邦      |
| 智利        | 日本   | 瑞典      | 中華人民共和國 <sup>1</sup>   | 哈薩克斯坦 * | 新加坡        |
| 捷克共和國     | 韓國   | 瑞士      | 保加利亞                   | 科索沃 *   | 泰國         |
| 丹麥        | 拉脫維亞 | 土耳其     | 中華台北                   | 黎巴嫩 *   | 特立尼達和多巴哥 * |
| 愛沙尼亞      | 盧森堡  | 英國      | 哥倫比亞                   | 立陶宛     | 突尼西亞       |
| 芬蘭        | 墨西哥  | 美國      | 哥斯達黎加                  | 中國澳門    | 阿拉伯聯合酋長國   |
| 法國        | 荷蘭   |         | 克羅地亞                   | 馬來西亞    | 烏拉圭        |
| 德國        | 紐西蘭  |         | 塞浦路斯                   | 馬爾他 *   | 越南 *       |
| 希臘        | 挪威   |         | 多明尼加共和國                | 摩爾多瓦 *  |            |
| 匈牙利       | 波蘭   |         | 馬其頓共和國 *               | 黑山共和國   |            |

註： 1. 中國參與 PISA 的四個城市和省份包括北京、上海、江蘇及廣東(以下簡稱「中國 (B-S-J-G)」)。

2. 十五個以紙筆進行 PISA 測試的國家和經濟體系以「\*」號標示。

4. PISA 建構了一個架構，說明三個素養範疇的評估所涵括的範圍與維度，而每個範疇均有三個維度：學生須具備的「知識內容」、需要進行的「過程」、以及運用或獲得知識技能的「處境」。除了評估三個範疇，PISA 2015 亦邀請學生和校長填寫問卷。在香港，PISA 還增設家長問卷和教師問卷，以補充學生和校長的看法，並了解家長如何參與子女的教育、教師採用的教學方法、以及學生在認知和情意方面的表現。



5. 在香港，PISA 2015 主測試於 2015 年 4 月至 5 月期間進行。研究採用二段分層抽樣方法，在第一階段，研究把學校按類型(官立、資助、私立學校——包括國際學校和直資學校)與收生成績<sup>1</sup> (高、中、低能力)分組，有系統地從學校組別中隨機抽選樣本學校，選中機率與學校的學生人數成正比例。得出的學校參與率為 90.2%，符合 OECD 標準。表二顯示參與學校在各組的分佈。

表二 香港參加 PISA 2015 主測試的學校分佈

| 顯層                | 隱層                    | 學校總數       | 參與學校數目     |
|-------------------|-----------------------|------------|------------|
| 官立學校              | 高能力                   | 15         | 6          |
|                   | 中能力                   | 7          | 2          |
|                   | 低能力                   | 8          | 2          |
| 資助學校              | 高能力                   | 119        | 45         |
|                   | 中能力                   | 115        | 37         |
|                   | 低能力                   | 124        | 28         |
|                   | 不適用 <sup>3</sup>      | 1          | 1          |
| 獨立學校 <sup>1</sup> | 本地 (直資 <sup>2</sup> ) | 59         | 17         |
|                   | 國際學校                  | 33         | 0          |
| <b>總數</b>         |                       | <b>481</b> | <b>138</b> |

註： 1. 獨立學校沒有學業能力分層。  
 2. 直資是參加直接資助計劃的學校。  
 3. 一所參與學校的收生級別只涵蓋中四至中六，因此沒有中一學生入學成績資料。

6. 在第二階段，研究從每所參與學校隨機抽樣選取 42 名十五歲學生。根據 OECD 的抽樣標準，共有來自 138 所中學的 5,359 名學生獲納入最後的分析樣本。表三顯示了樣本中的學生年級分佈。

表三 香港參加 PISA 2015 主測試的學生年級分佈

| 年級        | 參與學生人數      | 百分比 (%) <sup>*</sup> |
|-----------|-------------|----------------------|
| 中一        | 59          | 1.1                  |
| 中二        | 286         | 5.3                  |
| 中三        | 1384        | 25.8                 |
| 中四        | 3612        | 67.4                 |
| 中五        | 18          | 0.3                  |
| <b>總數</b> | <b>5359</b> | <b>100</b>           |

\* 總百分比的些微不符是由於約數之故。

<sup>1</sup> 收生成績指中一學生入學時的學業能力。

### 質素與均等

7. PISA 2015 研究結果為本港教育系統的「質素」與「均等」兩方面帶來啟示。「質素」指教育系統培育學生基礎素養的成效；「均等」指教育系統讓不同社經背景的學生均能從教育中獲益。
8. 就整體質素而言，香港學生表現良好。由 PISA 2000+<sup>2</sup>至 PISA 2015，香港持續在三個評估範疇中穩據前十名。在 PISA 2015，香港在科學排名第九，在閱讀和數學均排名第二。香港的平均成績顯著高於 OECD 平均值<sup>3</sup>。若以統計學的顯著度作準，香港的科學分數(523 分)只顯著低於新加坡(第一名: 556 分)、日本(第二名: 538 分)、愛沙尼亞(第三名: 534 分)、中華台北(第四名: 532 分)和芬蘭(第五名: 531 分)，但與澳門(第六名: 529 分)、加拿大(第七名: 528 分)、越南(第八名: 525 分)、中國(B-S-J-G)(第十名: 518 分)和韓國(第十一名: 516 分)並無顯著差異。閱讀方面，香港的平均分數為 527 分，只顯著低於新加坡(第一名: 535 分)，但與加拿大(第三名: 527 分)、芬蘭(第四名: 526 分)和愛爾蘭(第五名: 521 分)並無顯著差異。數學方面，香港的平均分數為 548 分，顯著低於新加坡(第一名: 564 分)，而與澳門(第三名: 544 分)和中華台北(第四名: 542 分)的分數相若，但高於其他所有參與國家和經濟體系(見附錄一)。
9. 就香港教育系統的均等而言，在 PISA 2015 的科學和閱讀範疇中的高分者(第 95 百分位數)和低分者(第 5 百分位數)之間的成績差距，比其他參與國家和經濟體系的差距相對較小(即較 OECD 平均值小)；但在數學範疇，高分者和低分者的成績差距則稍微大於 OECD 平均值。這個結果顯示，香港學生不論學習能力如何，都能大致均等地從香港的優質教育中獲益。此外，香港學生的社經及文化地位(economic, social and cultural status, ESCS)對能力表現的影響相對較小。PISA 以「社經坡度」(socio-economic gradient)表示社經背景對學業成績的影響，坡度反映社經背景有多大程度導致學生能力表現的差異<sup>4</sup>。香港的社經坡度不大，反映無論學生社經背景如何，表現一樣出色。(見附錄二)。
10. 由 PISA 2006 至 PISA 2015，香港中學在科學成績的校間差異減少，顯示學校之間的學能分隔在過去十年有所下降。同時間，科學成績的校內差異亦見減少，意味學校對不同能力學生的包容度可能有所改善<sup>5</sup>。校間及校內的科學成績差異減少，亦有可能與新高中課程實施下，修讀三科主要理科科目的學生比率下降、以及尖子比率下跌有關。

<sup>2</sup> 第一屆 PISA，即 PISA 2000，於 2000 年舉行，共有 32 個國家和經濟體系參加。香港和其他 10 個國家和經濟體系參加了於 2002 年 2 月舉行的 PISA 2000+。

<sup>3</sup> 在 PISA 2015，OECD 的科學和閱讀平均分皆為 493 分，數學平均分為 490 分，而標準差為 100 分。

<sup>4</sup> 坡度愈大，社經背景對學生表現的影響則較大，即較不平等。

<sup>5</sup> 由 PISA 2006 至 PISA 2015，香港科學表現的校間差異由 3059 減少至 1987，校內差異由 5230 減少至 4459。

## 科學素養表現

11. 香港學生於 PISA 2015 的科學能力表現(523 分)，顯著低於 PISA 2006 的 542 分、PISA 2009 的 549 分和 PISA 2012 的 555 分<sup>6</sup>；與 OECD 國家比較，香港學生在所有百分位數的分數均顯著高於 OECD 學生。就各個科學能力分項而言，即「解釋科學現象」(*explaining phenomena scientifically*)、「評估和設計科學探究」(*evaluating and designing scientific enquiry*)和「運用科學來闡釋數據及證據」(*interpreting data and evidence scientifically*)，香港學生在三者的表現相若。在科學知識分項上，香港學生在「內容知識」的表現比「過程及科學本質的知識」較佳。
12. 就科學能力水平而言，香港學生達到第五級和第六級的百分比為 7.4%，低於 OECD 平均值的 7.7%；但香港學生能達到第二級(即基本水平的科學能力)的百分比為 90.6%，高於 OECD 平均值的 78.8%。
13. 就科學能力的總分而言，香港男女生的表現並無顯著差異。此外，女生則於「評估和設計科學探究」(*evaluating and designing scientific enquiry*) 的表現比男生較佳，男生則於「解釋科學現象」(*explaining phenomena scientifically*)的表現比女生較佳。
14. PISA 2015 亦評估了學生在科學方面的自我認知能力和參與科學活動的程度，以了解學生的情意表現與其科學表現的關係。在自我認知能力的四個指標中<sup>7</sup>，香港學生對學習科學的興趣、對科學的喜愛、以及工具性動機均高於 OECD 平均值，而科學自我效能感則近乎 OECD 平均值。學生於各個自我認知能力指標和參與科學活動程度越高，科學能力表現越佳。相比 PISA 2006，PISA 2015 顯示香港學生的科學自我效能感和對科學的喜愛顯著下跌，工具性動機則顯著上升。

## 閱讀素養表現

15. 閱讀能力方面，香港學生於 PISA 2015 取得的平均分為 527 分，顯著地高於 PISA 2003 取得的分數(510)，但顯著地低於 PISA 2012 取得的分數(545)。香港學生在所有百分位數的分數均顯著高於 OECD 學生。由 PISA 2012 至 PISA 2015 香港學生的分數下跌，是由於所有百分位數(第 5 百分位數除外)的學生表現均有所下跌。
16. 性別差距方面，香港女生的閱讀表現顯著較男生為佳，兩者得分的差距為 28 分，與 OECD 平均值(27 分)相若。此外，香港學生於 PISA 2015 的性別差距，較 PISA 2003、PISA 2006 及 PISA 2009 的性別差距有所減少(分別為 32 分、31 分及 33 分)，但較 PISA 2000+及 PISA 2012 則有所增加(分別為 16 分及 25 分)。

<sup>6</sup> PISA 2006 首次重點評估科學能力，故不能直接把 PISA 2015 與 PISA 2006 前的兩屆評估（即 PISA 2000+和 PISA 2003）結果作出比較。

<sup>7</sup> PISA 2015 評估的自我認知能力有四個指標，包括對科學的興趣、喜愛科學、學習科學的工具性動機及科學自我效能感。

## 數學素養表現

17. 數學能力方面，香港學生於 PISA 2015 的表現良好(548 分)，與 PISA 2003(550 分)、PISA 2006(547 分)和 PISA 2009(555 分)的表現相若，但分數顯著低於 PISA 2012 的 561 分；與 OECD 平均值比較，香港學生在所有百分位數的表現均較 OECD 學生出色。
18. 香港男女生在整體數學能力的表現並無顯著差距，但在第 90 百分位數，男生的表現顯著優於女生。

## 家長、教師與學校層面因素

19. 在家長資源投放方面，香港學生家中有較多的教育、文化、物質和資訊及通訊科技(ICT)資源，在科學方面的表現亦趨向較佳。在家長參與方面，香港家長在子女約十歲時為其安排較多科學活動，子女的科學表現亦趨向較佳。此外，家長與子女聯繫溝通，以及給予子女情緒上的支持，均與子女的科學表現呈顯著的正相關。科學成績較好的學生與家長只有中度的學業溝通；科學成績中等的學生，卻與家長有較多的學業溝通；而科學成績略遜的學生，與家長的學業溝通則最少。
20. 在教學策略方面，香港科學科教師採用教師主導教學、調適教學、探究式教學、以及對學生的回饋，均顯著多於 OECD 國家的教師；其中教師主導教學和調適教學對香港學生的科學表現有正面影響。這四種教學策略可能有助於學生學習科學的情意發展，繼而間接地影響他們的科學能力表現。
21. 在學校氣氛方面，與 OECD 平均值比較，香港學校的紀律氣氛較 OECD 國家為佳，而教師給予學生的支援則與 OECD 國家相若。認為學校有較佳的紀律氣氛和教師支援的香港學生，其科學表現趨向較佳；而相比起教師支援，紀律氣氛與香港學生的科學表現相關較大。

### 給教育政策制訂者

22. 整體而言，香港學生在三個評估範疇持續有出色的表現。由此可以推論，香港的教育系統給學生提供了優質而均等的教育機會，在有效發展學生素養的同時，不會犧牲弱勢學生的學習機會，無論學生的社經背景如何，都能在教育系統中獲益。學生表現的校間和校內差異減少，既可理解為香港步向更均等的基礎教育系統，亦可能與高分者的比例改變有關，值得進一步研究。
23. 自 2009 年新高中課程實施，修讀完整三科主要理科科目——物理、化學和生物的香港學生比率大幅下降。儘管修讀至少一科理科科目或組合科學科的高中學生增加，學生所學的科學學科知識平均卻比以往減少，學習科學的深度和廣度亦相應減低。因此，政策制訂者宜充分考慮新高中課程所帶來的轉變，尤其是學生在科學方面的基礎知識和學習動機差距增大，這意味著教師需要更多支援、資源和時間，以照顧學生之間較大的學習差異。
24. 在過去二十年，世界各國推行情境化的「科學、科技與社會」(STS)教學模式；香港亦與時並進，近期的科學(中一至中三)課程架構和高中課程及評估指引，加強科學和科技知識與社會及環境的相互連繫，更強調科學探究的過程及科學的本質及歷史，乃為正確的發展方向，有利於培育學生的科學素養。然而，新的科學課程所涵蓋的科學學科知識可能因而減少。有見及此，課程設計者宜探討如何在現行的科學課程下，進一步優化科學探究及科學本質的教與學。
25. 香港學生的優異表現無可置疑，女生與男生在科學和數學方面表現同樣出色；然而，香港男生持續在閱讀方面落後於女生。因此，提升男生的閱讀能力，實為進一步提升學生素養的重要議題。

### 給教育工作者及家長

26. 學生的自我觀調查顯示，很多情意方面的因素均與香港學生的科學表現呈正相關，這些因素包括喜愛科學、對一般科學課題的興趣、學習科學的工具性動機和科學自我效能感。認知和情意因素相輔相成，兩者皆是培育公民的科學素養不可或缺的元素。
27. 過去香港中學的科學科教學，大多著重發展學生的認知能力，而情意發展在教學過程中或被視為毫不相干，或只屬次等考慮。然而，從情意因素對提升學生科學表現的重要影響來看，培養學生情意方面的能力是急須關注的問題。為提升學生對科學的興趣和愛好，科學科教師可在日常課堂讓學生有更多在實驗室親身實踐的經驗，並引入以現實生活為背景的專題研習。為提高學生學習科學的工具性動機，升學就業輔導教師可為學生提供與科學相關職業和就業前景的準確資訊，亦可透過增加學生體驗科學的機會，例如參觀大學科學實驗室和科學就業展覽，鼓勵學生考慮從事與科學相關的職業。

28. 研究結果證明，無論香港家長的社經地位如何，在子女年幼時提供與科學有關的活動是提升子女科學表現的有效途徑。除了鼓勵子女參與更多與科學有關的活動外，家長亦可以以身作則和教導子女科學，例如與子女一同閱讀有關科學的書籍、觀看或收聽有關科學的節目，並與子女討論從這些活動中學習的地方。
29. 教師專業組織、政府機構(例如課程發展處)和大專院校宜尋求更多的合作機會，充分利用 PISA 的研究成果來改善課程與教學。

### 給未來研究的啟示

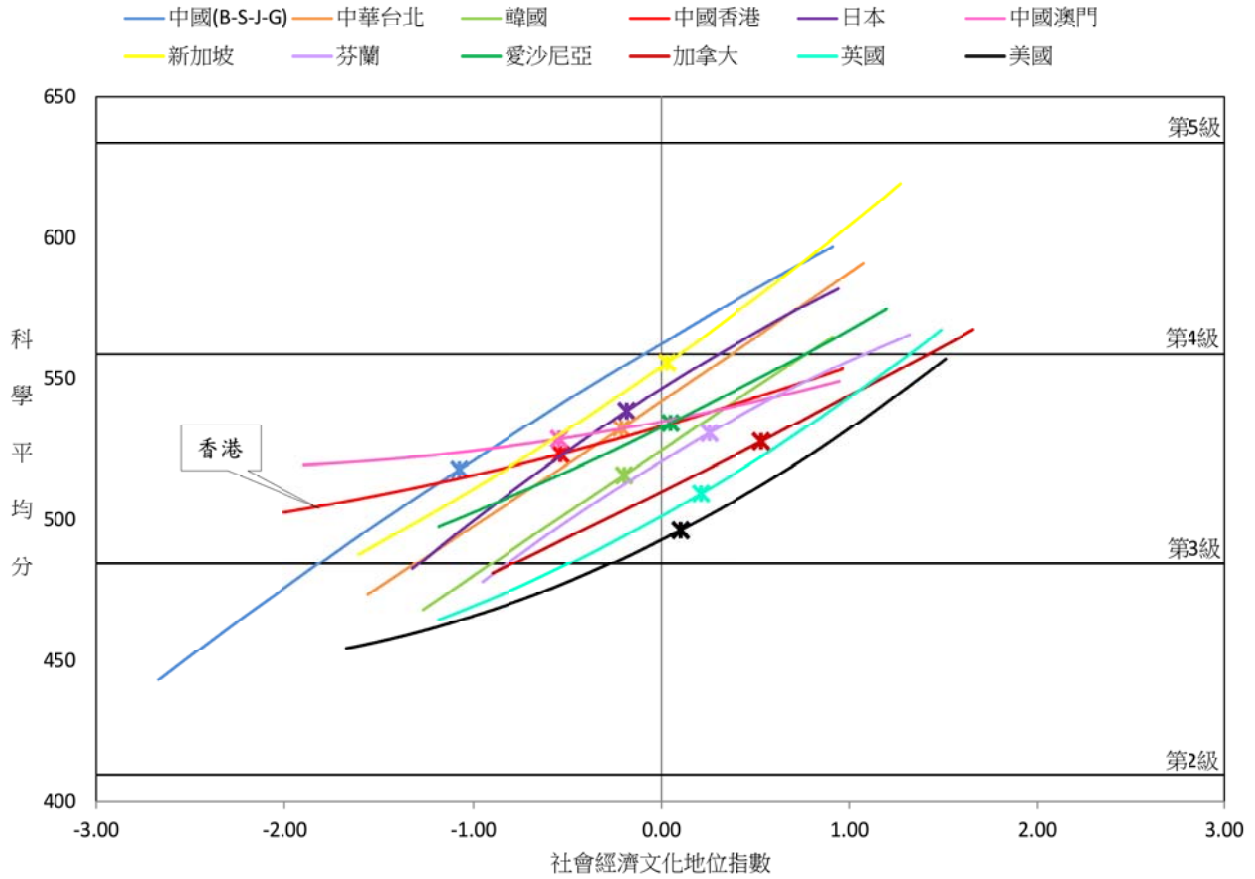
30. 與上屆 PISA 2012 比較，香港學生在 PISA 2015 的科學、閱讀及數學表現較為遜色；整體而言，高分者的跌幅較低分者較甚，男生的跌幅較女生較甚。學生表現的下跌是如何形成值得進行研究，研究的發現將會對日後改善科學科課程、教學法、以及學生的學習具有參考價值。
31. PISA 2015 提供了有關學生能力表現的資料，也提供了各種背景因素的資料，例如學生的移民身份、學生的校外學習時間、對學業和前途的期望等。這些主題都值得進一步研究，各項個人、家庭、教師和學校因素對學習成效的相對影響在未來也應予以探討。
32. 香港學生的科學表現出色，但科學自我效能感和對科學的喜愛卻有所下跌，值得進一步進行研究。鑑於這些自我觀與科學表現有正相關，我們建議展開縱向調查和行動研究，以了解如何提升學生的科學自我效能感和對科學的喜愛。
33. 香港學生在 PISA 2015 以電腦進行測試，此測試模式與現時香港在教育方面採用資訊及通訊科技 (ICT) 的趨勢一致。未來研究及發展宜探討如何在「數碼世界」的情景下，在校內最有效地使用資訊及通訊科技以支援課程革新。

附錄一 十五歲學生在 PISA 2015 的科學、閱讀與數學能力表現

| 科學           |     |       | 閱讀           |     |       | 數學           |     |       |
|--------------|-----|-------|--------------|-----|-------|--------------|-----|-------|
| 國家/經濟體系      | 平均值 | 標準誤差  | 國家/經濟體系      | 平均值 | 標準誤差  | 國家/經濟體系      | 平均值 | 標準誤差  |
| 新加坡          | 556 | (1.2) | 新加坡          | 535 | (1.6) | 新加坡          | 564 | (1.5) |
| 日本           | 538 | (3.0) | 中國香港         | 527 | (2.7) | 中國香港         | 548 | (3.0) |
| 愛沙尼亞         | 534 | (2.1) | 加拿大          | 527 | (2.3) | 中國澳門         | 544 | (1.1) |
| 中華台北         | 532 | (2.7) | 芬蘭           | 526 | (2.5) | 中華台北         | 542 | (3.0) |
| 芬蘭           | 531 | (2.4) | 愛爾蘭          | 521 | (2.5) | 日本           | 532 | (3.0) |
| 中國澳門         | 529 | (1.1) | 愛沙尼亞         | 519 | (2.2) | 中國 (B-S-J-G) | 531 | (4.9) |
| 加拿大          | 528 | (2.1) | 韓國           | 517 | (3.5) | 韓國           | 524 | (3.7) |
| 越南           | 525 | (3.9) | 日本           | 516 | (3.2) | 瑞士           | 521 | (2.9) |
| 中國香港         | 523 | (2.5) | 挪威           | 513 | (2.5) | 愛沙尼亞         | 520 | (2.0) |
| 中國 (B-S-J-G) | 518 | (4.6) | 紐西蘭          | 509 | (2.4) | 加拿大          | 516 | (2.3) |
| 韓國           | 516 | (3.1) | 德國           | 509 | (3.0) | 荷蘭           | 512 | (2.2) |
| 紐西蘭          | 513 | (2.4) | 中國澳門         | 509 | (1.3) | 丹麥           | 511 | (2.2) |
| 斯洛文尼亞        | 513 | (1.3) | 波蘭           | 506 | (2.5) | 芬蘭           | 511 | (2.3) |
| 澳洲           | 510 | (1.5) | 斯洛文尼亞        | 505 | (1.5) | 斯洛文尼亞        | 510 | (1.3) |
| 英國           | 509 | (2.6) | 荷蘭           | 503 | (2.4) | 比利時          | 507 | (2.4) |
| 德國           | 509 | (2.7) | 澳洲           | 503 | (1.7) | 德國           | 506 | (2.9) |
| 荷蘭           | 509 | (2.3) | 瑞典           | 500 | (3.5) | 波蘭           | 504 | (2.4) |
| 瑞士           | 506 | (2.9) | 丹麥           | 500 | (2.5) | 愛爾蘭          | 504 | (2.1) |
| 愛爾蘭          | 503 | (2.4) | 法國           | 499 | (2.5) | 挪威           | 502 | (2.2) |
| 比利時          | 502 | (2.3) | 比利時          | 499 | (2.4) | 奧地利          | 497 | (2.9) |
| 丹麥           | 502 | (2.4) | 葡萄牙          | 498 | (2.7) | 紐西蘭          | 495 | (2.3) |
| 波蘭           | 501 | (2.5) | 英國           | 498 | (2.8) | 越南           | 495 | (4.5) |
| 葡萄牙          | 501 | (2.4) | 中華台北         | 497 | (2.5) | 俄羅斯聯邦        | 494 | (3.1) |
| 挪威           | 498 | (2.3) | 美國           | 497 | (3.4) | 瑞典           | 494 | (3.2) |
| 美國           | 496 | (3.2) | 西班牙          | 496 | (2.4) | 澳洲           | 494 | (1.6) |
| 奧地利          | 495 | (2.4) | 俄羅斯聯邦        | 495 | (3.1) | 法國           | 493 | (2.1) |
| 法國           | 495 | (2.1) | 中國 (B-S-J-G) | 494 | (5.1) | 英國           | 492 | (2.5) |
| 瑞典           | 493 | (3.6) | 瑞士           | 492 | (3.0) | 捷克共和國        | 492 | (2.4) |
| 捷克共和國        | 493 | (2.3) | 拉脫維亞         | 488 | (1.8) | 葡萄牙          | 492 | (2.5) |
| 西班牙          | 493 | (2.1) | 捷克共和國        | 487 | (2.6) | 意大利          | 490 | (2.8) |
| 拉脫維亞         | 490 | (1.6) | 克羅地亞         | 487 | (2.7) | 冰島           | 488 | (2.0) |
| 俄羅斯聯邦        | 487 | (2.9) | 越南           | 487 | (3.7) | 西班牙          | 486 | (2.2) |
| 盧森堡          | 483 | (1.1) | 奧地利          | 485 | (2.8) | 盧森堡          | 486 | (1.3) |
| 意大利          | 481 | (2.5) | 意大利          | 485 | (2.7) | 拉脫維亞         | 482 | (1.9) |
| 匈牙利          | 477 | (2.4) | 冰島           | 482 | (2.0) | 馬爾他          | 479 | (1.7) |
| 立陶宛          | 475 | (2.7) | 盧森堡          | 481 | (1.4) | 立陶宛          | 478 | (2.3) |
| 克羅地亞         | 475 | (2.5) | 以色列          | 479 | (3.8) | 匈牙利          | 477 | (2.5) |
| 冰島           | 473 | (1.7) | 立陶宛          | 472 | (2.7) | 斯洛伐克共和國      | 475 | (2.7) |
| 以色列          | 467 | (3.4) | 匈牙利          | 470 | (2.7) | 以色列          | 470 | (3.6) |
| 馬爾他          | 465 | (1.6) | 希臘           | 467 | (4.3) | 美國           | 470 | (3.2) |
| 斯洛伐克共和國      | 461 | (2.6) | 智利           | 459 | (2.6) | 克羅地亞         | 464 | (2.8) |
| 哈薩克斯坦        | 456 | (3.7) | 斯洛伐克共和國      | 453 | (2.8) | 哈薩克斯坦        | 460 | (4.3) |
| 希臘           | 455 | (3.9) | 馬爾他          | 447 | (1.8) | 希臘           | 454 | (3.8) |
| 智利           | 447 | (2.4) | 塞浦路斯         | 443 | (1.7) | 馬來西亞         | 446 | (3.3) |
| 保加利亞         | 446 | (4.4) | 烏拉圭          | 437 | (2.5) | 羅馬尼亞         | 444 | (3.8) |
| 馬來西亞         | 443 | (3.0) | 羅馬尼亞         | 434 | (4.1) | 保加利亞         | 441 | (4.0) |
| 阿拉伯聯合酋長國     | 437 | (2.4) | 阿拉伯聯合酋長國     | 434 | (2.9) | 塞浦路斯         | 437 | (1.7) |
| 烏拉圭          | 435 | (2.2) | 保加利亞         | 432 | (5.0) | 阿拉伯聯合酋長國     | 427 | (2.4) |
| 羅馬尼亞         | 435 | (3.2) | 馬來西亞         | 431 | (3.5) | 智利           | 423 | (2.5) |
| 塞浦路斯         | 433 | (1.4) | 土耳其          | 428 | (4.0) | 土耳其          | 420 | (4.1) |
| 阿根廷          | 432 | (2.9) | 哥斯達黎加        | 427 | (2.6) | 摩爾多瓦         | 420 | (2.5) |
| 摩爾多瓦         | 428 | (2.0) | 特立尼達和多巴哥     | 427 | (1.5) | 烏拉圭          | 418 | (2.5) |
| 阿爾巴尼亞        | 427 | (3.3) | 哈薩克斯坦        | 427 | (3.4) | 黑山共和國        | 418 | (1.5) |
| 土耳其          | 425 | (3.9) | 黑山共和國        | 427 | (1.6) | 特立尼達和多巴哥     | 417 | (1.4) |
| 特立尼達和多巴哥     | 425 | (1.4) | 阿根廷          | 425 | (3.2) | 泰國           | 415 | (3.0) |
| 泰國           | 421 | (2.8) | 哥倫比亞         | 425 | (2.9) | 阿爾巴尼亞        | 413 | (3.4) |
| 哥斯達黎加        | 420 | (2.1) | 墨西哥          | 423 | (2.6) | 阿根廷          | 409 | (3.1) |
| 卡塔爾          | 418 | (1.0) | 摩爾多瓦         | 416 | (2.5) | 墨西哥          | 408 | (2.2) |
| 哥倫比亞         | 416 | (2.4) | 泰國           | 409 | (3.3) | 格魯吉亞         | 404 | (2.8) |
| 墨西哥          | 416 | (2.1) | 約旦           | 408 | (2.9) | 卡塔爾          | 402 | (1.3) |
| 黑山共和國        | 411 | (1.0) | 巴西           | 407 | (2.8) | 哥斯達黎加        | 400 | (2.5) |
| 格魯吉亞         | 411 | (2.4) | 阿爾巴尼亞        | 405 | (4.1) | 黎巴嫩          | 396 | (3.7) |
| 約旦           | 409 | (2.7) | 卡塔爾          | 402 | (1.0) | 哥倫比亞         | 390 | (2.3) |
| 印度尼西亞        | 403 | (2.6) | 格魯吉亞         | 401 | (3.0) | 秘魯           | 387 | (2.7) |
| 巴西           | 401 | (2.3) | 秘魯           | 398 | (2.9) | 印度尼西亞        | 386 | (3.1) |
| 秘魯           | 397 | (2.4) | 印度尼西亞        | 397 | (2.9) | 約旦           | 380 | (2.7) |
| 黎巴嫩          | 386 | (3.4) | 突尼西亞         | 361 | (3.1) | 巴西           | 377 | (2.9) |
| 突尼西亞         | 386 | (2.1) | 多米尼加共和國      | 358 | (3.1) | 馬其頓共和國       | 371 | (1.3) |
| 馬其頓共和國       | 384 | (1.2) | 馬其頓共和國       | 352 | (1.4) | 突尼西亞         | 367 | (3.0) |
| 科索沃          | 378 | (1.7) | 亞爾及利亞        | 350 | (3.0) | 科索沃          | 362 | (1.6) |
| 亞爾及利亞        | 376 | (2.6) | 科索沃          | 347 | (1.6) | 亞爾及利亞        | 360 | (3.0) |
| 多米尼加共和國      | 332 | (2.6) | 黎巴嫩          | 347 | (4.4) | 多米尼加共和國      | 328 | (2.7) |
| OECD 平均值     | 493 | (0.4) | OECD 平均值     | 493 | (0.5) | OECD 平均值     | 490 | (0.4) |

註：有顏色部分顯示該國家/經濟體系與香港成績有顯著分別。中國參與地區為北京及上海市、江蘇及廣東省。

附錄二 十二個國家和經濟體系的學生科學表現與社會經濟文化地位的關係



註：PISA 2015 之社會經濟文化地位指數由三個家庭背景相關變數衍生出來，包括家長教育程度、家長職業類別、家庭所擁有的教育資源數量及種類。中國參與地區為北京及上海市、江蘇及廣東省。



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Buddhist Tai Hung College  
Buddhist Wong Wan Tin College  
Caritas Fanling Chan Chun Ha Secondary School  
Caritas St. Joseph Secondary School  
Caritas Tuen Mun Marden Foundation Secondary School  
Carmel Divine Grace Foundation Secondary School  
Carmel Pak U Secondary School  
Chan Sui Ki (La Salle) College  
Cheung Sha Wan Catholic Secondary School  
China Holiness Church Living Spirit College  
Chiu Lut Sau Memorial Secondary School  
Choi Hung Estate Catholic Secondary School  
Christ College  
Christian & Missionary Alliance Sun Kei Secondary School  
Christian Alliance S W Chan Memorial College  
Christian Nationals' Evangelism Commission Lau Wing Sang Secondary School  
Clementi Secondary School  
Cognitio College (Hong Kong)  
Confucian Tai Shing Ho Kwok Pui Chun College  
Cotton Spinners Association Secondary School  
Cumberland Presbyterian Church Yao Dao Secondary School  
Daughters of Mary Help of Christians Siu Ming Catholic Secondary School  
Delia Memorial School (Broadway)  
ELCHK Lutheran Secondary School  
Elegantia College (Sponsored by Education Convergence)  
Evangel College  
Fanling Kau Yan College  
Fanling Lutheran Secondary School  
Fukien Secondary School  
Fukien Secondary School (Siu Sai Wan)  
Fung Kai Liu Man Shek Tong Secondary School  
Fung Kai No.1 Secondary School  
Heep Yunn School  
Heung To Middle School  
Heung To Middle School (Tin Shui Wai)  
HHCKLA Buddhist Leung Chik Wai College  
HHCKLA Buddhist Ma Kam Chan Memorial English Secondary School  
Ho Dao College (Sponsored by Sik Sik Yuen)  
Ho Lap College (Sponsored by the Sik Sik Yuen)  
Ho Ngai College (Sponsored by Sik Sik Yuen)  
Ho Yu College and Primary School (Sponsored by Sik Sik Yuen)  
Holy Trinity College  
Homantin Government Secondary School  
Hon Wah College  
Hong Kong And Macau Lutheran Church Queen Maud Secondary School  
Hong Kong Baptist University Affiliated School Wong Kam Fai Secondary and Primary School  
Hong Kong Sheng Kung Hui Bishop Hall Secondary School  
Hong Kong Taoist Association Tang Hin Memorial Secondary School  
Hong Kong True Light College  
Hong Kong Weaving Mills Association Chu Shek Lun Secondary School  
Kau Yan College  
Kiangsu-Chekiang College (Shatin)  
King Ling College  
King's College  
Kowloon Sam Yuk Secondary School  
Kowloon Tong School (Secondary Section)  
Kwai Chung Methodist College  
Kwun Tong Kung Lok Government Secondary School  
Lee Kau Yan Memorial School  
Ling Liang Church M H Lau Secondary School  
Lingnan Secondary School  
Lions College  
Lung Kong World Federation School Limited Lau Wong Fat Secondary School  
Madam Lau Kam Lung Secondary School of Miu Fat Buddhist Monastery  
Maryknoll Convent School (Secondary Section)  
Munsang College  
Newman Catholic College  
Ning Po No.2 College  
Po Chiu Catholic Secondary School  
Po Leung Kuk Laws Foundation College  
Po Leung Kuk Lee Shing Pik College  
Po Leung Kuk Lo Kit Sing (1983) College  
Po Leung Kuk Mrs Ma Kam Ming-Cheung Fook Sien College  
Po Leung Kuk Tong Nai Kan Junior Secondary College  
Po Leung Kuk Vicwood K.T. Chong Sixth Form College  
Po Leung Kuk Wu Chung College  
Po Leung Kuk Yao Ling Sun College  
Pok Oi Hospital Tang Pui King Memorial College  
Pui Ching Middle School  
Pui Shing Catholic Secondary School  
Queen Elizabeth School  
Queen Elizabeth School Old Students' Association Secondary School  
Queen's College Old Boys' Association Secondary School  
S.K.H. Bishop Baker Secondary School  
S.K.H. Bishop Mok Sau Tseng Secondary School  
S.K.H. Lam Woo Memorial Secondary School  
S.K.H. Leung Kwai Yee Secondary School  
S.K.H. Li Fook Hing Secondary School  
S.K.H. St. Simon's Lui Ming Choi Secondary School  
S.K.H. Tsang Shiu Tim Secondary School  
Sacred Heart Canossian College  
SALEM - Immanuel Lutheran College

Shatin Tsung Tsin Secondary School  
Shau Kei Wan East Government Secondary School  
Sheung Shui Government Secondary School  
Shun Tak Fraternal Association Lee Shau Kee College  
Shun Tak Fraternal Association Leung Kau Kui College  
Shun Tak Fraternal Association Seaward Woo College  
South Tuen Mun Government Sec Sch  
St. Bonaventure College And High School  
St. Catharine's School For Girls, Kwun Tong  
St. Francis' Canossian College  
St. Francis Xavier's College  
St. Joseph's Anglo-Chinese School  
St. Joseph's College  
St. Louis School  
St. Margaret's Girls' College, Hong Kong  
St. Mark's School  
St. Paul's Co-Educational College  
St. Paul's College  
St. Paul's School (Lam Tin)  
St. Stephen's Church College  
St. Stephen's Girls' College  
St. Teresa Secondary School  
Stewards Ma Kam Ming Charitable Foundation Ma Ko Pan Memorial College  
Stewards Pooi Tun Secondary School  
Tack Ching Girls' Secondary School  
Tak Oi Secondary School  
The Association of Directors & Former Directors of Pok Oi Hospital Ltd. Leung Sing Tak College  
The Bishop Hall Jubilee School  
The Chinese Foundation Secondary School  
The Church of Christ In China Chuen Yuen College  
The Church of Christ In China Kei Chi Secondary School  
The Church of Christ In China Kei Long College

The Church of Christ In China Kei San Secondary School  
The Church of Christ In China Kei To Secondary School  
The Church of Christ In China Rotary Secondary School  
The Hong Kong Chinese Christian Churches Union Logcs Academy  
The Jockey Club Eduyoung College  
The Methodist Church Hong Kong Wesley College  
The Methodist Lee Wai Lee College  
The Mission Covenant Church Holm Glad College  
The Pentecostal Holiness Church Wing Kwong College  
The Salvation Army William Booth Secondary School  
The True Light Middle School of Hong Kong  
Tin Ka Ping Secondary School  
Tin Shui Wai Government Secondary School  
True Light Girls' College  
Tsuen Wan Government Secondary School  
Tsuen Wan Public Ho Chuen Yiu Memorial College  
Tsung Tsin Christian Academy  
Tuen Mun Catholic Secondary School  
Tung Wah Group of Hospitals Li Ka Shing College  
Tung Wah Group of Hospitals Lo Kon Ting Memorial College  
Tung Wah Group of Hospitals S.C. Gaw Memorial College  
Tung Wah Group of Hospitals Wong Fut Nam College  
Tung Wah Group of Hospitals Yau Tze Tin Memorial College  
United Christian College  
United Christian College (Kowloon East)  
Valtorta College  
Workers' Children Secondary School  
Yan Chai Hospital Law Chan Chor Si College  
Yan Chai Hospital Lim Por Yen Secondary School  
Yan Chai Hospital No. 2 Secondary School  
Yan Chai Hospital Wong Wha San Secondary School  
Yan Oi Tong Tin Ka Ping Secondary School  
Ying Wa College

## Reading

Ka Wai CHUN  
Kit Ling LAU  
Yee Fun MAN  
Ying Ling MAN  
Choi Wai TONG

## 閱讀

秦家慧  
劉潔玲  
文綺芬  
文英玲  
湯才偉

## Mathematics &amp; Problem Solving

Kwok Keung AU  
Ling Po SHIU  
Chi Shing TSE  
Yau Heng WAN  
Ka Lok WONG  
Ka Ming WONG

## 數學及解難

區國強  
蕭寧波  
謝志成  
溫有恒  
黃家樂  
黃家鳴

## Science

Sin Pui CHEUNG  
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Kwok Chi LAU  
Yuk Ping LAM  
Kin Wah MAK  
Pun Hon NG

## 科學

張善培  
朱利民  
劉國智  
藍郁平  
麥建華  
吳本韓

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Siu Yung JONG  
Ho Man LEE  
Sai Wing PUN

## 電腦化評估

莊紹勇  
李浩文  
潘世榮

## Policy Analysis

Yue Ping CHUNG  
Jun LI  
Dongshu OU  
Wai Yin POON  
Hin Wah WONG

## 政策分析

鍾宇平  
李軍  
歐冬舒  
潘偉賢  
黃顯華

## Centre Staff

Yuk Ping LAM  
Thomas Sze Kit LEE  
Kwok Wing SUM  
Eric Chung Yin TSANG  
Grace Suk Wai WONG

## 研究中心職員

藍郁平  
李仕傑  
岑國榮  
曾仲賢  
黃淑慧

**For more information on PISA 2015, please contact:  
Hong Kong Centre for International Student Assessment**

Telephone: (852) 2603 7209; Facsimile: (852) 2603 5336

Email: [hkcisa@fed.cuhk.edu.hk](mailto:hkcisa@fed.cuhk.edu.hk)

Website: [www.fed.cuhk.edu.hk/~hkcisa](http://www.fed.cuhk.edu.hk/~hkcisa)

Address: Room 612, Sino Building,

The Chinese University of Hong Kong, Shatin, Hong Kong

**Education Bureau**

Telephone: (852) 2892 6611; Facsimile: (852) 3574 0340

Email: [eordt3@edb.gov.hk](mailto:eordt3@edb.gov.hk)

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please visit the website at [www.pisa.oecd.org](http://www.pisa.oecd.org)

## PROJECT TEAM MEMBERS 項目小組成員

### Principal Investigator 首席研究員

Sui Chu HO Department of Educational Administration and Policy, CUHK 何瑞珠

### Project Leaders 統籌研究員

Yue Ping CHUNG Department of Educational Administration and Policy, CUHK 鍾宇平

Hin Wah WONG Department of Curriculum and Instruction, CUHK 黃顯華

Wing Kwong TSANG Department of Educational Administration and Policy, CUHK 曾榮光

### Co-Investigators 研究員

Kwok Keung AU Department of Mathematics, CUHK 區國強

Sin Pui CHEUNG Department of Curriculum and Instruction, CUHK 張善培

Lee Man CHU School of Life Sciences, CUHK 朱利民

Ka Wai CHUN Department of Curriculum and Instruction, CUHK 秦家慧

Siu Yung JONG Department of Curriculum and Instruction, CUHK 莊紹勇

Yuk Ping LAM Hong Kong Centre for International Student Assessment, HKIER, CUHK 藍郁平

Kit Ling LAU Department of Curriculum and Instruction, CUHK 劉潔玲

Kwok Chi LAU Department of Curriculum and Instruction, CUHK 劉國智

Ho Man LEE Department of Computer Science and Engineering, CUHK 李浩文

Jun LI Faculty of Education, HKU 李軍

Kin Wah MAK Department of Chemistry, CUHK 麥建華

Yee Fun MAN Department of Curriculum and Instruction, CUHK 文綺芬

Ying Ling MAN Department of Chinese Language Studies, The Education University of Hong Kong 文英玲

Pun Hon NG Department of Curriculum and Instruction, CUHK 吳本韓

Dongshu OU Department of Educational Administration and Policy, CUHK 歐冬舒

Wai Yin POON Department of Statistics, CUHK 潘偉賢

Sai Wing PUN Department of Curriculum and Instruction, CUHK 潘世榮

Ling Po SHIU Department of Educational Psychology, CUHK 蕭寧波

Choi Wai TONG Hong Kong Institute of Educational Research, CUHK 湯才偉

Chi Shing TSE Department of Educational Psychology, CUHK 謝志成

Yau Heng WAN Department of Mathematics, CUHK 溫有恒

Ka Lok WONG Faculty of Education, HKU 黃家樂

Ka Ming WONG Glasgow Kelvin College, UK 黃家鳴

## COLLABORATING PARTIES 協作機構

### Hong Kong Party 香港機構

The Chinese University of Hong Kong 香港中文大學  
(commissioned by Education Bureau, The Government of HKSAR 香港特別行政區政府 教育局委辦)

### International Parties 國際機構

Organisation for Economic Co-operation and Development (OECD) 經濟合作與發展組織  
PISA Consortium PISA 協作組織

### Advisor 研究顧問

Prof. Douglas J. WILLMS Consultant of OECD PISA, University of New Brunswick, Canada 德·威廉教授