

FOREWORD

Entering the era of globalization, Hong Kong is getting more and more related to other parts of the world. It is important for us to examine the quality of education and the effectiveness of our educational system from an international as well as a comparative perspective. How do various educational reforms impact on students' cognitive growth and attitude towards learning and schooling? Have students acquire the knowledge and skills essential for meeting the challenges of the twenty-first century? Are students able to make rational decision and communicate their idea effectively? Are students prepared for life-long learning? All these are important questions worthy of investigation.

By providing stakeholders of the education community with "reason" and "data," the *First HKPISA Report*, published after PISA 2000, has established a baseline for evaluating the quality and equality of education in Hong Kong. This *Second HKPISA Report* will extend our understanding of the Hong Kong education system by providing a longitudinal perspective. It is hoped that it can provide: (i) researchers with the opportunity for examining the current state of affair of our education system and the outcome of educational reforms; (ii) policy makers with the information for formulating policies that are responsive to global development; and (iii) teachers and parents with a broader view beyond the local context to regard their children's learning.

With the vision of a better future for all students regardless of their social background, we hope stakeholders of our educational community will be able to find in this report robust "rationale" and "evidence" in support of their decision and action.

We would like to take this opportunity to thank all the students, parents, teachers and principals involved in this project for their cooperation and help in the study; our patron, Education and Manpower Bureau for their financial support; our advisors, local and abroad, and the project leaders for their valuable advice.

HO, Sui-chu Esther
Director
HKPISA Centre
HKIER, CUHK

November 2005

CONTENTS

Chapter 1 Introduction

1.1	Overview of PISA	1
1.2	Assessment Framework of PISA 2003	2
1.3	Sampling in PISA	4
1.4	Assessment Instruments	5
1.5	Sampling in HKPISA 2003	6
	1.5.1 Trial Study	6
	1.5.2 Main Study	7
	1.5.3 Student Assessment	7
1.6	Data Management	8
1.7	PISA 2003 Reports	9
1.8	Organization of HKPISA Report	9

Chapter 2 Hong Kong PISA Results from an International Perspective

Sui-Chu HO & Wai-Leung KWONG

2.1	Introduction	10
2.2	Overview of Performance in Mathematical, Scientific, and Reading Literacy	11
2.3	Performance Comparison between HKPISA+ and HKPISA 2003	13
2.4	Distribution of Literacy Scores by Higher and Lower Achievers	14
2.5	Distribution of Mathematical Proficiency Levels	18
2.6	Distribution of Literacy Scores by Gender	21
2.7	Distribution of Literacy Scores by Immigration Status	26
2.8	Distribution of Literacy Scores by Family Structure	30
2.9	Distribution of Literacy Scores by Parent Occupation Index (ISEI)	32
2.10	Distribution of Literacy Scores by Parent Education Levels	33
2.11	Distribution of Literacy Scores by Family Economic, Social, and Cultural Status (ESCS Index)	35
2.12	Summary	40

Chapter 3 Mathematical Literacy Performance of Hong Kong's 15-Year Old Students in PISA 2003

Ka-Ming WONG & Huk-Yuen LAW

3.1	Introduction	41
3.2	The Construct for the Assessment of Mathematical Literacy in PISA	42
	3.2.1 Mathematical Content	42
	3.2.2 Mathematical Processes	43
	3.2.3 Mathematical Situations and Contexts	44
	3.2.4 Item Types in Mathematical Literacy Assessment	45

3.3	Six Levels of Proficiency in Mathematical Literacy	46
3.4	Sample Mathematical Literacy Tasks	49
3.4.1	<i>Sample Unit 1 - Cubes</i>	50
3.4.2	<i>Sample Unit 2 - Walking</i>	51
3.4.3	<i>Sample Unit 3 - Exchange Rate</i>	54
3.4.4	<i>Sample Unit 4 - Earthquake</i>	56
3.5	Profile of the Mathematical Literacy Performance of Hong Kong Students	57
3.5.1	<i>Overall Mathematical Literacy Performance Compared with Other Participating Countries/Regions</i>	57
3.5.2	<i>Distribution across Mathematical Proficiency Levels</i>	61
3.5.3	<i>Performance on the Mathematical Sub-Scales</i>	64
3.6	Gender Differences in Mathematical Literacy of Hong Kong Students	65
3.7	Summary	69

Chapter 4 Scientific Literacy Performance of Hong Kong's 15-Year Old Students in PISA 2003

Din-Yan YIP

4.1	Introduction	70
4.2	The Construct for the Assessment of Scientific Literacy in PISA 2003	70
4.2.1	<i>Scientific Content</i>	70
4.2.2	<i>Item Types in Scientific Literacy Assessment</i>	70
4.2.3	<i>Scale for Measuring Performance in Scientific Literacy</i>	71
4.3	Sample Scientific Literacy Tasks	72
4.3.1	<i>Sample Unit 1 - Daylight</i>	72
4.3.2	<i>Sample Unit 2 - Cloning</i>	74
4.4	Profile of the Scientific Literacy Performance of Hong Kong Students	76
4.4.1	<i>Overall Scientific Literacy Performance Compared with other Participating Countries/Regions</i>	76
4.4.2	<i>Distribution of Scientific Literacy Performance</i>	77
4.4.3	<i>Hong Kong Student Performance in Different Components of Scientific Literacy</i>	78
4.5	Gender Differences in Scientific Literacy of Hong Kong Students	79
4.5.1	<i>Gender Differences in Scientific Literacy in Hong Kong and other Countries/Regions</i>	79
4.5.2	<i>Gender Differences in Performance across Ability Levels</i>	81
4.5.3	<i>Gender Differences in Different Components of Scientific Literacy</i>	82
4.5.4	<i>Gender Differences in Performance in Items of Different Nature</i>	83
4.6	Summary	84

Chapter 5 Reading Performance of Hong Kong's 15-Year Old Students in PISA 2003

Cecilia Ka-Wai CHUN

5.1	Introduction	85
5.2	The Construct for the Assessment of Reading Literacy in PISA 2003	85
5.2.1	<i>The Process of Reading - Aspects of Reading</i>	86
5.2.2	<i>The Content of Reading - Text Formant and Text Type</i>	87
5.2.3	<i>The Context of Reading - Purposes of Text</i>	87
5.2.4	<i>Format of Responses</i>	87
5.3	Proficiency Levels in Reading Literacy	89
5.4	Sample Reading Literacy Tasks	91
5.4.1	<i>Sample Unit 1 - Graffiti</i>	91
5.4.2	<i>Sample Unit 2 - Labour</i>	94
5.5	Profile of the Reading Performance of Hong Kong Students	96
5.5.1	<i>Overall Reading Performance Compared with other Participating Countries/Regions</i>	97
5.5.2	<i>Variation in Reading Performance</i>	99
5.5.3	<i>Distribution across Reading Proficiency Levels</i>	101
5.5.4	<i>Performance across Different Aspects of Reading</i>	103
5.5.5	<i>Performance across Text Formats and Text Types</i>	103
5.5.6	<i>Performance across Contexts of Use</i>	104
5.5.7	<i>Comparison with Top Countries</i>	105
5.6	Summary	106

Chapter 6 Problem Solving Performance of Hong Kong's 15-Year Old Students in PISA 2003

Sui-Chu HO & Chi-Chung LAM

6.1	Introduction	107
6.2	The Construct for the Assessment of Problem Solving Skills in PISA 2003	107
6.3	Proficiency Levels in Problem Solving Skills	109
6.4	Sample Tasks of Problem Solving Skills	110
6.4.1	<i>Decision Making Units - Energy Needs</i>	111
6.4.2	<i>System Analysis and Design Units - Library System</i>	114
6.4.3	<i>Trouble Shooting Units - Irrigation</i>	118
6.5	Profile of the Problem Solving Performance of Hong Kong Students	122
6.5.1	<i>Overall Problem Solving Performance Compared with other Participating Countries/Regions</i>	122
6.5.2	<i>Distribution of Problem Solving Performance</i>	123
6.5.3	<i>Percentage of Students at Each Level of Proficiency on the Problem Solving Scale</i>	125
6.5.4	<i>Performance on the Problem Solving Sub-Scales</i>	127

6.6	Gender Differences in Problem Solving	129
6.7	Summary	131

Chapter 7 Effect of Student Background and Parental Involvement and Investment

Sui-Chu HO

7.1	Introduction	132
7.2	Parental Involvement and Investment from an International Perspective	132
7.3	Conceptualization and Operationalization of Parental Involvement and Investment in HKPISA 2003	134
7.4	Parental Involvement and Investment in Hong Kong	137
7.5	Methodology and Analysis	138
7.6	Between-School Variance in Literacy Performance	139
7.7	Student Background, School Context and Parental Involvement and Investment related to Students' Mathematical Literacy	140
7.8	Student Background, School Context and Parental Involvement and Investment related to Students' Scientific Literacy, Reading Literacy and Problem Solving Skills .	142
7.9	Summary	144

Chapter 8 Conclusions and Implications

8.1	Introduction	147
8.2	Quality and Equality	147
8.3	Student Achievement in Mathematical Literacy	148
8.4	Student Achievement in Scientific Literacy	149
8.5	Student Achievement in Reading Literacy	149
8.6	Student Achievement in Problem Solving Skills	150
8.7	Parental Involvement and Investment	151
8.8	Implications and Recommendations	151
	8.8.1 For Policy Makers	151
	8.8.2 For Educators & Parents	152
8.9	Looking Forward to Future Study	154

Appendix I: Explanatory Note on Multi-Level Analysis in Chapter 7..... 156

References..... 158

Acknowledgement

LIST OF FIGURES

Figure 2.6.1	Gender Differences in Mathematical Literacy in PISA 2003	22
Figure 2.6.2	Gender Differences in Scientific Literacy in PISA 2003	23
Figure 2.6.3	Gender Differences in Reading Literacy in PISA 2003	24
Figure 2.6.4	Gender Differences in Mathematical , Scientific and Reading Literacy in HKPISA 2003 and HKPISA+	26
Figure 2.7.1	Percentage of Non-Native and First-Generation Students (left scale) and Performance of Non-Native, First-Generation and Native Students on the Combined Mathematical Literacy Scale (right scale)	27
Figure 2.7.2	Percentage of Non-Native and First-Generation Students (left scale) and Performance of Non-Native, First-Generation and Native Students on the Combined Scientific Literacy Scale (right scale)	28
Figure 2.7.3	Percentage of Non-Native and First-Generation Students (left scale) and Performance of Non-Native, First-Generation and Native Students on the Combined Reading Literacy Scale (right scale)	29
Figure 2.11.1	Relationship between Student Performance in Mathematics and ESCS in Nine Countries/Regions	38
Figure 2.11.2	Performance in Mathematics and the Impact of Socio-Economic and Cultural Background	39
Figure 3.5.1.1	Comparison of Student Performance on the Combined Mathematical Literacy Scale	59
Figure 3.5.2.1	Percentage of Students at Each Level of Proficiency on the Combined Mathematical Scale	63
Figure 3.6.1	Comparison of Scores between Hong Kong Girls and Boys in Mathematical Literacy	66
Figure 3.6.2	Percentage of Students at Each Level of Proficiency on the Combined Mathematical Literacy Scale, by Gender	68
Figure 4.4.2.1	Comparison of Mean Scores between Hong Kong and OECD Average in Scientific Literacy at Different Percentiles	78
Figure 4.4.3.1	Comparison of Mean Scores between Hong Kong and OECD Countries in the Different Components of Scientific Literacy	78
Figure 4.5.1.1	Gender Differences in Scientific Literacy Performance in PISA 2003 and PISA 2000	80
Figure 4.5.2.1	Comparison of Mean Scores between Hong Kong Girls and Boys in Scientific Literacy at Different Percentiles	81
Figure 5.2.1.1	The Five Aspects of Reading Comprehension	86
Figure 5.5.2.1	A Comparison of Student Performance on the Combined Reading Literacy Scale in PISA 2003 and PISA+	100

Figure 5.5.3.1	Percentage of Students at Each Level of Proficiency on the Reading Literacy Scale	101
Figure 6.5.2.1	Comparison of Mean Scores between Hong Kong and OECD Average in Problem Solving Scale at Different Percentiles	124
Figure 6.5.3.1	Comparison of Distribution of Problem Solving Proficiency Levels between Hong Kong and OECD Average	126
Figure 6.5.3.2	Percentage of Students at Each Level of Proficiency on the Problem Solving Scale across Countries/Regions	127

LIST OF TABLES

Table 1.1.1	Participating Countries/Regions of PISA 2003	1
Table 1.2.1	Assessment Framework of PISA 2003	3
Table 1.5.1.1	Distribution of Schools Participating in the Trial Study of HKPISA 2003	6
Table 1.5.2.1	Selected and Participating Schools for Each Sampling Stratum in HKPISA 2003	7
Table 1.5.3.1	Distribution of Students Participating in the Main Study of HKPISA 2003	8
Table 2.2.1	Mean Performance of 15-Year-Old Students in Mathematical, Scientific, and Reading Literacy	12
Table 2.3.1	Mean Scores and Percentile Comparisons in Mathematics, Science, and Reading between HKPISA+ and HKPISA 2003	13
Table 2.4.1	Variation in Student Performance on the Combined Mathematical Literacy Scale	15
Table 2.4.2	Variation in Student Performance on the Scientific Literacy Scale	16
Table 2.4.3	Variation in Student Performance on the Reading Literacy Scale	17
Table 2.5.1	Summary Descriptions for Six Levels of Overall Mathematical Literacy	18
Table 2.5.2	Percentage of Students at Each Level of Proficiency on the Combined Mathematical Literacy Scale	20
Table 2.6.1	Student Performance on the Combined Mathematical, Scientific, and Reading Literacy Scales, by Gender	25
Table 2.8.1	Family Structure of Students Participated in PISA 2003, by Countries	31
Table 2.8.2	Performance in Mathematics, Science and Reading in Hong Kong, by Family Structure	32
Table 2.9.1A	Socio-Economic Index of Occupation Status (ISEI) by National Quarters of the Index	33
Table 2.9.1B	Performance on the Mathematical Literacy Scale, by National Quarters of the ISEI Index	33
Table 2.9.1C	Performance on the Scientific Literacy Scale, by National Quarters of the ISEI Index	33
Table 2.9.1D	Performance on the Reading Literacy Scale, by National Quarters of the ISEI Index	33
Table 2.10.1A	Percentage of Students and Performance on the Combined Mathematical Literacy Scale, by Level of Mother's Education and Father's Education	34
Table 2.10.1B	Percentage of Students and Performance on the Scientific Literacy Scale, by Level of Mother's Education and Father's Education	34
Table 2.10.1C	Percentage of Students and Performance on the Reading Literacy Scale, by Level of Mother's Education and Father's Education	35
Table 2.11.1	Relationship between Mathematical Literacy Performance and the Index of Economic, Social and Cultural Status (ESCS)	36

Table 3.2.1.1	Distribution of Mathematical Items by “Overarching Ideas”	42
Table 3.2.1.2	Distribution of Mathematical Items by “Mathematical Curricular Strands”	43
Table 3.2.3.1	Distribution of Mathematical Items by “Situations or Contexts”	45
Table 3.2.4.1	Distribution of Item Types for the Assessment of Mathematical Literacy	46
Table 3.3.1	Score Range of the Mathematical Proficiency Levels	47
Table 3.3.2	Brief Descriptions of Six Levels of Proficiency in the Four Mathematical Sub-Scales	48
Table 3.5.1.1	Mean Performance in Mathematical Literacy of Participating Countries/Regions	58
Table 3.5.1.2	Comparison of Mean Scores between Hong Kong and OECD Average in Mathematical Literacy at Different Percentiles	59
Table 3.5.1.3	Comparison of the Percentage of Correct Answers between Hong Kong and the OECD Average in Mathematics by Various Dimensions of the Mathematical Literacy Framework	61
Table 3.5.3.1	Proportion of Students at Each Proficiency Level of the Mathematical Sub-Scales	64
Table 3.5.3.2	Mean Scores and Percentile Comparisons in Space and Shape and Change and Relationship between 2003 and 2000	65
Table 3.6.1	Performance of Different Percentiles of Hong Kong Girls and Boys in Mathematical Literacy	66
Table 3.6.2	Comparison of the Percentage of Correct Answers between Girls and Boys of Hong Kong in Mathematics by Various Dimensions of the Mathematical Literacy Framework	67
Table 4.2.2.1	Distribution of Assessment Items for the Scientific Literacy Scale in PISA 2003	71
Table 4.4.1.1	Mean Performance in Scientific Literacy of Participating Countries/Regions	76
Table 4.4.2.1	Comparison of Mean Scores between Hong Kong and OECD Average in Scientific Literacy in Different Ability Ranges	77
Table 4.5.2.1	Scientific Literacy Performance of Hong Kong Boys and Girls at Different Percentiles	81
Table 4.5.3.1	Comparison of the Percentage of Correct Answers between Girls and Boys of Hong Kong in Science by Scientific Processes	82
Table 4.5.4.1	Comparison of the Percentage of Correct Answers between Girls and Boys of Hong Kong in Science by Item Format	83
Table 4.5.4.2	Comparison of the Percentage of Correct Answers between Girls and Boys of Hong Kong in Science by Thematic Areas	83
Table 5.2.4.1	Distribution of Response Types across Aspects of Reading, Text Formats, Text Types and Contexts of Use	88
Table 5.3.1	Summary Descriptions of Five Levels of Proficiency in the Three Reading Sub-Scales	90

Table 5.3.2	Score Range of the Reading Proficiency Levels	91
Table 5.5.1	Grade Level Distribution of Students Participating in the Main Study of HKPISA 2003 and HKPISA+	97
Table 5.5.1.1	Mean Performance in Reading Literacy of Participating Countries/Regions	98
Table 5.5.2.1	Comparison between Hong Kong and OECD in Variation in Reading Performance	99
Table 5.5.3.1	Proportion of Hong Kong Students at each Proficiency Level in PISA 2003 and PISA+	102
Table 5.5.3.2	Mean Score Comparison across Grade Level of Students Participating in HKPISA 2003 and HKPISA+	102
Table 5.5.4.1	Comparison of the Percentage of Correct Answers between Hong Kong and the OECD Average in Reading by Aspects of Reading	103
Table 5.5.5.1	Comparison of the Percentage of Correct Answers between Hong Kong and the OECD Average in Reading by Text Types	104
Table 5.5.6.1	Comparison of the Percentage of Correct Answers between Hong Kong and the OECD Average in Reading by Contexts of Use	105
Table 5.5.7.1	Student Performance Comparison between Finland, Korea, and Hong Kong ..	105
Table 6.2.1	Comparative Features of the Three Types of Problem Solving	109
Table 6.3.1	Brief Descriptions for Four Levels of Problem Solving Scale	110
Table 6.5.1.1	Mean Performance in Problem Solving Scale of Participating Countries/Regions	122
Table 6.5.2.1	Comparison of Mean Scores between Hong Kong and OECD Average in Problem Solving Scale at Different Percentiles	123
Table 6.5.2.2	Disparity of High and Low Achievers in Problem Solving Scale across Countries/Regions	125
Table 6.5.3.1	Score Range of the Problem Solving Proficiency Levels	126
Table 6.5.4.1	Comparison of the Percentage of Correct Answers between Hong Kong and the OECD Average in Problem Solving by Question Units	128
Table 6.5.4.2	Comparison of the Percentage of Correct Answers between Hong Kong and the OECD Average in Problem Solving by Problem Types	129
Table 6.5.4.3	Comparison of the Percentage of Correct Answers between Hong Kong and the OECD Average in Problem Solving by Item Formats	129
Table 6.6.1	Gender Differences in Student Performance in Problem Solving Sorted by Difference	130
Table 6.6.2	Comparison of the Percentage of Correct Answers between Girls and Boys of Hong Kong in Problem Solving by Problem Types	131
Table 6.6.3	Comparison of the Percentage of Correct Answers between Girls and Boys of Hong Kong in Problem Solving by Item Formats	131
Table 7.3.1	Questionnaire Items for Measuring Five Types of Parental Involvement in HKPISA 2003	135

Table 7.3.2	Questionnaire Items for Measuring Three Types of Parental Investment in HKPISA 2003	136
Table 7.4.1	Descriptive Statistics of Parental Involvement	137
Table 7.4.2	Descriptive Statistics of Parental Investment	138
Table 7.4.3	Correlation of Parental Involvement and Investment	138
Table 7.6.1	Comparison of Between-School Variance in Performance between Hong Kong and OECD Countries/Regions in 2000 and 2003	139
Table 7.7.1	Effects of Student and School Background and Parental Involvement and Investment on Students' Mathematical Literacy	142
Table 7.8.1	Effects of Parental Involvement and Parental Investment on Students' Scientific Literacy, Reading Literacy and Problem Solving Skills	144