

# What Can PISA 2012 Data Tell Us?

## Performance and Challenges in Five Participating Southeast Asian Countries

Lei Mee Thien, Nordin Abd Razak, John P. Keeves  
and I Gusti Ngurah Darmawan (Eds.)



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*Performance and Challenges in Five Participating Southeast Asian Countries*

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## TABLE OF CONTENTS

Preface	vii
Acknowledgments	xi
Prologue	xiii
<i>John P. Keeves</i>	
1. PISA: Malaysia's Wake up Call for a More Balanced Approach to Educational Delivery and Attainment	1
<i>Azian T. S. Abdullah, Muhammad Zaini Mohd Zain, Sheela G. Nair, Rusliza Abdullah and Ihsan Ismail</i>	
2. A Multilevel Analysis of Singaporean Students' Mathematics performance in PISA 2012	17
<i>Qian Chen</i>	
3. Education Assessment System and PISA 2012 in Vietnam	35
<i>Le Thi My Ha</i>	
4. Students' Performance in PISA and the Adequacy of Teaching and Learning	51
<i>Precharn Dechsri</i>	
5. Diagnosing Weaknesses of Indonesian Students' Learning	63
<i>Harry Firman</i>	
6. Factors Associated with Malaysian Mathematics Performance in PISA 2012	81
<i>Lei Mee Thien and I Gusti Ngurah Darmawan</i>	
7. Problem-Solving Skills among Malaysian Students: What We Learned from PISA	107
<i>Sharifah Norul Akmar Syed Zamri</i>	
8. The Variation in Teaching and Learning Practices and Their Contribution to Mathematics Performance in PISA 2012	123
<i>Nordin Abd Razak and Azadeh Shafaei</i>	
9. Assessing the Quality and Equity of Student Performance in Five Southeast Asian Countries	159
<i>I Gusti Ngurah Darmawan</i>	

## TABLE OF CONTENTS

10. Understanding PISA and Its Impact on Policy Initiative: A Review of the Evidence <i>Petra Lietz, Mollie Tobin and Dita Nugroho</i>	181
11. What Comes Next – Insights for Reform Initiatives and Future Research <i>Esther Sui Chu Ho</i>	207
12. The Foundation Problems for Educational Research Arising from the PISA Studies: Important Issues for Research into PISA Studies <i>John P. Keeves and I Gusti Ngurah Darmawan</i>	219
Epilogue: The Challenges Confronting All People Living on the Planet Earth <i>John P. Keeves and I Gusti Ngurah Darmawan</i>	239
About the Contributors	249

## PREFACE

The Programme for International Student Assessment (PISA) that was launched in 2000 and conducted by the Organisation for Economic Co-operation and Development (OECD) is an ambitious large-scale assessment study that attempts to measure and compare proficiency in Reading, Mathematics, and Science Literacies in a large number of OECD and partner countries. PISA assesses to what extent the 15-year-old students are acquiring key knowledge and skills that are essential for full participation in modern societies. The assessment tests are administered every three years, which does not only find out whether students can reproduce what they have learned. It also examines how well they can extrapolate from what they have learnt and apply the knowledge and studies in unfamiliar settings, both in and outside of school or to real-life situations and be equipped for full participation in society.

In the 2012 cycle, all 34 OECD member countries and 31 partner countries and economies participated in PISA which represented more than 80 per cent of the World economy. In total, 510,000 students between the ages of 15 years 3 months and 16 years 2 months completed the assessment tests in 2012, representing about 28 million 15-year-old students in the schools of the 65 participating countries and economies. Notably, five Southeast Asian countries participated in PISA 2012: Indonesia, Malaysia, Singapore, Thailand, and Vietnam.

In this book, these five countries show a diversity of performance in Mathematics, Science, and Reading Literacies. Singapore and Vietnam record high performance in Reading, Mathematics, and Science Literacies. The performance on PISA 2012 tests in Indonesia, Malaysia, and Thailand indicate the challenges to improve students' Reading, Mathematics, and Science Literacies.

The purpose of this book is to present the details of the performance as well as school, teacher, and student factors that influence students' performance in Mathematics, Science, and Reading Literacies among these five Southeast Asian countries. The first five chapters focus on the performance issues in the five specific countries in all three literacies as well as the countries' initiatives to improve in the next cycle of PISA performance in Malaysia, Singapore, Indonesia, Thailand, and Vietnam. Chapter 6 discusses the factors that are associated with the Malaysian Mathematics Literacy in PISA 2012 using multilevel analysis in order to identify school and student level effects.

The results of the computer-based assessment (CBA) of problem-solving skills in PISA 2012 among Malaysian students are no doubt a cause for concern. Chapter 7 provides a critical analysis of the CBA problem-solving performance among the Malaysian students in PISA 2012. The chapter begins with a view of the overall poor performance relative to the international mean performance, followed by an analysis of the possible factors accounting for this poor performance.



## PREFACE

The influence of teaching and learning strategies on student performance in PISA 2012 differ substantially across countries and relatively little is known about the processes contributing to these differences. With respect to this issue, Chapter 8 discusses the differences in teaching and learning strategies between the five participating Southeast Asian countries as well as the effects of these strategies on students' Mathematics Performance. Specifically, a number of reports using PISA data show that school systems differ not only in their average performance, but also in how equitably they distribute educational opportunities among students after allowing for individual, family, and Socioeconomic background. In relation to this, Chapter 9 focuses on issues regarding the quality and equity in learning outcomes of students in the five participating Southeast Asian countries by examining the distributions and the levels of student performance in the PISA 2012 assessment study, as well as the effects of Gender and Socioeconomic background on student performance in all three domains of Mathematics, Science, and Reading Literacies.

In addition to monitoring the quality of education in national systems, the PISA empirical results provide the necessary evidence base for making changes to both policies and practices in education. In this regard, Chapter 10 presents evidence from two systematic reviews of the impact of large scale assessments including PISA on educational policy. Particular attention is given to the types of assessment programmes undertaken, their goals and uses, the stages of the policy process informed by assessments; and the facilitators of and barriers to the uses of assessment data in the educational policy-making process. This chapter concludes with considerations regarding how the capacities of large-scale assessments to inform both policy development and implementation may be increased. Chapter 11 is concerned with 'What comes next?' and shed light on a new direction for future research and practices based on the findings from the first ten chapters.

Chapter 12 discussed three important issues that relate to the conduct of the PISA Studies. The first issue is related to the simplistic employment of each country's mean score in each domain of Mathematics, Science, and Reading Literacies. These mean scores are argued to be unsatisfactory indicators of the national educational enterprise in each country. This chapter strongly argues for research into a change in the key criteria and the recorded emphasis of the PISA Studies from mean levels of performance in each participating country to consideration of the importance of educational yield, namely 'How many get how far'. Chapter 12 also considers the issues associated with measurement on an absolute interval scale, in order that changes across countries and over time can be measured accurately and can be meaningfully compared. In addition, this chapter draws attentions to the influence that computer-based assessment is having on the processes of learning and teaching in countries throughout the World. There is clearly need for research to be undertaken into the problems of yield and measurement as well as computer-based learning, teaching, and assessment.

The Epilogue examines the challenges facing all countries and economies operating on planet Earth and argues that the PISA Studies are critical components of the UNESCO ‘Education for All’ movement with concern for the ‘Challenged Earth’.

This is the first book regarding the issues of PISA that has been published with respect to the Southeast Asian region. It is hoped that the content of this book can benefit and provide greater understanding for readers of several important aspects: (a) country performance in PISA 2012 for each participating Southeast Asian country, (b) the need for international comparative studies from the perspective at all levels of the teaching and learning process, (c) equity and quality of education, (d) how PISA impacts on policy making, and (e) the initiatives and future directions, and challenges to improve PISA performance in the future cycles of the PISA Studies. In these regards, the readership of this book could be extended to the educators, officers from the ministries of education, researchers, policy makers, practising teachers, lecturers in universities and teacher training institutions, postgraduate students, as well as both primary and secondary school principals and teachers.

*Lei Mee Thien*



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We would like to thank the Southeast Asia Minister of Education Organisation Regional Centre for Science and Mathematics Education (SEAMEO RECSAM) for their great effort in organising the first Symposium on PISA: Critical Review and Findings of PISA 2012 in year 2014. This book presents the central outcomes of the symposium. Our special thanks to the Centre Director, Dr. Hj. Mohd Johan bin Zakaria and Deputy Director in Research and Development Division, Dr. Suhaidah Tahir for their great support that leads to this book. The first editor wishes to thank Prof. John P. Keeves, Assoc. Prof. Dr. Nordin Abd Razak, and Dr. I Gusti Ngurah Darmawan who spent a great deal of time despite their tight schedule in providing constructive comments and suggestions to improve each book chapter in addition to proofreading and editing. A note of appreciation is also extended to Ms. Mei Yean Ong who helped by organising, reformatting, and redrawing the figures and tables in this book. Last but not least, we would like to thank our families for their love and moral support so that we could ensure the success of this book.



JOHN P. KEEVES

## PROLOGUE

It is now 50 years since the first substantial report on a cross-national study of educational achievement was released from the Unesco Institute of Education in Hamburg, with the purpose of building a deeper understanding of the processes of education across a changing World. Twenty-five years later in 1990 UNESCO conducted a World Conference at Jomtien in Thailand which gave rise to the program of “Education for All” that introduced a world-wide policy which was endorsed by the United Nations Organisation (UNO) in the field of education. This required a monitoring program. Subsequently, the Organisation for Economic Co-operation and Development (OECD), following a meeting that had been held at Poitiers in France in 1988, introduced in the year 2000, the Programme for International Student Assessment (PISA) from a centre in Paris. Initially PISA tested in three fields in order to measure and compare proficiency in Mathematics, Science, and Reading Literacies in a large number of OECD and partner countries. These fields would appear to have been chosen, without theoretical or empirical research foundations on the grounds of the importance of Mathematics and Science in the developed countries of Europe and the significance of fluency and strength in the national language of each country involved. The PISA Studies were conducted on a triennial basis and gradually spread to the developing countries and economies that became partners in the Programme. Furthermore, these fields were different from the tests of knowledge that continued to be conducted by the International Association for the Evaluation of Educational Achievement (IEA), which maintained an operating centre in Hamburg and offices in The Netherlands. In the intervening years IEA had conducted courses in Thailand, and scholars had been sent to work in Malaysia, Singapore, Thailand, and Vietnam, and had welcomed educational leaders from two countries that are also involved in the preparation of this book namely, Indonesia and Australia to work in Hamburg and Stockholm.

It is not surprising that the five countries of Southeast Asia which are participating in the current study are working together to compare their experiences in the PISA Studies with a view to disseminating information about the PISA Programme across the developed and developing countries of the World. There are five major issues that are associated with the PISA Studies that are being addressed in this book.

1. Within each of the five countries of Southeast Asia, there is the need to report to the Ministries of Education involved on the lessons learnt and the policies and practices that had been introduced or may be introduced which result directly from participation in the PISA Studies.

2. There are issues that need to be considered as a consequence of the population explosion currently taking place across the World, as well as the challenges confronting the people living on planet Earth during the twenty-first century.
3. There are short-comings in the administration of the PISA tests that need both consideration and research associated with (a) the random sampling of the schools and the students, (b) the accuracy of the absolute interval scale of measurement, (c) the scores recorded across countries and the different languages involved, and (d) the measuring instruments employed between occasions.
4. The rapidly advancing uses of computer-based learning and teaching as well as assessment are beginning to modify the nature and processes of educational provision at all levels of operation.
5. In addition, the availability of increasingly powerful computers is giving rise to new analytical procedures for the statistical examination of the data that are obtained from the students tested and the levels of operation of the variables that are hypothesised to influence the outcomes of the educational processes involved.

These five major issues warrant investigation and reporting to all countries of the World, including not only those countries that were engaged in PISA 2012, but also to the approximately 200 countries that are currently members of the United Nations Organisation.

*John P. Keeves*

AZIAN T. S. ABDULLAH, MUHAMMAD ZAINI MOHD ZAIN,  
SHEELA G. NAIR, RUSLIZA ABDULLAH AND IHSAN ISMAIL

## 1. PISA

### *Malaysia's Wake up Call for a More Balanced Approach to Educational Delivery and Attainment*

#### INTRODUCTION

Education in Malaysia has been continually evolving over the past 60 years. The various stages of development that the country has gone through, beginning from the post-independence era to the current education transformation process, are testament to the fact that we are consistently striving to provide the best possible learning experiences for our children by ensuring that our education remains relevant to the needs of the nation and the rapidly changing global environment. This sentiment is aptly captured by the following preamble to the Education Act 1996:

... the purpose of education is to enable Malaysian society to have a command of the knowledge, skills, and values necessary in a world that is highly competitive and globalised, arising from the impact of rapid development in science, technology, and information. (The Commissioner of Law Revision, Malaysia, TCLRM, 2006, p. 11)

The greatest challenge for any education system is to ensure the success of every child who goes through the system. In Malaysia, the National Education Philosophy postulates that every child has the potential to learn and it is the responsibility of the education system to provide the right learning environment and opportunities for a child to develop in a holistic and integrated manner. The belief that every child can succeed is at the core of the Malaysian education system.

This belief is encrusted within the National Curriculum, whereby the objective of the curriculum is to ensure that Malaysian students acquire the necessary skills and knowledge that enable them to participate effectively both at national and international environments. The nation's educational goals are manifested in the National Curriculum which is designed in such a way that it contributes to the holistic development of individuals (mental, emotional, spiritual, and physical) by imparting knowledge and skills, encouraging healthy attitudes and instilling accepted moral values.



The Malaysian education system is taking into consideration all aspects of learning, clearly stating the vision and goals of education as well as translating them into a comprehensive curriculum that encompasses what the nation's education is all about. Consequently, the question arises, why then do we need our students to participate in the Programme for International Student Assessment (PISA)? What can we learn by benchmarking ourselves against countries with different education systems?

Basically, PISA is a large-scale assessment study administered to 15-year-old students in three different domains – Mathematics, Science, and Reading Literacies. The test questions are not content based as they do not measure students' ability to memorise facts and reproduce them under examination conditions. Rather, PISA stipulates that students draw on their acquired and existing knowledge and real-world problem solving skills. Some researchers believe that PISA is an indicator of whether school systems are successfully preparing students for the twenty-first century global knowledge economy (Asia Society, 2014).

Besides these, international benchmarks provide a wider context to assess what being the best or among the best really means as they have the capacity to show the possibilities that can be achieved by education systems. Furthermore, PISA data are useful in the sense that they can reveal common patterns and trends among high performing school systems in the world. PISA data can also indicate strategies used by successful systems in reforming or transforming their education to enhance learning outcomes (Artelt et al., 2003; Asia Society, 2014).

In a nutshell, what PISA provides can be termed as 'performance indicators'. While it is true that public examinations in Malaysia can be used to evaluate the performance of our students within the national context, or what can be termed as 'national performance indicators', participation in international student assessments such as PISA provides a greater context for the evaluation of student performance across different countries and different education systems. The Malaysian Ministry of Education (MOE) also hopes to obtain a deeper perspective of the strengths and weaknesses of important areas within the education system.

#### MALAYSIA'S PARTICIPATION IN PISA

On October 23, 2009 the Malaysian Cabinet approved the MOE's proposal to participate in PISA, an international comparative study that measures the achievement of students aged 15+ years in the three literacy domains. The Educational Planning and Research Division (EPRD) of the MOE was assigned to carry out this study. PISA aims to improve the quality of education as well as measure the extent to which students acquiring the knowledge and skills needed to become successful members of society. The study also identifies factors related to educational attainment to assist the Ministry to formulate policies to improve the outcomes.

Malaysia, with nine other countries and economies, participated in PISA 2009 for the first time in the year 2010. It was termed PISA 2009+ due to the one-year

lag behind the main study that was carried out in 2009. However all instruments and materials remained the same as the main PISA 2009 study. The PISA 2009+ findings were reported in 2011, a year after the PISA 2009 international report was published.

For each cycle of PISA, one subject is tested in detail, taking up nearly two-thirds of the total testing time. The major domain was Reading Literacy in 2000 and 2009, Mathematics Literacy in 2003 and 2012, Science Literacy in 2006 and the 2015 cycle. So, PISA 2009+ focused on Reading, with Mathematics and Science Literacies as minor domains of assessment. The study assessed not only whether students could use basic knowledge, but also whether they could extrapolate from what they had learned and, could apply their knowledge in new situations. It emphasised the mastery of processes, the understanding of concepts, and the ability to function in various types of situations.

In the PISA 2012 cycle, around 5,197 15-year-old students in 164 Malaysian schools are involved in the assessment study. The distribution of students based on type of school, gender, and form is shown in Table 1. The majority of students representing the country come from national secondary schools, with female students out-numbering the males. Most of the 15-year-old students involved are in Form 4 at the time of testing. The existence of the one-year Remove Class for students moving from national type primary schools using Chinese or Tamil languages as the medium of instruction to secondary schools using only the national language, explains the presence of several Form 2 and 3 students. The only Form 5 student who taking part may have gone through a fast-track system from Year 3 to Year 5 in primary school, skipping Year 4.

*Table 1. Distribution of students by type of school, gender and form*

		<i>No of Students</i>	<i>No. of Schools</i>
Types of School	National Secondary	4247	135
	Religious	166	5
	Vocational / Technical	295	9
	Fully Residential	91	3
	MARA Junior Science College	95	3
	Others	303	9
Gender	Male	2452	
	Female	2745	
Form	2	3	
	3	177	
	4	5016	
	5	1	

In the PISA 2012, students’ data were collected in two modes; cognitive tests and questionnaires. Paper-based tests were used, with assessments lasting a total of two hours, comprising four 30-minute clusters of test material from one or more subjects, for each student. An additional 40 minutes was devoted to the computer-based assessment of problem solving. Test items were a mixture of multiple-choice items and questions requiring students to construct their own responses. The items were organised in groups based on a passage setting out a real-life situation. A total of about 390 minutes testing time was involved. Items were employed with different students taking different combinations of test items. For each country, the total set of questions was packaged into 13 linked test booklets. Since the design and translation of the test as well as the sampling and data collection, were subjected to strict quality controls, the PISA findings were considered to be comparable across countries.

Students also answered a background questionnaire, which took 30 minutes to complete, that sought information about themselves, their home, school, and learning experiences. School Principals were given a questionnaire to complete in 30 minutes that covered the school system and the learning environment.

Decisions about the scope and nature of the questionnaires and the background information to be collected were made by leading experts in participating countries. Considerable efforts and resources were devoted to achieving cultural and linguistic breadth and balance in the questionnaires.

## RESULTS

The international results of PISA 2012 were released in December 2013 and a comparison was made with the results of PISA 2009+ in all the three domains as shown in Table 2. Students obtained an average score of 421 for Mathematics Literacy compared to 404 in PISA 2009+ and involved an increase of 17 points. With respect to Science Literacy, the average score in PISA 2012 was 420 compared to 422 in 2009, indicating a small decrease. Reading Literacy on the other hand, in 2012 had an average score of 398, decreasing by 16 points when compared to 414 in 2009. Based on the rank in performance with respect to the other 65 participating countries in 2012, the results left Malaysia in the bottom third of the table again for all the three domains.

*Table 2. PISA performance across domains in PISA 2009 and PISA 2012*

<i>Domain</i>	<i>2009+</i>		<i>2012</i>		<i>Difference</i>
	<i>Mean</i>	<i>SE</i>	<i>Mean</i>	<i>SE</i>	
Mathematics	404	2.71	421	3.18	17*
Science	422	2.68	420	3.00	2*
Reading	414	3.67	398	3.33	16*

*Note: \*p < .05*

*Gender*

Table 3 shows the analysis by domain and gender in PISA 2009+ and 2012. In both cycles and in all domains, girls performed better than boys significantly. This is most evident in Reading Literacy where the mean scores of girls are about 39 and 40 points higher than boys in PISA 2009+ and 2012 respectively. For Mathematics Literacy, girls outperform boys with mean scores of approximately three and eight points higher than boys in PISA 2009+ and 2012 respectively. Similarly, for Science Literacy, girls have better performance by approximately 10 and 11 points higher than boys in PISA 2009+ and 2012 respectively.

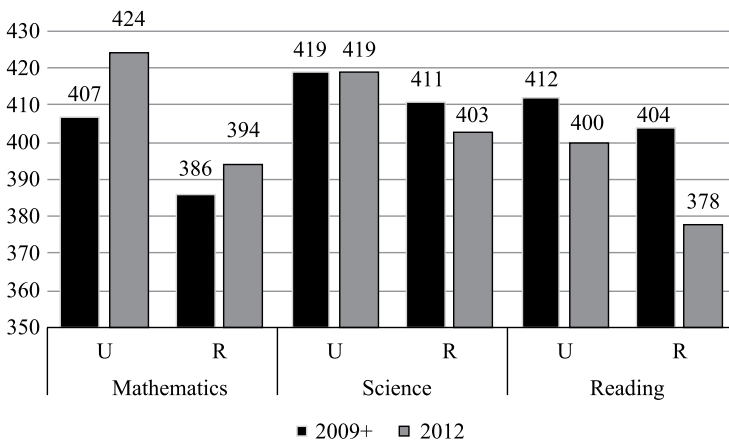
*Table 3. Students' performance in PISA 2009 and 2012 by gender*

PISA	Mathematics			Science			Reading		
	Boys	Girls	Difference	Boys	Girls	Difference	Boys	Girls	Difference
2009+	402.80 (3.09)	405.70 (2.96)	2.90*	417.06 (2.94)	427.23 (2.96)	10.17*	387.56 (3.78)	426.87 (3.96)	39.31*
2012	416.50 (3.69)	424.50 (3.70)	8.00*	413.77 (3.80)	424.87 (3.13)	11.10*	377.50 (3.88)	417.58 (3.32)	40.08*

Note: \*  $p < .05$ , parentheses indicate standard error

*School Location*

The analysis of performance by domain, location, and cycle between occasions is shown in Figure 1. In general, students in Urban schools perform better than students in Rural schools in all domains. The biggest difference is in the 2012



*Figure 1. Performance by domain, location and cycle*

Mathematics Literacy where students in Urban schools achieve an average score of 424 while students in Rural schools only obtain an average score of 394. The difference is bigger compared to the performance in the same domain in PISA 2009, where Urban students score 407 points and Rural students score 386. For Science Literacy, there is a slight decrease in the performance of Rural students while the performance of Urban students remain the same. In Reading Literacy, the performance of students in both locations decrease but it is larger for Rural students when compared to their Urban counterparts. In general, the difference between the performance of students in Urban and Rural locations is larger in 2012 when compared to 2009 for all domains.

### *Performance in Mathematics*

Mathematics Literacy in PISA measures the capability of individuals to ‘Formulate’, ‘Employ’ and ‘Interpret’ mathematics in a variety of contexts. It includes reasoning mathematically, and using mathematics concepts, procedures and facts to ‘Describe’, ‘Explain’, and ‘Predict’ phenomena. It assists individuals to recognise the role that mathematics play in the world and to make well-founded judgments and decisions as constructive, engaged and reflective citizens (OECD, 2014a). Mathematics Literacy involves three inter-related aspects.

1. The Mathematics Processes that describe what individuals do to connect the context of the problem with mathematics and thus solve the problem, and the capabilities that underlie these processes.
2. The Mathematics Content that is targeted for use in the assessment items.
3. The contexts in which the assessment items are located.

The Mathematics Processes are ‘Formulate’, ‘Employ’, and ‘Interpret’ while the Mathematics Content includes ‘Change and Relationship’, ‘Space and Shape’, ‘Quantity’, and ‘Uncertainty and Data’. The contexts used to classify PISA assessment items are ‘Personal’, ‘Occupational’, ‘Societal’, and ‘Scientific’.

Analysis on Malaysian students’ performance with regards to Mathematics Processes show that they performed best in ‘Employing’ (423), followed by ‘Interpreting’ (418), and ‘Formulating’ (406). This shows that our students were more comparable in using mathematics formulae to solve problems but it was not easy for them to interpret the results. The capability of Malaysian students to formulate situations mathematically is the lowest among the three Mathematics Processes. Further analyses of the Mathematics Processes with respect to school location show that students in Urban schools perform considerably better than students in Rural schools in all three Mathematics Processes as shown in Figure 2. The difference is more evident in Formulating where Urban students score 423 points while the Rural students only score 379 points.

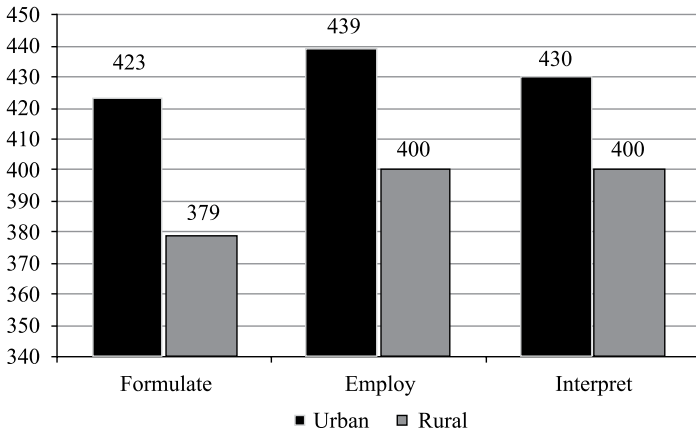


Figure 2. Mathematics performance by mathematics process and location

Figure 3 shows the performance of Malaysian students in PISA 2012 according to Mathematics Content and School Location. With regards to Mathematics Content, Malaysian students perform best in Space and Shape (449 – Urban; 412 – Rural), followed by Uncertainty and Data (434 – Urban; 405 – Rural), Quantity (425 – Urban; 385 – Rural) and Change and Relationship (419 – Urban; 375 – Rural). The performance of students in Urban schools is distinctly better than those in Rural schools in all the Mathematics Content. The biggest gap is in Change and Relationship where students in Urban schools record an average score of 419 while students in Rural schools record 375 points.

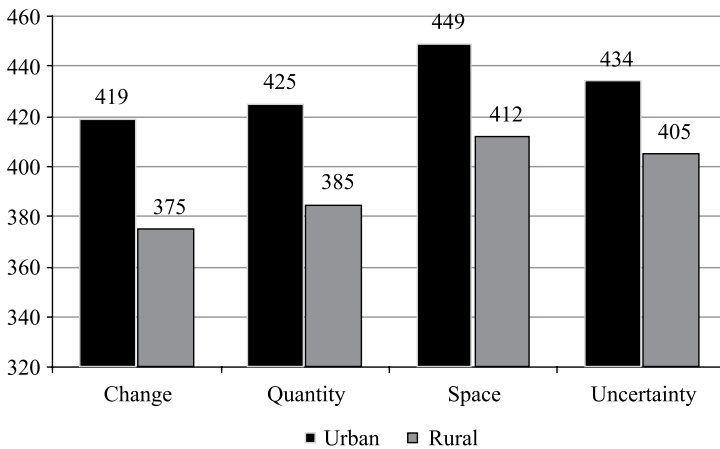
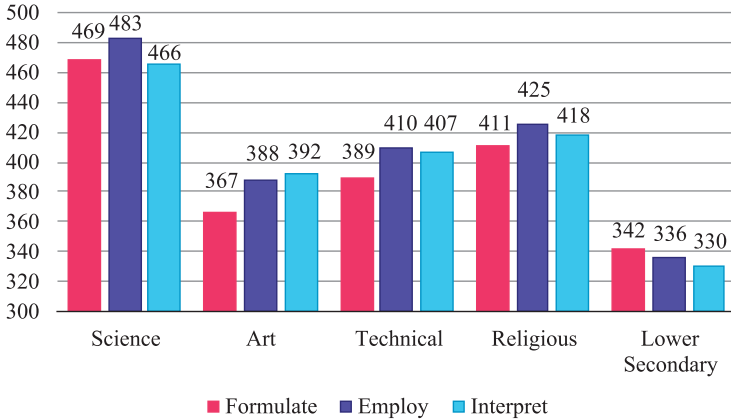


Figure 3. Mathematics performance by mathematics content and location

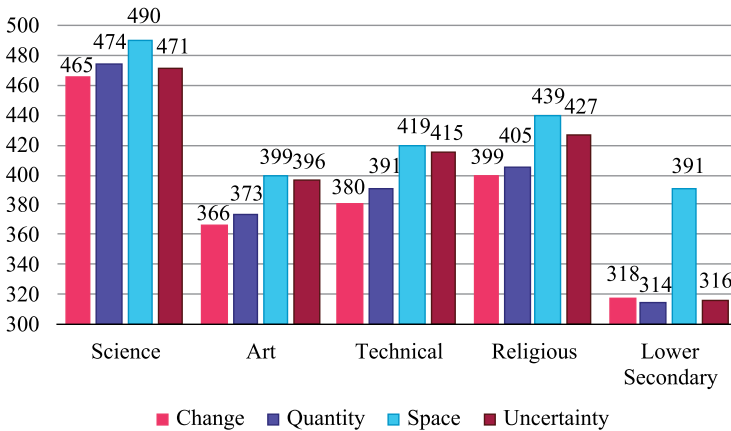
*Student Performance by Streams and Mathematics Processes*

Students who take part in PISA 2012 are from five different Learning Stream, namely, Science, Art, Technical, Religious, and Lower Secondary. Figure 4 shows the performance of students from the different Streams in Mathematics Processes. The Science Stream students perform the best with average scores of 469 in Formulating, 483 in Employing, and 466 in Interpreting.



*Figure 4. Performance by mathematics process and stream*

Figure 5 shows the performance of students from different Streams in Mathematics Content. The Science Stream students again perform the best in Mathematics



*Figure 5. Performance by mathematics content and stream*

Content when compared to students from other Streams. For Lower Secondary students, their performance in Space and Shape are the highest as compared to the other Mathematics Content. This can be due to the fact that Malaysian students are exposed to Space and Shape at the Lower Secondary level and this may contribute to the higher performance in that content area.

## DISCUSSION

In order to improve the performance of Malaysian students in PISA, immediate and short-term measures as well as long-term strategies are recommended by MOE's TIMSS and PISA Steering Committee with consultancy and support from the Performance and Delivery Unit (PADU). These measures and strategies are further discussed in this section.

### *Short Term Plans*

The Malaysian MOE benchmarks the standards for the learning of English Language (Reading), Mathematics, and Science to international standards and made reference to the OECD's publication, *PISA 2012 Assessment and Analytical Framework*. This publication presents the theory underlying the PISA 2012 assessment, including a re-developed and expanded framework for Mathematics Literacy, incorporating processes that students need to engage in when they solve problems. It also provides the basis for the assessment of Reading and Science Literacies. Within each domain, the knowledge content that students have to acquire is outlined, as well as the processes that need to be performed and the contexts in which knowledge and skills are applied. It also illustrated the domains and their aspects with sample tasks (OECD, 2013).

### *Visits by MOE Staff to Singapore and Vietnam*

The Malaysian MOE also paid visits to Singapore and Vietnam in their effort to learn best practices in the classrooms, specifically, and the education systems, in general. Through this initiative, all students are being taught curricula that have been benchmarked to the standards of the higher performing education systems. Performance targets are also set for PISA assessments. To date, several activities have been planned to ensure that these targets are met.

### *Briefing on PISA*

The Curriculum Development Division (CDD) carries out a nation-wide series of briefings to Science and Mathematics Teachers to provide them with a greater understanding of the significance of PISA. The purpose of these briefings is to enlighten them on the content of this assessment which is largely based on Higher Order Thinking Skills (HOTS).



Briefings are also given to all School Principals and the Heads of Science and Mathematics in secondary schools across the country. They are briefed on the implementation of the PISA framework, on detailed descriptions of the enculturation of HOTS in Science and Mathematics as well as on ensuring a smooth implementation of the PISA main study at the school level.

### *HOTS Questions in Teaching and Learning*

It is recognised that curriculum and assessment form a partnership whereby any change in one partner is likely to influence the other. The National Curriculum is giving greater focus on aspects such as critical thinking, innovativeness, and HOTS, therefore it is only natural that the national examinations and school-based assessments undergo changes that are aligned to the National Curriculum.

Consequently, changes are being made to the format and content of the national examinations and school-based assessments to reflect the changes in the curriculum. For instance, the percentage of questions that test higher-order thinking are being gradually increased to comprise at least 40 per cent of questions in the Year 6 Primary School Examination (UPSR) and 50 per cent in the Form 5 Secondary School Exam (SPM) by 2016. This means that students need to be trained to think critically and to apply their knowledge in different settings. School-based assessments also need to place more emphasis on testing HOTS. This is also in line with the PISA assessment.

### *Implementation of Competency and Literacy Assessment (CLA)*

In order to ensure a better understanding of PISA among teachers and students, the MOE implements the ‘Competency and Literacy Assessment (CLA)’ also known as ‘mock tests’, which are being administered by the Examination Syndicate. This assessment comprises two papers with questions which are comparable to the quality of questions in PISA. All Form 3 students are required to sit for this PISA-type Mathematics and Science Literacy assessments. These Form 3 students enter Form 4 in 2015 and are included in Malaysia’s sample for PISA 2015.

### *Resource Materials*

In order to assist teachers and students in the process of change-oriented HOTS pedagogy, effective resource materials are very important. Since 2013, the resource materials, focusing on the HOTS elements as well as TIMSS and PISA questions are uploaded to the Curriculum Development Division’s (CDD) website for easy access.

Teachers are required to use HOTS questions in class and to allocate time for students to answer the PISA released items in Mathematics, Science, and Reading Literacies that are being uploaded to the CDD website. In order to assist teachers, the CDD categorises the PISA released questions according to topics and themes based on the curricula for Mathematics, Science, and Languages.

### *Teacher Skills Upgrading Course in HOTS*

As part of the curriculum reform and the emphasis on HOTS, STEM (Science, Technology, Engineering, and Mathematics) subjects, Science and Mathematics are being accorded additional instructional time and more emphasis is given to the practical application of knowledge through laboratory and project-based work.

Up-skilling programmes are also carried out to enhance teachers' content knowledge and pedagogical strategies. These courses on HOTS are being conducted for pre- and in-service teachers, as well as lecturers in teacher education institutes and universities across the country continuously and comprehensively. The Teacher Education Division (TED) of the MOE is responsible for this initiative with SEAMEO-RECSAM providing the necessary courses. Courses at the school level are conducted during weekends through the "face-to-face" and "on-line" methods.

### *Long Term Strategies*

Providing high quality education is one of the goals of the Malaysian MOE. Some researchers argue that PISA does not measure the quality or the functioning of an education system. What it does measure are the students' capabilities to answer PISA questions. Likewise, many researchers and educationists argue that PISA results only provide information about what is happening in the areas of Reading, Science, and Mathematics Literacies. This raises the question of other important areas such as the Arts or Social Sciences. PISA does not provide any indicator to show how students are performing in the curriculum areas of Reading, Science, and Mathematics Literacies with respect to knowledge learnt.

### *The Malaysia Education Blueprint 2013–2025*

Bearing those in mind, the MOE is adopting a more balanced approach to assess the education system. Instead of relying solely on the PISA results, the MOE also embarks on other projects to obtain a comprehensive view of the education system. An extensive review of the education policy in Malaysia is being undertaken to examine the efficiency of the existing system and its significance to the current needs of the nation. UNESCO is being commissioned to carry out a review. Based on their initial findings, they published the Malaysia Education Policy Review (UNESCO, 2012) which contains detailed information on the performance and effectiveness of Malaysia's education system. Among the areas for evaluation are the curriculum, teacher development and ICT in education, Technical and Vocational Education and Training (TVET), assessment and examinations as well as the MOE's governance system.

The recommendations made by UNESCO through a multitude of analyses, interviews with various stakeholders and research conducted with the support of both national and international education experts, were used to develop *The Malaysia*

*Education Blueprint 2013–2025* which outlined specific strategies and initiatives to improve the overall quality of education in Malaysia (Ministry of Education, MOE, 2013). The Blueprint mapped out a comprehensive educational transformation plan from pre-school to post-secondary school levels. This Blueprint also looks into students' performance in international assessments such as PISA and TIMSS that helped to identify problems in student achievement and areas within the national education system that needed to be addressed.

### *New Primary and Secondary School Curricula*

The objective of the National Curriculum is to ensure that Malaysian students acquire the necessary skills and knowledge that can enable them to participate effectively both at national and international environments. Bearing this in mind, an assessment of the different aspects of the curriculum was carried out and as a result, the Ministry introduced in stages the new curriculum, the *Primary School Standard Curriculum* (KSSR), beginning in 2011 for Year 1 pupils. By 2016, the KSSR is expected to be fully implemented in all primary schools and a revised version is planned to be implemented in 2017.

Likewise, a standard-based reform of the existing curriculum for Secondary Schools is planned to be ready for Form 1 students by 2017. The existing curriculum is being revised to ensure the acquisition of a balanced set of knowledge and skills such as creative thinking, innovation, problem-solving, and leadership. The emphasis is still on student-centred learning and differentiated teaching, but there is a greater focus on problem-based and project-based work, and school-based assessment. The revised curricula, known as the Secondary School Standard Curriculum and Primary School Standard Curriculum (Revised version) are planned to be implemented in stages in 2017 (MOE, 2013).

### *In-Depth Analysis of PISA Results*

The Blueprint is the result of an extensive collaboration among different interest groups. Although some of the initiatives are directly linked to international assessments and benchmarking, the general process of transformation is driven by the determination to improve the overall education system and structure to increase access, equity and quality in education. The significance of PISA in making decisions pertaining to education policies is not being emphasised without first engaging in the in-depth analysis of the PISA results.

Researchers and education administrators can play more prominent roles in ensuring that the vast datasets that have been collected are put to good use. The MOE has invested heavily in PISA, therefore it is only befitting that extensive use is made of the PISA data to enable the Ministry to find solutions to important issues in education. Additional data from PISA can provide greater understanding of many unexplored areas in education. Detailed information about: (a) how students are

faring in the different domains assessed (OECD, 2014a); (b) how equity in education is evolving (OECD, 2014b); (c) student' engagement with and at school; (d) their drive and motivation to succeed; and (e) the beliefs they hold about themselves (OECD, 2014c); as well as (f) the association of student performance with various characteristics of individual schools and school systems (OECD, 2014d) that can be extracted, measured, and used from the PISA database.

Evidence found from the PISA database shows that (a) the gender gap in performance of the three PISA domains has increased; (b) students in urban locations perform better than students in rural location in all domains; (c) students are more capable when using mathematics formula to solve problems than when interpreting the results; and (d) students do better when they are exposed to content area at the lower secondary school level. Using this dataset more intensively, interpreting them more accurately and making changes to the education system based on the hard evidence provided by the PISA results is the main value of the PISA.

### *Globally Competent Citizens*

It is very important that the useful information from the PISA students' results is used to enhance students' learning outcomes. Whatever changes that take place must serve as catalysts to improve the entire education system, including the delivery system. Teachers need to change the ways that teaching and learning processes take place in the classroom. Elements such as critical thinking and Higher Order Thinking Skills (HOTS) that are advocated in the PISA assessment have always been included as part of the curriculum.

The Malaysian education system is already moving in a meaningful direction, well aligned with the fundamental principles of PISA which tests students on literacy, skills, and capabilities. Historically however, it cannot be denied that the emphasis of the Malaysian education system is still on the achievements of students in the Public Examinations, although the National Education Philosophy dictates a holistic development of students. Based on growing global acknowledgement, it is no longer sufficient for a student to leave the system equipped only with certain basic skills. The focus of education is now shifting towards developing individuals who possess the capability to think critically, to be innovative, possess good communication skills and have the competence to become good global citizens. In short, the country needs globally competent citizens, and PISA study is designed to make a substantial contribution towards these goals. Consequently, it is not surprising that 65 out of the 200 countries are currently involved in the PISA Studies.

## CONCLUSION

Every three years, when the PISA results are published by the OECD, there is bound to be an overwhelming response from educationists, stakeholders, policy makers, and the general public. In the case of Malaysia, there has been in the past a complete

backlash from all sectors, from politicians to the general public to our dismal showing in the PISA results. Questions abound on the overall effectiveness of education in Malaysia and the quality of the educational outcomes. While these questions are very difficult to answer, the concerns that the education administrators and the general public have raised about the country's education system are fully justified and it is up to the MOE to provide the impetus to set Malaysia's education on the track with globalisation. The MOE is being given the mandate to produce knowledgeable, skilled and progressive citizens on whose shoulders the future of this nation and the global world rests. As such, it is only natural for all parties concerned to react with scepticism over the capacity of the MOE to fulfil the needs of the nation.

Most opinions and concerns about the standard of Malaysia's education are being based on where the country stands in the PISA results. However, there is more to PISA than just scores and rankings. It is a treasure trove of information that provides participating countries with more than just a global benchmark of where their 15-year-old students stand in terms of their mastery of three skills and capabilities – Reading, Mathematics, and Science Literacies. If the PISA students' results are used effectively by policy makers and researchers, the findings have the capacity to yield information about the key strengths and major issues in education at the macro and micro levels, and even down to each individual student's level of performance. We have to ensure that prior to leaving the school system, all Malaysian students have to reach a certain standard of performance in education as identified by the PISA, to enable them to meet the challenges confronting in a fast changing world.

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