Research Report

Performance comparison between IB and non-IB school students on the International Schools' Assessment

Ling Tan

Australian Council *for* Educational Research

Report prepared for the International Baccalaureate by ACER February 2021

Table of Contents

List of Tables

List of Figures

EXECUTIVE SUMMARY

This report examines the performance of students enrolled in the IB Primary Years Programme (PYP) and the IB Middle Years Programme (MYP) on the ACER International Schools' Assessment (ISA) compared with non-IB students from the same ISA cohorts. The ISA is an assessment created especially for students in international schools in Grades 3 to 10. The assessment asks both multiple-choice and open-ended questions in the areas of writing, reading, mathematics and science, and provides international normative information about student performance. The ISA scales for Reading, Mathematical Literacy and Scientific Literacy are based on those developed for the internationally endorsed frameworks of the OECD's Programme for International Student Assessment (PISA).

The IB – non-IB comparison studies, based on students who participated in the ISA were completed in 2009 and in 2011. The current study is a follow-up which was based on students who participated in ISA assessments in 2017-18 and 2018-19. This study replicates previous studies using ISA October 2017/February 2018/May 2018 and October 2018/February 2019/May 2019 data. The analysis includes analysis of student performance on five ISA assessment areas (Section 2.1), magnitude of effect by domain (Section 2.2.1), magnitude of effect by sub-strand (Section 2.2.2), magnitude of effect by region (Section 2.2.3), country analysis of student performance (Section 2.2.4), PISA benchmark analysis (Section 2.3), and multilevel analysis of effects on the length of IB authorization (Section 2.4).

For this study, in 2017-2019, of 445 schools participating in the administration of the ISA, a total of 189 PYP, 142 MYP and 148 DP schools were designated as authorised programmes. In this study, non-IB schools were defined in two ways. A broad definition of non-IB international schools are the non-IB ISA schools which are accredited by an association and/or have an 'international focus' to their curriculum without necessarily being accredited by any particular organisation. A narrow definition of non-IB international schools are the subset of the broad non-IB ISA schools that have a formal accreditation by an international education board. In 2017-2019, a total of 179,198 international students participated in ISA assessments, of which 41% were IB students, 57% were the non-IB students based on the broad definition, and 55% were the non-IB students based on the narrow definition. By region, 43% of all students enrolled at schools in the Asia-Pacific region, 20% of these students enrolled at schools in Europe, 27% of these students enrolled at schools in the Middle East, and percentages of students enrolled at schools in Africa and Americas were 5% and 6% respectively.

The key findings of this research project are summarised as follows. An analysis of student performance among PYP and MYP students based on statistical significance test and Cohen's *d* effect size showed evidence that, on a global level, the PYP and the MYP students performed better than students from non-IB schools in four of five ISA assessment domain areas in the majority of grade levels. The difference in Expository Writing was significant at all grades with effect sizes ranging from 0.10 to 0.30 (comparisons based on broad definition of non-IB students) and from 0.11 to 0.32 (comparisons based on narrow definition of non-IB students), whereas the differences in Scientific Literacy were significant at Grades 7, 9 and 10 with effect sizes of 0.27, 0.33 and 0.61 respectively (comparisons based on broad definition of non-IB students), and 0.33, 0.41 and 0.61 respectively (comparisons based on narrow definition of non-IB students). No significant difference was found between the broad definition and the narrow definition of non-IB students in the majority of IB and non-IB comparisons.

The analysis of ISA performance based on the Cohen's *d* was followed by comparisons of magnitude of effects against the results of two-level multilevel models, on a global level. After taking into account the clustering at school level using the multilevel model, there is a lower number of significant differences between IB and non-IB students from the results of multilevel models compared with the results from the non-model-based Cohen's *d*. This is expected because the multilevel models would result in relatively larger standard errors for estimated mean scores for IB and non-IB students. After further controlling for students' gender and English-speaking background in the multilevel model, the magnitude of effects were found to

be mostly similar to those from the multilevel Model 1. The effect sizes between the two definitions of non-IB students were also mostly similar for each multilevel model.

The multilevel modelling of student performance among PYP and MYP students showed evidence that, on a global level, the PYP and the MYP students performed better than students from non-IB schools in the ISA assessment areas at a number of grade levels. The difference in Expository Writing was significant at Grades 3, 5, 7 and 9 with effect sizes > 0.20, whereas the difference in Scientific Literacy was significant at Grades 9 and 10 with effect sizes > 0.35. In addition, IB students outperformed non-IB students in Reading at Grades 3, 5 and 9 with effect sizes > 0.2, in Narrative Writing at Grades 3, 5, 7 and 9 with effect sizes > 0.1, in Mathematical Literacy at Grade 9 with effect sizes > 0.2. There was no evidence to indicate IB students performed at a lower level in comparison to the non-IB students.

Grade	Mathematical Literacy	Reading	Narrative Writing	Expository Writing	Scientific Literacy
3		++	+	++	NA
4					NA
5		++	+	++	NA
6					NA
7		+	++	++	++
8				++	
9	++	++	++	++	++
10					+++

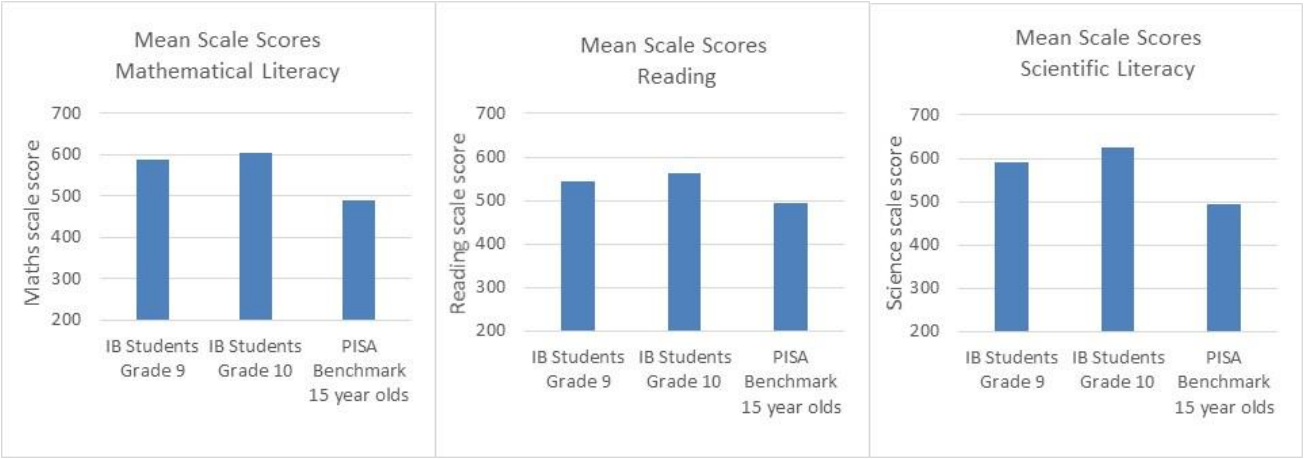
Note: +small effect size, ++ medium effect size, +++ large effect size

The global analysis of ISA performance was followed by detailed analysis of magnitude of effects in five geographical regions, i.e. Asia-Pacific, Europe, the Middle East, Africa and the Americas. The regional analysis of magnitude of effects indicated that there was evidence based on the statistical significance test and Cohen's *d* that IB students outperformed the non-IB students in majority of comparison groups in the Middle East (94%), Africa (55%) and the Americas (62%) with small to large differences in effect size. However, only 8% of comparison groups in the Asia-Pacific and 7% of comparison groups in Europe showed that IB students significantly outperformed non-IB students with small to medium differences. After controlling for data clustering at schools, IB students significantly outperformed non-IB students in a smaller number of comparisons: in the Middle East (31% and 34%), Africa (11% and 12%) and the Americas (5% and 5%) with medium to large differences, and in Europe (6% and 4%) and Asia-Pacific (3% and 13%) with small to medium differences, before and after controlling for student characteristics, respectively.

In order to understand the degree to which the IB curriculum promotes particular cognitive and/or academic strengths within assessment areas, this research performed drill-down analysis on sub-strands of ISA assessment areas. This sub-strands analysis found that, after controlling for data clustering at schools with or without controlling for student characteristics, IB students performed better than non-IB students for all five domains in all sub-strands at Grade 9 (except for broad definition of non-IB students in Model 1 of Mathematical Literacy), with mostly small to medium differences. In Mathematical Literacy, IB students outperformed non-IB students in Space and Shape at Grades 3, 5 and 9, in Uncertainty and Data at Grades 5 and 9, with small to medium differences. In Reading, IB students outperformed non-IB students in all sub-strands at Grades 3, 5 and 9 with small to medium differences and in Reflect and Evaluate with small differences. In Narrative Writing, IB students outperformed non-IB students in the Content criterion and in Language at grades 3, 5, 7 and 9; and in Spelling at grades 3 and 9. In the Expository Writing task, IB students outperformed non-IB students in Content and in Structure and Organisation at grades 3, 5, 7 and 9; and in Language at grades 3, 5, 7 and 9. In Scientific Literacy, IB students performed better than non-IB students in Evaluate and design scientific enquiry at Grades 7, 9 and 10, in Explain phenomena scientifically at Grade 10, and in Interpret data and evidence scientifically at Grades 9 and 10, with medium to large effect sizes. However, non-IB students outperformed IB students in all sub-strands of Mathematical

Literacy and Reading (except for Reflect and Evaluate) and in the language criteria of Narrative Writing at Grade 10, with small to medium differences based on Cohen's *d*. However, these differences were not statistically significant based on the results of multilevel modelling.

This project also assessed how the Grade 9 and Grade 10 ISA scores of IB students aligned with PISA benchmarks. IB students achieved average scores of 587 and 604 in Mathematical Literacy at Grades 9 and 10, respectively. This is significantly better than the PISA 2015 OECD mean of 490 in Mathematics for 15 year-olds. In Reading, IB average scores were 545 and 563 in Grades 9 and 10, respectively. This is above the PISA 2015 OECD mean of 493 in Reading. In Scientific Literacy, IB average scores were 592 and 624 in Grades 9 and 10, respectively. This is above the PISA 2015 OECD mean of 493 in Scientific Literacy. The effect sizes in all three domains were large: 1.11 and 1.32 for grades 9 and 10 in Mathematical Literacy, 0.58 and 0.78 for Grades 9 and 10 in Reading, and 1.10 and 1.46 for Grades 9 and 10 in Scientific Literacy. The results are not surprising because PISA results were based on performance of representative samples from all types of schools from each participating country.



A multilevel analysis was conducted to evaluate the effects of length of IB authorization on school performance. The multilevel analysis indicated that there was some evidence to support that positive effects of length of IB authorization existed on school performance in Mathematical Literacy, Reading, Expository Writing and Scientific Literacy. For every additional year of PYP authorization there was a half unit to two unit increase in school performance in Mathematical Literacy except for Grade 3, six to nine unit increase in Reading, three to four unit increase in Expository Writing, and less than a half unit increase in Narrative Writing at Grade 6. For every additional year of MYP authorization, there is a two to four unit increase in school performance in Mathematical Literacy, one unit to six unit increase in Reading, two to four unit increase in Expository Writing, one unit increase in Narrative Writing at Grade 10, and one to four unit increase in Scientific Literacy at Grades 7 to 9. After further controlling for student characteristics (i.e. gender and English-speaking background) in the multilevel models, the positive effects of the length of IB authorization decreased slightly by less than one unit.

This investigation was conducted with limited background information about schools and students, and inferences from the results of this study should be made with caution. ISA performance data were not census data, and schools participating in each country were not a random sample. As schools can choose to participate in ISA assessments, the results of this study were only applicable to the sample of schools who participated in this study.

1. Project Overview

The International Baccalaureate (IB) offers a continuum of international education for children between the ages of 3 and 19 years. The Primary Years Programme (PYP) is designed for students aged 3 to 12; the Middle Years Programme (MYP) serves students aged 11 to 16; and the Diploma Programme (DP) is a challenging two-year curriculum, primarily aimed at students aged 16 to 19. It leads to a qualification that is widely recognized by the world's leading universities. The IB curriculum was originally developed to meet the needs of internationally mobile students. Although the IB curriculum is now offered in all types of schools, many international schools continue to offer the IB curriculum.

The International Schools' Assessment (ISA) is an assessment created especially for students in international schools in Grades 3 to 10. The assessment asks both multiple-choice and open-ended questions in the areas of writing, reading, mathematics and scientific literacy, and provides international normative information about student performance. The Reading, Mathematical Literacy and Scientific Literacy are based on the internationally endorsed reading, mathematical literacy and scientific literacy frameworks of the OECD's Programme for International Student Assessment (PISA), respectively. The ISA includes open-ended questions in Mathematical Literacy, Reading and Scientific Literacy, which require students to construct responses, for example, to explain their reasoning, to find evidence or to justify their opinion. Many of the schools participating in the ISA administration implement the IB curriculum, providing an opportunity to examine the performance of PYP and MYP students in Grades 3 to 10.

This analysis is based on students who participated in the ISA in 2017-18 and 2018-19. There were three sittings of ISA in each of these years; the first in October and the second and third sittings were in the following year in February and May making a total of six sittings. This means that some students could be represented in the analysis twice (i.e. in grade 3 for 2017-18, and again in grade 4 for 2018-19). As cross-sectional analyses were performed for each grade level, a student would appear only once in any of these analyses.

This research study compares performance of IB cohorts that participated in ISA with non-IB student cohorts from the recent ISA data in 2017-18 and 2018-19 for Reading, Mathematical Literacy, Narrative Writing, Expository Writing and Scientific Literacy. Scientific Literacy data for this period covers Grades 7-10 only. The replication study addresses the following research questions.

Q1. How do PYP and MYP students compare to non-IB students from similar international schools on the ISA measures of mathematical literacy, reading, narrative writing, and expository writing, at each grade level?

Q2. What is the magnitude of the effect?

- IB and non-IB student performance by domain and sub-domain and by grade
- IB and non-IB student performance by region and by country

Q3. How do IB students' Grade 9 and Grade 10 ISA scores compare to PISA benchmarks in each of the ISA domains?

Q4. To what degree is the length of IB implementation associated with ISA student performance in IB schools?

1.1 Information on IB Schools and Students Participating in the ISA

For this study, the recent ISA assessment data from 2017-18 and 2018-19 data are merged with the IB's data on school authorization status, because schools may administer ISA tests every one or two years. The data from 2019-20 are not used for this study because a number of schools did not participate the ISA assessments due to the global pandemic. In 2017-19, 445 schools participated in the administration of the ISA and the distribution of authorised IB programmes is shown in Table 1. A total of 189 PYP, 142 MYP and 148 DP schools were designated as authorised programmes. Because the ISA does not assess students in the last two years of schooling (i.e. year level 11 and 12), the current analyses of IB school performances focus on authorised PYP and MYP schools.

Table 1 Schools Programme Status

Category	Type of IB Programmes	
	No of Schools	Percentage
No IB Programme	244	54.8
IB Schools	201	45.2
PYP Only	39	8.8
PYP + MYP + DP	116	26.1
PYP + MYP	14	3.1
MYP + DP	12	2.7
PYP + DP	20	4.5
Total	445	100.0

An international school that has been participating in ISA over time may have different IB status across years. A school is a non-IB school before applying any IB authorization. During the application, it is considered a candidate IB school. A school becomes an authorised IB school after going through the PYP and/or MYP authorization process. Therefore, the IB status of an international school at an ISA test sitting is determined by the IB candidate date, authorised date, and withdrawal or termination year together with information on the ISA test sitting. In IB schools, students in Grades 3 to 6 are classified as PYP students and students in Grades 7 to 10 are classified as MYP students. In this study, candidate IB schools are not considered as either IB or non-IB schools to provide a clear interpretation between IB and non-IB. For this study, there were two comparison groups of non-IB schools defined as following:

- A broad definition included all non-IB schools participating in the ISA, which are either accredited by an international association or have 'an international focus' to their curriculum without necessarily being accredited by any particular organisation;
- A narrow definition included the non-IB schools participating in the ISA, which have formal accreditation by an international education board.

The non-IB cohort consists of schools (or students in schools) with no authorised IB programme in that year level. For example, students in grade 5 of an authorised MYP-only school are defined as non-IB cohort. In addition, the non-IB cohort excludes schools which are labelled as being interested in IB programmes, IB candidate schools, or schools that had withdrawn from the IB programmes. A non-IB school is defined as a school in the non-IB cohort. Non-IB students are students from non-IB schools.

Table 2 shows the total number of schools and students for each grade and the proportion of IB and non-IB schools and students for the current study. The data for the current study based on 2017-18 and 2018-19 ISA data (179,198 students) are a larger sample than the previous 2011 study (50,714 students) as a result of increased school participation in ISA assessments in recent years. Compared to the previous study (Tan & Bibby, 2011), the proportion of students from IB schools has dropped from 61%-73% to 38% - 45% across grade levels in the recent data. The non-IB cohort based on the narrow definition is slightly smaller than the non-IB cohort based on the broad definition in each grade level (up to 4% less in number of schools and 3% less in number of students). For a small number of schools (24 schools), their students participated in ISA at both primary years and secondary years, but they were PYP only or MYP only IB schools.

Table 2 IB and Non-IB Schools and Students

Grade Level	Schools					Students				
	Total (N)	Non-IB (Broad) (%)	Non-IB (Narrow) (%)	Authorised IB (%)	Candidate IB (%)	Total (N)	Non-IB (Broad) (%)	Non-IB (Narrow) (%)	Authorised IB (%)	Candidate IB (%)
3	379	56.2	54.1	40.9	2.9	31933	57.1	55.7	41.7	1.1
4	315	53.0	50.5	44.1	2.9	25853	54.3	52.5	44.7	1.0
5	393	55.7	52.7	41.5	2.8	31772	56.1	53.9	43.0	0.9
6	275	57.1	53.1	41.1	1.8	21421	61.1	58.1	38.2	0.6
7	284	60.9	57.7	34.5	4.6	23822	58.9	56.4	37.8	3.3
8	228	55.7	52.2	39.0	5.3	17912	56.5	54.2	40.0	3.5
9	221	54.3	51.1	42.1	3.6	17916	55.0	51.7	42.2	2.8
10	115	49.6	47.8	48.7	1.7	8569	53.7	53.6	44.8	1.5

Table 3 shows the total number of schools and students for each grade and the proportion of IB and non-IB schools and students for the Asia-Pacific, Europe, the Middle East, Africa and the Americas. It is observed that often more non-IB students than IB students participated in the ISA in Africa, the Americas, Europe and the Middle East. On the other hand, more IB students than non-IB students from the Asia-Pacific participated in ISA. A list of countries for each region is included in Appendix 4.

Table 3 Distribution of IB and Non-IB Schools and Students by Region

Region	Grade Level	Schools					Students				
		Total (N)	Non-IB (Broad) (%)	Non-IB (Narrow) (%)	Authorised IB (%)	Candidate IB (%)	Total (N)	Non-IB (Broad) (%)	Non-IB (Narrow) (%)	Authorised IB (%)	Candidate IB (%)
Asia-Pacific	3	169	46.2	43.2	50.3	3.6	15483	46.9	45.4	52.3	0.8
	4	140	41.4	37.9	55.0	3.6	11715	43.4	41.8	56.0	0.6
	5	167	46.1	43.1	50.9	3.0	14244	44.6	43.4	54.8	0.6
	6	112	45.5	40.2	52.7	1.8	7674	48.3	46.4	51.7	0.1
	7	112	53.6	50.0	41.1	5.4	9397	48.8	48.3	47.2	4.0
	8	97	47.4	43.3	47.4	5.2	7629	51.3	50.7	45.5	3.2
	9	85	47.1	42.4	49.4	3.5	6359	42.8	39.6	54.4	2.8
	10	53	39.6	35.8	58.5	1.9	3899	43.8	43.6	55.7	0.5
Europe	3	98	54.1	54.1	45.9	0.0	5562	50.6	50.6	49.4	0.0
	4	79	50.6	50.6	48.1	1.3	4464	44.5	44.5	54.9	0.6
	5	106	53.8	50.9	45.3	0.9	6184	50.0	46.1	49.7	0.3
	6	73	52.1	50.7	46.6	1.4	4436	52.7	47.8	46.9	0.4
	7	84	56.0	54.8	39.3	4.8	5342	51.3	47.5	43.7	5.0
	8	61	49.2	47.5	44.3	6.6	3666	41.9	37.2	51.3	6.8
	9	67	44.8	44.8	52.2	3.0	4250	41.2	41.2	54.1	4.7
	10	34	47.1	47.1	50.0	2.9	2118	46.6	46.6	48.4	5.0
Middle East	3	63	84.1	81.0	12.7	3.2	7448	80.1	77.3	18.2	1.7
	4	62	80.6	77.4	16.1	3.2	7234	76.2	72.6	22.1	1.8
	5	69	81.2	78.3	15.9	2.9	8106	77.4	74.4	21.2	1.4
	6	60	78.3	75.0	18.3	3.3	7438	77.5	74.4	21.0	1.5
	7	51	80.4	76.5	15.7	3.9	6351	78.6	75.1	19.4	1.9
	8	47	76.6	72.3	19.1	4.3	5184	74.8	71.3	22.9	2.3
	9	41	78.0	73.2	17.1	4.9	4957	77.1	74.0	20.5	2.4
	10	16	81.3	81.3	18.8	0.0	1799	83.4	83.4	16.6	0.0
Africa	3	24	62.5	58.3	33.3	4.2	1456	54.9	53.8	41.1	4.1
	4	22	59.1	54.5	36.4	4.5	1464	48.6	47.8	48.8	2.6
	5	26	57.7	50.0	38.5	3.8	1375	47.5	45.0	50.8	1.7
	6	22	72.7	63.6	27.3	0.0	1031	58.8	53.8	41.2	0.0
	7	18	66.7	61.1	27.8	5.6	986	53.5	52.7	43.6	2.8
	8	17	64.7	58.8	29.4	5.9	893	51.2	49.9	46.6	2.2
	9	10	50.0	50.0	40.0	10.0	742	48.9	48.9	50.4	0.7
	10	5	60.0	60.0	40.0	0.0	385	42.6	42.6	57.4	0.0

Region	Grade Level	Schools					Students				
		Total (N)	Non-IB (Broad) (%)	Non-IB (Narrow) (%)	Authorised IB (%)	Candidate IB (%)	Total (N)	Non-IB (Broad) (%)	Non-IB (Narrow) (%)	Authorised IB (%)	Candidate IB (%)
Americas	3	25	56.0	56.0	36.0	8.0	1984	70.7	70.7	27.1	2.2
	4	12	50.0	50.0	50.0	0.0	976	75.8	75.8	24.2	0.0
	5	25	56.0	56.0	36.0	8.0	1863	77.3	77.3	20.5	2.2
	6	8	62.5	62.5	37.5	0.0	842	80.6	80.6	19.4	0.0
	7	19	68.4	63.2	31.6	0.0	1746	66.9	61.4	33.1	0.0
	8	6	66.7	66.7	33.3	0.0	540	62.0	62.0	38.0	0.0
	9	18	72.2	66.7	27.8	0.0	1608	73.8	60.0	26.2	0.0
	10	7	57.1	57.1	42.9	0.0	368	66.3	66.3	33.7	0.0

1.2 Methodology

In this study, ISA scale scores from five domains, Mathematical Literacy, Reading, Narrative Writing, Expository Writing and Scientific Literacy, were used for investigations. The ISA scales were constructed based on the Rasch model (Rasch, 1980) using ACER ConQuest software (Adams, Wu & Wilson, 2015). The scale for each domain was constructed by using some common tasks (questions) within any year for adjacent grades, and by using some common tasks over time, from one year to the next. In this way all the tests in a particular domain were linked and equated, and could be placed on a common scale. This method allows student performance to be compared across grade levels and over calendar years. In order to assess a school's performance in sub-strands of a domain, the percentage correct over all questions within an assessed sub-strand in Mathematical Literacy, Reading and Scientific Literacy, and raw score for each criterion of each writing task were used.

The t-test and effect size were used for comparing performance between IB cohorts and non-IB cohorts in the previous studies (Tan & Bibby, 2010; Tan & Bibby, 2011). The t-test helps to determine whether there is a difference between group means after taking into account the spread of group distributions. In this study, two-level multilevel modelling was fitted by domain and grade for comparing performance between IB cohorts and non-IB cohorts. The two-level multilevel models take into account the potential effects that arise from the hierarchical structure of the ISA achievement data, with students located within different schools. The nested data structure of country and region was not used for multilevel modelling due to insufficient number of schools at country level (<10 schools per country for non-IB/IB group) and insufficient number of countries at region level (< 10 countries in Africa, Americas and the Middle East for IB group) (Hox, 2010; Snijders & Bosker, 2012). The SPSS Mixed procedure was used for fitting multilevel models (SPSS, 2005).The two-level multilevel models are described below.

Unconditional Model

The unconditional model is a two-level regression model which was fitted by domain and grade.

Level-1: $Y_{ij} = \beta_{0j} + e_{ij}$

Level-2: $\beta_{0j} = \gamma_{00} + \mu_{0j}$

where: Y_{ij} is the scale score of a domain for student *i* in school *j*,

β_{0j} is the expected average ISA score of a domain for school *j*,

e_{ij} is deviation from the expected ISA scale score of student *i* in school *j*,

γ_{00} is the grand mean of scale scores,

μ_{0j} is deviation of school *j* from the grand mean.

Conditional Model 1

The conditional model 1 is a two-level regression model with IB school status in level 2.

Level-1: $Y_{ij} = \beta_{0j} + e_{ij}$

Level-2: $\beta_{0j} = \gamma_{00} + \gamma_{01}(IB_j) + \mu_{0j}$

where: γ_{00} is the expected average ISA scale score for the non-IB cohort,

γ_{01} is the expected difference in scale score between the IB cohort and the non-IB cohort,
IB_j is the IB status of a school *j*,
μ_{0j} is deviation of school *j* from the conditional grand mean score

Conditional Model 2

The conditional model 2 is a two-level regression model with student gender and English-speaking background (ESB) as covariate in level 1 and IB school status in level 2.

Level-1: $Y_{ij} = \beta_{0j} + \beta_{1j}(Female_{ij}) + \beta_{2j}(ESB_{ij}) + e_{ij}$

Level-2: $\beta_{0j} = \gamma_{00} + \gamma_{01}(IB_j) + \mu_{0j}$

$\beta_{1j} = \gamma_{10}$

$\beta_{2j} = \gamma_{20}$

where: β_{0j} is the conditional mean ISA scale score for the male students from non-English speaking background in school *j*,
β_{1j} is the expected difference in scale score between female students and male students,
β_{2j} is the expected difference in scale score between ESB students and non-ESB students,
e_{ij} is deviation from the conditional mean ISA scale score of student *i* in school *j*,
γ_{00} is the conditional mean ISA scale score for the non-IB cohort,
γ_{01} is the expected difference in scale score between the IB cohort and the non-IB cohort,
IB_j is the IB status of a school *j*,
μ_{0j} is deviation of school *j* from the conditional grand mean score

In order to measure the magnitude of any difference, the effect size Cohen's *d* (Cohen, 1988) was calculated as the difference between two means divided by a pooled standard deviation for the data:

$$d = \frac{\mu_1 - \mu_2}{\sigma_{pooled}}$$

where $\sigma_{pooled} = \sqrt{\frac{\sigma_1^2 + \sigma_2^2}{2}}$ refers to pooled standard deviation, which is the root mean square of the two standard deviations. When the two standard deviations are similar, the root mean square will be similar to the simple average of the two variances. Effect size is independent of sample size. This value indicates how much it is that the IB students are different from the comparable non-IB students. A small value close to zero suggests it is likely that there is little difference in the mean performance of that IB cohort and the ISA cohort. A large value suggests it is likely that the IB cohort and the ISA cohort are performing very differently. The effect size value is categorised as follows: $d < 0.1$ indicates a negligible difference in means, $0.1 \leq d < 0.2$ a small difference in means, $0.2 \leq d < 0.5$ a medium difference in means, and $d \geq 0.5$ a large difference in means.

The magnitude of regression coefficients from the multilevel models is on the original scale of each ISA domain. For the purpose of comparing to the effect sizes based on the non-model based Cohen's *d*, the regression coefficient of IB (i.e. γ_{01}) can be standardised by outcome variable (Lorah, 2018). In this report, the regression of coefficient of IB was standardised by the pooled standard deviation.

The statistical significance level is set at 0.05 which is associated with a 95% confidence interval. A symbol "+" was used to indicate that the performance of a subgroup from IB schools was statistically significantly higher than the performance of a comparison group. A symbol "–" was used to indicate that the performance of a subgroup from IB schools was statistically significantly lower than the performance of a comparison group. In the tables of this report, estimates with medium to large effect sizes were highlighted in bold. In addition, the following symbols were used to indicate group differences. For example, a symbol "++" was used to indicate that the performance of a subgroup from IB schools was statistically significantly higher than the performance of a comparison group, and the difference had a medium effect size.

+	Statistically significant difference (higher), small effect size ($0.1 \leq d < 0.2$)
++	Statistically significant difference (higher), medium effect size ($0.2 \leq d < 0.5$)
+++	Statistically significant difference (higher), large effect size ($d \geq 0.5$)
–	Statistically significant difference (lower), small effect size ($0.1 \leq d < 0.2$)
– –	Statistically significant difference (lower), medium effect size ($0.2 \leq d < 0.5$)
– – –	Statistically significant difference (lower), large effect size ($d \geq 0.5$)

The intraclass correlation (ICC) was used to measure how strongly students in the same group resemble each other. For multilevel models, clustering in data can be ignored if ICC and design effect across both IB schools and non-IB schools in a grade are too small (ICC < 0.05 and design effect < 2) (Muthén & Satorra, 1995). Data analysis indicated that very small ICCs are usually caused by small number of schools (<4) in either IB schools or non-IB schools. The ICC or the proportion of between-school variance, is calculated as follows:

$$\text{Proportion of Between School Variance} = \frac{\text{Between School Variance}}{\text{Between School Variance} + \text{Within School Variance}}$$

2 Analysis of Student Performance

This section presents a series of analyses of ISA's 2017-2018 and 2018-2019 data. The broad goals of these analyses are to understand student performance on the ISA assessment areas among PYP and MYP students, to understand magnitude of effect between IB students and non-IB students by domain and by region, and to understand the degree to which the IB schools are associated with particular cognitive and/or academic strengths within assessment areas.

2.1 How do PYP and MYP students compare to non-IB students from similar international schools on the ISA assessment areas?

This section shows the non-modelled average performance of IB and non-IB students in ISA Mathematical Literacy, Reading, Narrative Writing, Expository Writing and Scientific Literacy by grade level. The performance of non-IB students is reported for both the broad definition and the narrow definition. The performance statistics (i.e. number of students, mean scale score, standard deviation of scale scores), Cohen's *d* and significance of difference are reported for the performance of IB and non-IB students.

In Mathematical Literacy (Table 4) IB students had statistically significant higher mean scores than the non-IB students in Grades 5, 7 and 9. The Cohen's *d* effect size indexes indicated they were mostly small differences between IB and non-IB students. The performance of non-IB students based on broad definition was similar to that based on narrow definition except in Grade 9. The effect size in Grade 9 indicated a small difference when IB students were compared to the broad definition of non-IB students, but it suggested a medium difference for the narrow definition of non-IB students.

Table 4 Performance of IB and Non-IB Students in Mathematical Literacy

Grade	IB			Non-IB (Broad)			Non-IB (Narrow)			IB vs Non-IB (Broad)		IB vs Non-IB (Narrow)	
	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.
3	12,638	309	94	17,183	305	110	16,760	304	110	0.04		0.05	
4	10,936	380	92	13,136	375	105	12,699	376	105	0.04		0.04	
5	13,020	437	92	16,844	426	103	16,215	426	104	0.12	+	0.12	+
6	7,753	469	88	12,053	463	99	11,439	463	100	0.07		0.07	
7	8,411	517	83	12,980	504	93	12,427	503	93	0.14	+	0.15	+
8	6,688	547	87	9,342	545	98	8,943	546	99	0.02		0.01	
9	7,067	587	87	9,155	571	95	8,623	568	94	0.18	+	**0.21**	++
10	3,481	604	83	4,160	604	98	4,155	604	98	0.00		0.00	

In Reading, IB students had statistically higher mean scores than the non-IB students in Grades 3, 4, 5, 7 and 9, as shown in Table 5. The Cohen's *d* effect size indexes show small differences in Grades 3, 4, 7 and 9 (only based on the broad definition of non-IB students), and medium differences in Grades 5 and 9 (only based on the narrow definition of non-IB students). Medium differences in Grade 5 were shown for both the narrow and the broad definition of non-IB students.

Table 5 Performance of IB and Non-IB Students in Reading

Grade	IB			Non-IB (Broad)			Non-IB (Narrow)			IB vs Non-IB (Broad)		IB vs Non-IB (Narrow)	
	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.
3	12,614	303	92	17,159	287	107	16,736	287	106	0.16	+	0.16	+
4	10,938	345	88	13,027	334	102	12,588	335	102	0.12	+	0.11	+
5	13,019	393	89	16,705	371	106	16,047	371	106	**0.23**	++	**0.22**	++
6	7,777	430	93	11,906	422	100	11,295	422	100	0.09		0.08	
7	8,474	484	89	12,929	473	97	12,374	472	97	0.12	+	0.12	+
8	6,727	509	82	9,327	504	89	8,933	505	89	0.07		0.06	
9	7,132	545	82	9,115	529	91	8,584	526	88	0.19	+	**0.23**	++
10	3,450	563	83	4,162	562	89	4,157	562	89	0.01		0.01	

In Narrative Writing, IB students had a statistically significant higher mean score than the non-IB students mean score in Grades 3, 5, 6, 7, 8 and 9 (based on based on the broad definition of non-IB students), as shown in Table 6. However, no significant difference found at Grade 8 based on the narrow definition of non-IB students. There was no significant difference found in grades 4 and 10 between IB student performance and non-IB student performance. The Cohen's *d* effect size indexes showed small differences at Grades 3, 5, 6, 7, 8 and 9 (only based on the broad definition of non-IB students), and small differences at Grades 3, 5 and 6 and medium differences at Grades 7 and 9 (only based on the narrow definition of non-IB students).

Table 6 Performance of IB and Non-IB Students in Narrative Writing

Grade	IB			Non-IB (Broad)			Non-IB (Narrow)			IB vs Non-IB (Broad)		IB vs Non-IB (Narrow)	
	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.
3	11,869	366	54	13,593	359	63	13,377	359	64	0.11	+	0.12	+
4	10,237	405	59	9,683	401	70	9,506	401	70	0.06		0.06	
5	12,469	450	62	12,735	441	76	12,318	440	76	0.14	+	0.14	+
6	7,285	480	65	8,811	473	77	8,434	473	78	0.11	+	0.10	+
7	8,131	515	67	10,339	501	85	10,011	500	85	0.18	+	**0.20**	++
8	6,523	541	66	7,014	533	84	6,799	534	85	0.10	+	0.09	
9	6,764	567	65	6,794	554	84	6,418	551	83	0.18	+	**0.21**	++
10	3,556	587	64	3,209	585	79	3,204	585	79	0.04		0.04	

In Expository Writing, IB students achieved significantly higher mean scores than the non-IB students in all grades, as shown in Table 7. The Cohen's *d* effect sizes indicated that small differences existed at Grades 3, 4 and 10, and medium differences at Grades 5 to 9.

Table 7 Performance of IB and Non-IB Students in Expository Writing

Grade	IB			Non-IB (Broad)			Non-IB (Narrow)			IB vs Non-IB (Broad)		IB vs Non-IB (Narrow)	
	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.
3	11,824	417	54	13,437	408	65	13,221	407	65	0.15	+	0.16	+
4	10,214	453	58	9,717	446	74	9,540	445	74	0.10	+	0.11	+
5	12,437	494	60	12,764	477	78	12,353	477	78	**0.24**	++	**0.24**	++
6	7,235	517	62	8,783	502	79	8,407	502	80	**0.21**	++	**0.20**	++
7	8,134	546	64	10,283	528	86	9,956	527	87	**0.24**	++	**0.25**	++
8	6,494	575	63	6,962	559	89	6,771	559	90	**0.22**	++	**0.21**	++
9	6,747	600	68	6,838	576	93	6,476	573	92	**0.30**	++	**0.32**	++
10	3,533	620	67	3,238	612	87	3,233	612	87	0.11	+	0.11	+

In Scientific Literacy, IB students achieved significantly higher mean scores than the non-IB students in Grades 7, 9 and 10, as shown in Table 8. The Cohen's *d* effect sizes indicated that medium differences existed at Grades 7 and 9, and a large difference at Grade 10.

Table 8 Performance of IB and Non-IB Students in Scientific Literacy

Grade	IB			Non-IB (Broad)			Non-IB (Narrow)			IB vs Non-IB (Broad)		IB vs Non-IB (Narrow)	
	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.
7	2,145	525.2	90	7,035	500.1	93.7	6,500	495.1	90.2	**0.27**	++	**0.33**	++
8	1,882	550	82	4,929	544.2	93.3	4,635	543.9	94.1	0.07		0.07	
9	1,811	591.5	83.7	5,514	562.6	90	5,080	556.6	85.8	**0.33**	++	**0.41**	++
10	1,118	624.4	84.5	1,342	573.6	83	1,339	573.5	83.1	**0.61**	+++	**0.61**	+++

Overall, the results suggested that IB students performed better than the non-IB students in four of five ISA assessment domain areas in the majority of grade levels based on the test of statistical significance and effect size (Cohen's *d*). In Reading, IB students outperformed non-IB students in Grades 3, 4, 5, 7 and 9 with effect sizes ranging from small to medium. In Writing tasks, IB students outperformed non-IB students in Grades 3, 5, 6, 7, and 9 with effect sizes ranging from small to medium. In Expository Writing, IB

students achieved significantly higher mean scores than the non-IB students in Grades 4, 8 and 10 with small to medium effect sizes. There was no significant difference found in Narrative Writing at Grades 4 and 10 between IB student performance and non-IB student performance. In Mathematical Literacy, IB students performed better than non-IB students in Grades 5, 7 and 9 with mostly small effect sizes. In Scientific Literacy, IB students performed better than non-IB students in Grades 7, 9 and 10 with effect sizes ranging from medium to large. No significant difference was found between the broad definition and the narrow definition of non-IB students in the majority of IB and non-IB comparisons.

2.2 What is the magnitude of the effect?

This section aims to understand the magnitude of effects between IB students and non-IB students. A series of two-level multilevel modelling was performed to investigate the effect of IB curriculum at school level. For each domain (or sub-strand) and grade, two conditional models were fit with IB status at school level. The first conditional model (Model 1) is a two-level regression model with only IB school status in level 2. The second conditional model (Model 2) is a two-level regression model with student gender and English-speaking background (ESB) as covariate in level 1 and IB school status in level 2.

The magnitude of effects is measured in effect sizes. The effect sizes allow the comparison of the magnitude of differences between IB students and non-IB students from multilevel models against the non-modelled based Cohen's *d*. The effect sizes derived from multilevel models are presented together with the non-modelled Cohen's *d* in the tables in this section. For each domain (or sub-strand) and grade level, six effect sizes are reported: three methods of calculations, i.e. Cohen's *d* (denoted as Non-Model in each table), standardised regression coefficient of IB status from the two-level multilevel model with IB status of school (Model 1), and standardised regression coefficient of IB status from two-level multilevel model with student gender and English-Speaking background and the IB status of school (Model 2), and by two definitions of non-IB students, i.e. broad definition and narrow definition.

2.2.1 Magnitude of Effect by Domain

This section presents the magnitude of effects between IB students and non-IB students in all five ISA assessment domain areas. Appendix 2 shows regression coefficients of IB status from multilevel models and ICCs across all schools by domain and grade. Appendix 1 shows the boxplots of the non-modelled performance of IB students, non-IB students (broad definition) and non-IB students (narrow definition) by gender and by English-speaking background.

In Mathematical Literacy (Table 9) IB students outperformed non-IB students in grades 5, 7 and 9, with differences that were small to medium as indicated by statistical significance test and the non-model based Cohen's *d*. After taking into account clustering at school level using the multilevel model (Model 1), IB students outperformed non-IB students in Mathematical Literacy at Grade 9 with a medium difference. No significant difference was found between the two groups in other grades. After further controlling for students' gender and English-Speaking background in the multilevel model (Model 2), IB students outperformed non-IB students in Mathematical Literacy at Grade 9 with a medium difference. There were negative effect sizes from the results of multilevel models in Grades 4, 6 and 10, but they were not statistically significant.

There are less number of significant differences between IB and non-IB students from the results of multilevel models than the results based on the Cohen's *d* effect size. This is expected because the multilevel models would result in relatively larger standard errors for estimated mean scores for IB and non-IB students after taking into account clustering of students within each school. The effect sizes from the multilevel Model 1 were similar to those from the multilevel Model 2. The effect sizes between the two definitions of non-IB students were also similar for each multilevel model.

Table 9 Comparison of Effect Sizes in Mathematical Literacy

Grade	Non-Model				Model 1				Model 2			
	Broad		Narrow		Broad		Narrow		Broad		Narrow	
	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.
3	0.04		0.05		0.07		0.09		0.08		0.09	
4	0.04		0.04		-0.03		-0.01		-0.03		-0.01	
5	0.12	+	0.12	+	0.10		0.12		0.11		0.12	
6	0.07		0.07		-0.05		-0.04		-0.05		-0.03	
7	0.14	+	0.15	+	0.11		0.14		0.11		0.14	

8	0.02		0.01		0.03		0.05		0.03		0.05	
9	0.18	+	**0.21**	++	**0.22**	++	**0.25**	++	**0.22**	++	**0.26**	++
10	0.00		0.00		-0.05		-0.05		-0.04		-0.05	

In Reading (Table 10), IB students outperformed non-IB students in Grades 3, 4, 5, 7 and 9, with small to medium differences as indicated by the non-model based Cohen's *d*. After taking into account clustering at school level using the multilevel model (Model 1), IB students outperformed non-IB students in Grades 3, 5, 7 and 9 with small to medium differences. At Grade 7, the difference between IB and non-IB students only applied to the narrow definition of the non-IB students. There was no significant difference at Grade 7 using the broad definition. No significant difference was found between IB and non-IB students in other grades. After further controlling for students' gender and English-Speaking background in the multilevel model (Model 2), the significant difference of the two groups remained the same as in the Model 1.

Table 10 Comparison of Effect Sizes in Reading

Grade	Non-Model				Model 1				Model 2			
	Broad		Narrow		Broad		Narrow		Broad		Narrow	
	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.
3	0.16	+	0.16	+	**0.26**	++	**0.28**	++	**0.24**	++	**0.26**	++
4	0.12	+	0.11	+	0.08		0.10		0.07		0.09	
5	**0.23**	++	**0.22**	++	**0.29**	++	**0.30**	++	**0.26**	++	**0.27**	++
6	0.09		0.08		0.01		0.04		0.02		0.05	
7	0.12	+	0.12	+	0.15		0.18	+	0.13		0.17	+
8	0.07		0.06		0.04		0.04		0.04		0.04	
9	0.19	+	**0.23**	++	**0.24**	++	**0.26**	++	**0.21**	++	**0.24**	++
10	0.01		0.01		0.01		0.01		0.02		0.02	

In Narrative Writing (Table 11), IB students outperformed non-IB students in Grades 3, 5, 6, 7, 8 and 9, with small to medium differences as indicated by Cohen's *d*. At Grade 8, the effect size was significant only based on the broad definition of non-IB students. There was no significant difference based on the narrow definition. After taking into account clustering at school level using the multilevel model (Model 1), IB students outperformed non-IB students in Grades 3, 5, 7 and 9 with small to medium differences. No significant difference was found between the two groups in other grades. After further controlling for students' gender and English-Speaking background in the multilevel model (Model 2), the significant difference of the two groups remained the same as in the Model 1.

Table 11 Comparison of Effect Sizes in Narrative Writing

Grade	Non-Model				Model 1				Model 2			
	Broad		Narrow		Broad		Narrow		Broad		Narrow	
	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.
3	0.11	+	0.12	+	0.17	+	0.18	+	0.16	+	0.17	+
4	0.06		0.06		-0.01		0.00		-0.01		0.01	
5	0.14	+	0.14	+	0.16	+	0.18	+	0.14	+	0.16	+
6	0.11	+	0.10	+	0.05		0.07		0.06		0.08	
7	0.18	+	**0.20**	++	0.19	+	**0.21**	++	0.18	+	**0.20**	++
8	0.10	+	0.09		0.09		0.09		0.11		0.12	
9	0.18	+	**0.21**	++	**0.27**	++	**0.29**	++	**0.25**	++	**0.27**	++
10	0.04		0.04		0.10		0.09		0.10		0.09	

In Expository Writing (Table 12), IB students outperformed non-IB students with small differences at Grades 3, 4 and 10, and medium differences at Grades 5 to 9 as indicated by Cohen's *d*. After taking into account clustering at school level using the multilevel model (Model 1), IB students outperformed non-IB students in Grades 3, 5, 7, 8 and9 with small to medium differences. No significant difference was found

between the two groups in other grades. After further controlling for students' gender and English-Speaking background in the multilevel model (Model 2), the significant difference of the two groups remained the same as in the Model 1. There were negative effect sizes from the multilevel models in grade 4 but they were not statistically significant.

Table 12 Comparison of Effect Sizes in Expository Writing

Grade	Non-Model				Model 1				Model 2			
	Broad		Narrow		Broad		Narrow		Broad		Narrow	
	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.
3	0.15	+	0.16	+	**0.23**	++	**0.25**	++	**0.22**	++	**0.25**	++
4	0.10	+	0.11	+	-0.03		-0.01		-0.03		-0.01	
5	**0.24**	++	**0.24**	++	**0.29**	++	**0.30**	++	**0.27**	++	**0.28**	++
6	**0.21**	++	**0.20**	++	0.08		0.11		0.09		0.12	
7	**0.24**	++	**0.25**	++	**0.21**	++	**0.23**	++	**0.21**	++	**0.23**	++
8	**0.22**	++	**0.21**	++	0.18	+	0.19	+	0.19	+	**0.21**	++
9	**0.30**	++	**0.32**	++	**0.37**	++	**0.38**	++	**0.36**	++	**0.37**	++
10	0.11	+	0.11	+	0.16		0.15		0.16		0.15	

In Scientific Literacy (Table 13), IB students outperformed non-IB students with medium differences at Grades 7 and 9 and a large difference at Grade 10 as indicated by Cohen's *d*. After taking into account clustering at school level using the multilevel model (Model 1), IB students outperformed non-IB students in Grades 7 (only based on narrow definition of non-IB students), 9 and 10, with medium to large differences. No significant difference was found between the two groups in Grade 8. After further controlling for students' gender and English-Speaking background in the multilevel model (Model 2), the significant difference of the two groups remained the same as in the Model 1.

Table 13 Comparison of Effect Sizes in Scientific Literacy

Grade	Non-Model				Model 1				Model 2			
	Broad		Narrow		Broad		Narrow		Broad		Narrow	
	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.
7	**0.27**	++	**0.33**	++	**0.23**		**0.29**	++	**0.21**		**0.27**	++
8	0.07		0.07		-0.02		0.00		-0.01		0.01	
9	**0.33**	++	**0.41**	++	**0.40**	++	**0.44**	++	**0.36**	++	**0.40**	++
10	**0.61**	+++	**0.61**	+++	**0.59**	+++	**0.61**	+++	**0.60**	+++	**0.61**	+++

In summary, the comparison results based on multilevel modelling of student performance among PYP and MYP students showed evidence that, on a global level, the PYP and the MYP students performed better than students from non-IB schools in the ISA assessment areas at a number of grade levels. In Reading, IB students outperformed non-IB students in Grades 3, 5 and 9 based on both Cohen's *d* and effect sizes from multilevel models, and in Grades 4 and 7 based on Cohen's *d* only. In Writing tasks, IB students outperformed non-IB students in Grades 3, 5, 7 and 9 based on both Cohen's *d* and effect sizes from multilevel models, in Grade 6 based on Cohen's *d* only. In Mathematical Literacy, IB students performed better than non-IB students in Grade 9 based on both Cohen's *d* and effect sizes from multilevel models, in Grades 5 and 7 based on Cohen's *d* only, and performed equally well with the non-IB students in grades 3, 4, 6, 8 and 10. In Scientific Literacy, IB students performed better than non-IB students in Grades 9 and 10 based on both Cohen's *d* and effect sizes from multilevel models, in Grade 7 based on Cohen's *d* only, and performed equally well with the non-IB students in Grade 8. Note that there was a significantly medium positive effect size in Grade 9 in all five ISA assessment areas. There was no evidence to indicate IB students did not perform well in comparison to the non-IB students.

2.2.2 Magnitude of Effect by Sub-strand

This section aims to understand the degree to which the IB curriculum promotes particular cognitive and/or academic strengths within assessment areas. ISA Mathematical Literacy, Reading and Scientific Literacy each consists of a number of sub-strands. Mathematical Literacy consists of four sub-strands: Change and Relationships, Quantity, Space and Shape, and Uncertainty and Data. Reading consists of three sub-strands: Integrate and Interpret, Reflect and Evaluate, and Access and Retrieve.[1] Scientific Literacy consists of three sub-strands: Evaluate and design scientific enquiry, Explain phenomena scientifically, and Interpret data and evidence scientifically. Each Writing task consists of three criteria: Content, Language, and Spelling for Narrative Writing, and Content, Language, and Structure and Organisation for Expository Writing. The description of ISA sub-strands is available in Appendix 7. Effect sizes of sub-strands in Mathematical Literacy, Reading and Scientific Literacy were calculated using the difference in average percentage corrects between IB students and non-IB students in each sub-strand divided by pooled standard deviation. Effect sizes of Writing Task criteria were calculated based on the difference in average raw scores between IB students and non-IB students for each criterion divided by pooled standard deviation. Both percentage correct and raw score are sample-dependent, and therefore only the 2018-19 ISA assessment data were used for this analysis.

In the sub-strands of Mathematical Literacy, as shown in Table 14, IB students performed as well as or better than non-IB students in all sub-strands in Grades 3 to 9. On the other hand, non-IB students outperformed IB students in all sub-strands at Grade 10 based on the Cohen's *d*, but these differences were not significant based on the results of multilevel models. After taking into account data clustering at schools with or without controlling for student characteristics, IB students outperformed non-IB students in all sub-strands at Grade 9 (except for the broad definition of non-IB students in Model 1), in Space and Shape at Grades 3 and 5, in Uncertainty and Data at Grade 5, with small to medium differences. There were negative but negligible effect sizes in Change and Relationships and in Quantity at Grades 4, 6 and 8 based on the results of multilevel models.

Table 14 Comparison of Effect Sizes by Mathematical Literacy Sub-strand

Strand	Grade	Non-Model				Model 1				Model 2			
		Broad		Narrow		Broad		Narrow		Broad		Narrow	
		Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.
Change and Relationships	3	0.05		0.06		0.03		0.03		0.03		0.04	
	4	0.04		0.05		-0.03		-0.01		-0.03		-0.01	
	5	0.13	+	0.13	+	0.08		0.09		0.09		0.10	
	6	0.00		0.00		-0.09		-0.08		-0.09		-0.08	
	7	0.16	+	0.17	+	0.11		0.14	+	0.11		0.14	
	8	-0.01		-0.01		0.01		0.02		0.01		0.02	
	9	0.18	+	**0.21**	++	0.20	+	**0.22**	++	**0.20**	++	**0.23**	++
	10	-0.15	-	-0.15	-	-0.04		-0.04		-0.03		-0.04	
Quantity	3	0.06		0.07		0.01		0.02		0.01		0.03	
	4	0.04		0.04		-0.06		-0.04		-0.05		-0.04	
	5	0.12	+	0.12	+	0.07		0.08		0.08		0.09	
	6	0.03		0.03		-0.07		-0.05		-0.06		-0.05	
	7	0.10	+	0.12	+	0.09		0.11		0.09		0.11	
	8	-0.01		-0.01		-0.01		0.01		-0.02		0.01	
	9	0.14	+	0.16	+	0.14		0.17	+	0.15	+	0.18	+
	10	-0.13	-	-0.13	-	-0.02		-0.03		-0.01		-0.02	
Space and Shape	3	0.17	+	0.17	+	0.14	+	0.15	+	0.14	+	0.15	+
	4	0.09		0.10	+	0.00		0.03		0.00		0.03	
	5	0.16	+	0.17	+	0.12	+	0.14	+	0.13	+	0.14	+
	6	0.07		0.07		0.01		0.01		0.01		0.01	
	7	0.15	+	0.17	+	0.13		0.15	+	0.13		0.15	+
	8	0.11	+	0.11	+	0.08		0.10		0.08		0.10	
	9	0.14	+	0.16	+	0.19	+	**0.22**	++	0.20	+	**0.23**	++

[1] The names of ISA Reading sub-strands were revised in 2014. The earlier Reading sub-strands were named as Interpreting, Reflecting, and Retrieving Information.

Strand	Grade	Non-Model				Model 1				Model 2			
		Broad		Narrow		Broad		Narrow		Broad		Narrow	
		Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.
	10	-0.16	-	-0.16	-	0.00		0.00		0.00		0.00	
Uncertainty and Data	3	0.07		0.08		0.05		0.06		0.05		0.06	
	4	0.06		0.07		0.01		0.02		0.01		0.02	
	5	**0.22**	++	**0.22**	++	0.19	+	0.19	+	0.18	+	0.19	+
	6	0.14	+	0.14	+	0.05		0.06		0.05		0.06	
	7	0.11	+	0.13	+	0.08		0.10		0.08		0.10	
	8	0.03		0.03		0.02		0.04		0.02		0.04	
	9	**0.24**	++	**0.27**	++	**0.23**	++	**0.26**	++	**0.23**	++	**0.26**	++
	10	-0.13	-	-0.13	-	-0.03		-0.04		-0.03		-0.03	

In Reading, as shown in Table 15, IB students performed better than non-IB students in all sub-strands at Grades 3, 5, 7 and 9 with small to medium effect sizes, based on Cohen's *d*. IB students performed as well as non-IB students in all sub-strands at Grades 4, 6 and 8. On the other hand, non-IB students outperformed IB students in Access and Retrieve and in Integrate and Interpret at Grade 10 based on the Cohen's *d*, but these differences were not significant based on the results of multilevel models. After taking into account data clustering at schools with or without controlling for student characteristics, IB students outperformed non-IB students in all sub-strands at Grades 3, 5 and 9 with small to medium differences and also in Reflect and Evaluate and in Integrate and Interpret (based on narrow definition of non-IB students in both Models 1 and 2) at Grade 7 with small differences.

Table 15 Comparison of Effect Sizes by Reading Sub-strand

Strand	Grade	Non-Model				Model 1				Model 2			
		Broad		Narrow		Broad		Narrow		Broad		Narrow	
		Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.
Access and Retrieve	3	**0.24**	++	**0.25**	++	**0.24**	++	**0.26**	++	**0.23**	++	**0.24**	++
	4	0.06		0.07		0.03		0.04		0.02		0.04	
	5	**0.30**	++	**0.30**	++	**0.26**	++	**0.26**	++	**0.24**	++	**0.24**	++
	6	0.11	+	0.11	+	0.05		0.06		0.06		0.07	
	7	0.13	+	0.14	+	0.11		0.13		0.10		0.12	
	8	0.09		0.09		0.02		0.02		0.02		0.02	
	9	**0.21**	++	**0.22**	++	0.18	+	0.20	+	0.17	+	0.19	+
	10	**-0.26**	--	**-0.26**	--	-0.12		-0.11		-0.10		-0.10	
Integrate and Interpret	3	**0.24**	++	**0.25**	++	**0.24**	++	**0.26**	++	**0.22**	++	**0.24**	++
	4	0.09		0.09		0.05		0.07		0.05		0.07	
	5	**0.31**	++	**0.31**	++	**0.27**	++	**0.28**	++	**0.25**	++	**0.26**	++
	6	0.13	+	0.13	+	0.04		0.06		0.05		0.06	
	7	0.12	+	0.14	+	0.13		0.16	+	0.11		0.14	+
	8	0.06		0.06		0.02		0.03		0.02		0.03	
	9	**0.20**	++	**0.22**	++	0.19	+	**0.21**	++	0.17	+	0.19	+
	10	-0.15	-	-0.15	-	-0.04		-0.03		-0.02		-0.02	
Reflect and Evaluate	3	0.18	+	0.18	+	0.19	+	**0.20**	++	0.18	+	0.19	+
	4	0.11	+	0.12	+	0.07		0.10		0.07		0.09	
	5	**0.22**	++	**0.22**	++	**0.22**	++	**0.22**	++	0.19	+	0.20	+
	6	0.11	+	0.11	+	0.04		0.06		0.05		0.06	
	7	0.17	+	0.19	+	0.16	+	0.18	+	0.15	+	0.17	+
	8	0.13	+	0.12	+	0.06		0.07		0.06		0.07	
	9	**0.22**	++	**0.25**	++	0.19	+	**0.21**	++	0.18	+	0.20	+
	10	-0.06		-0.06		0.05		0.04		0.06		0.06	

In the Writing tasks, as shown in Table 16 and Table 17, after taking into account data clustering at schools with or without controlling for student characteristics, IB students outperformed non-IB students in the Content criterion and in Language at Grades 3, 5, 7 and 9; and in Spelling at Grades 3, and 9 on the Narrative Writing task. The difference shown at Grade 7 only applied to the narrow definition of non-IB students for multilevel models. For the Expository Writing task, IB students outperformed non-IB students in Content and in Structure and Organisation at Grades 3, 5, 7, 8 and 9; and in Language at Grades 3, 5, 6 (except for the broad definition of non-IB students in the Model 1), 7 and 9. In all other criteria and other grades, there were no statistically significant differences based on the results of multilevel models.

Table 16 Comparison of Effect Sizes by Narrative Writing Criteria

Strand	Grade	Non-Model				Model 1				Model 2			
		Broad		Narrow		Broad		Narrow		Broad		Narrow	
		Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.
Content	3	**0.29**	++	**0.30**	++	**0.21**	++	**0.22**	++	**0.20**	++	**0.21**	++
	4	**0.25**	++	**0.26**	++	0.03		0.04		0.03		0.04	
	5	**0.25**	++	**0.26**	++	0.16	+	0.17	+	0.14	+	0.15	+
	6	**0.23**	++	**0.24**	++	0.07		0.09		0.08		0.10	
	7	**0.27**	++	**0.29**	++	0.17	+	0.19	+	0.16	+	0.18	+
	8	0.19	+	0.19	+	0.07		0.08		0.09		0.10	
	9	**0.26**	++	**0.29**	++	**0.24**	++	**0.26**	++	**0.22**	++	**0.24**	++
	10	-0.06		-0.06		0.09		0.08		0.09		0.08	
Language	3	**0.27**	++	**0.28**	++	0.19	+	**0.20**	++	0.17	+	0.19	+
	4	**0.20**	++	**0.21**	++	0.02		0.03		0.02		0.03	
	5	**0.25**	++	**0.26**	++	0.16	+	0.18	+	0.14	+	0.16	+
	6	0.19	+	0.19	+	0.05		0.07		0.07		0.08	
	7	**0.25**	++	**0.26**	++	0.16	+	0.18	+	0.15	+	0.17	+
	8	0.15	+	0.15	+	0.06		0.06		0.08		0.08	
	9	**0.25**	++	**0.28**	++	**0.24**	++	**0.26**	++	**0.22**	++	**0.25**	++
	10	-0.11	-	-0.11	-	0.04		0.03		0.04		0.03	
Spelling	3	0.19	+	0.19	+	0.11	+	0.13	+	0.11	+	0.12	+
	4	0.14	+	0.15	+	-0.01		0.00		-0.01		0.00	
	5	0.16	+	0.17	+	0.09		0.10		0.07		0.08	
	6	0.11	+	0.12	+	0.04		0.05		0.06		0.06	
	7	0.15	+	0.17	+	0.11		0.13	+	0.10		0.12	+
	8	0.11	+	0.10	+	0.05		0.06		0.07		0.08	
	9	0.17	+	0.19	+	0.19	+	**0.21**	++	0.17	+	0.20	+
	10	0.00		0.00		0.12		0.12		0.13		0.12	

Table 17 Comparison of Effect Sizes by Expository Writing Criteria

Strand	Grade	Non-Model				Model 1				Model 2			
		Broad		Narrow		Broad		Narrow		Broad		Narrow	
		Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.
Content	3	**0.34**	++	**0.35**	++	**0.20**	++	**0.22**	++	**0.20**	++	**0.22**	++
	4	**0.24**	++	**0.25**	++	0.01		0.02		0.01		0.02	
	5	**0.34**	++	**0.34**	++	**0.24**	++	**0.25**	++	**0.23**	++	**0.24**	++
	6	**0.30**	++	**0.30**	++	0.07		0.09		0.07		0.09	
	7	**0.28**	++	**0.30**	++	0.17	+	0.19	+	0.17	+	0.18	+
	8	**0.33**	++	**0.33**	++	0.17	+	0.18	+	0.18	+	0.19	+
	9	**0.39**	++	**0.41**	++	**0.37**	++	**0.37**	++	**0.35**	++	**0.36**	++
	10	0.00		0.00		0.18		0.18		0.18		0.18	
Language	3	**0.32**	++	**0.33**	++	**0.23**	++	**0.25**	++	**0.23**	++	**0.24**	++
	4	**0.21**	++	**0.22**	++	-0.02		0.00		-0.02		0.00	
	5	**0.36**	++	**0.36**	++	**0.27**	++	**0.28**	++	**0.26**	++	**0.26**	++
	6	**0.26**	++	**0.26**	++	0.12		0.14	+	0.13	+	0.15	+
	7	**0.28**	++	**0.30**	++	0.18	+	**0.20**	++	0.17	+	0.19	+
	8	**0.24**	++	**0.24**	++	0.11		0.13		0.13		0.14	
	9	**0.31**	++	**0.33**	++	**0.30**	++	**0.31**	++	**0.29**	++	**0.29**	++

	10	-0.02		-0.02		0.12		0.12		0.12		0.12	
Structure	3	**0.32**	++	**0.33**	++	**0.22**	++	**0.24**	++	**0.22**	++	**0.23**	++
	4	**0.26**	++	**0.27**	++	0.00		0.01		0.00		0.01	
	5	**0.36**	++	**0.37**	++	**0.25**	++	**0.26**	++	**0.24**	++	**0.25**	++
	6	**0.28**	++	**0.28**	++	0.04		0.06		0.05		0.06	
	7	**0.30**	++	**0.31**	++	0.17	+	0.19	+	0.16	+	0.18	+
	8	**0.34**	++	**0.33**	++	0.16	+	0.17	+	0.17	+	0.19	+
	9	**0.36**	++	**0.39**	++	**0.34**	++	**0.35**	++	**0.33**	++	**0.34**	++
	10	-0.01		-0.01		0.16		0.15		0.16		0.15	

In Scientific Literacy, as shown in Table 18, after taking into account data clustering at schools with or without controlling for student characteristics, IB students performed better than non-IB students in Evaluate and design scientific enquiry at Grades 7, 9 and 10, in Explain phenomena scientifically at Grade 10, and in Interpret data and evidence scientifically at Grade 7 (based on the narrow definition of non-IB students for multilevel models) and also at Grades 9 and 10, with medium to large effect sizes. In all other sub-strands and other grades, there were no statistically significant differences based on the results of multilevel models.

Table 18 Comparison of Effect Sizes by Scientific Literacy Sub-strand

Strand	**Grade**	**Non-Model**				**Model 1**				**Model 2**			
		Broad		**Narrow**		**Broad**		**Narrow**		**Broad**		**Narrow**	
		Effect Size	**Sig. of Diff.**	**Effect Size**	**Sig. of Diff.**	**Effect Size**	**Sig. of Diff.**	**Effect Size**	**Sig. of Diff.**	**Effect Size**	**Sig. of Diff.**	**Effect Size**	**Sig. of Diff.**
Evaluate and design scientific enquiry	7	**0.37**	++	**0.40**	++	**0.27**	++	**0.32**	++	**0.26**	++	**0.30**	++
	8	**0.21**	++	**0.21**	++	0.06		0.09		0.07		0.10	
	9	**0.44**	++	**0.48**	++	**0.35**	++	**0.38**	++	**0.31**	++	**0.33**	++
	10	**0.81**	+++	**0.82**	+++	**0.64**	+++	**0.67**	+++	**0.66**	+++	**0.69**	+++
Explain phenomena scientifically	7	0.17	+	**0.20**	++	0.03		0.08		0.01		0.06	
	8	-0.08		-0.08		-0.08		-0.07		-0.08		-0.07	
	9	0.12	+	0.16	+	0.17		0.18		0.13		0.15	
	10	**0.44**	++	**0.44**	++	**0.38**	++	**0.38**	++	**0.39**	++	**0.39**	++
Interpret data and evidence scientifically	7	**0.43**	++	**0.47**	++	**0.22**		**0.28**	++	**0.21**		**0.27**	++
	8	0.17	+	0.17	+	0.04		0.07		0.05		0.07	
	9	**0.56**	+++	**0.62**	+++	**0.47**	++	**0.52**	+++	**0.45**	++	**0.49**	++
	10	**0.57**	+++	**0.57**	+++	**0.50**	++	**0.51**	+++	**0.51**	+++	**0.51**	+++

2.2.3 Magnitude of Effect by Region

The following section presents comparison outcomes between IB students and non-IB students by regions. The comparisons of ISA performance were presented in five geographical regions: the Asia-Pacific, Europe, the Middle East, Africa and the Americas. Appendix 3 shows regression coefficients of IB status from multilevel models by domain and grade for each region.

2.2.3.1 Asia-Pacific

In the Asia-Pacific (see Table 19), non-IB students outperformed IB students in Mathematical Literacy, Narrative Writing and Expository Writing at Grades 3-6, 8 and 10, in Reading at Grades 4-8 and 10, and in Scientific Literacy at Grade 8, with differences that were small to medium as indicated by statistical significance test and Cohen's *d*. On the other hand, IB students outperformed non-IB students in Scientific Literacy at Grades 7, 9 and 10, with small to medium differences.

Taking into account clustering at school level using the multilevel model (Model 1), non-IB students outperformed IB students in Mathematical Literacy at Grade 4 (based on the broad definition of non-IB students) and also at Grade 6. Non-IB students also outperformed IB students in Narrative Writing and Expository Writing at Grade 4, with small to medium differences. On the other hand, IB students outperformed non-IB students in Expository Writing at Grade 9 based on the broad definition of non-IB students with a medium difference.

After controlling for students' gender and English-Speaking background in the multilevel model (Model 2), IB students outperformed non-IB students in Mathematical Literacy (based on the narrow definition of non-IB students), Reading, Narrative Writing, Expository Writing at Grade 9, and in Scientific Literacy at Grade 7 (based on the narrow definition of non-IB students) and at Grade 9 (based on the broad definition of non-IB students). All of these differences were medium differences. On the other hand, non-IB students outperformed IB students in Mathematical Literacy at Grades 4 and 6, Narrative Writing at Grade 4 (only based on the broad definition of non-IB students) and Expository Writing at Grade 4, with small to medium differences.

Table 19 Comparison of Effect Sizes in Asia-Pacific

Domain	Grade	Non-Model				Model 1				Model 2			
		Broad		Narrow		Broad		Narrow		Broad		Narrow	
		Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.
Mathematical Literacy	3	**-0.25**	--	**-0.25**	--	-0.07		-0.06		-0.07		-0.06	
	4	**-0.24**	--	**-0.24**	--	-0.19	-	-0.19		**-0.20**	--	-0.20	-
	5	-0.19	-	-0.19	-	-0.04		-0.04		-0.03		-0.03	
	6	**-0.25**	--	**-0.25**	--	**-0.22**	--	**-0.22**	--	**-0.21**	--	**-0.22**	--
	7	-0.09		-0.09		-0.01		0.00		-0.02		-0.01	
	8	**-0.28**	--	**-0.28**	--	-0.12		-0.10		-0.13		-0.11	
	9	-0.03		-0.05		0.20		**0.23**		**0.21**		**0.24**	++
	10	**-0.33**	--	**-0.33**	--	-0.14		-0.17		-0.13		-0.16	
Reading	3	-0.07		-0.06		0.17		0.19	+	0.15		0.17	
	4	**-0.29**	--	**-0.28**	--	**-0.21**		**-0.20**		**-0.20**		-0.19	
	5	-0.10	-	-0.09		0.09		0.10		0.08		0.09	
	6	**-0.27**	--	**-0.26**	--	-0.18		-0.13		-0.14		-0.10	
	7	-0.12	-	-0.11	-	-0.02		0.03		0.02		0.07	
	8	**-0.34**	--	**-0.34**	--	-0.18		-0.18		-0.10		-0.09	
	9	0.02		-0.03		0.19		0.18		**0.26**	++	**0.29**	++
	10	-0.19	-	-0.19	-	-0.11		-0.10		-0.01		-0.01	
	3	-0.13	-	-0.12	-	0.01		0.02		0.00		0.01	

Domain	Grade	Non-Model				Model 1				Model 2			
		Broad		Narrow		Broad		Narrow		Broad		Narrow	
		Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.
Narrative Writing	4	**-0.24**	--	**-0.24**	--	-0.19	-	-0.19	-	-0.18	-	-0.18	
	5	-0.17	-	-0.16	-	-0.03		-0.02		-0.04		-0.03	
	6	**-0.20**	--	**-0.20**	--	-0.05		-0.02		-0.03		0.01	
	7	-0.06		-0.06		0.01		0.03		0.05		0.07	
	8	**-0.24**	--	**-0.24**	--	-0.06		-0.08		0.01		0.01	
	9	0.03		-0.01		0.20		0.18		**0.26**	++	**0.28**	++
	10	**-0.24**	--	**-0.24**	--	0.00		-0.03		0.07		0.04	
Expository Writing	3	-0.11	-	-0.11	-	0.12		0.14		0.11		0.13	
	4	**-0.32**	--	**-0.32**	--	**-0.25**	--	**-0.25**	--	**-0.24**	--	**-0.23**	--
	5	-0.11	-	-0.11	-	0.09		0.09		0.08		0.08	
	6	-0.19	-	-0.18	-	-0.10		-0.07		-0.09		-0.05	
	7	-0.04		-0.03		0.01		0.03		0.04		0.06	
	8	-0.14	-	-0.14	-	0.01		0.02		0.06		0.08	
	9	0.06		0.01		**0.28**	++	**0.23**		**0.33**	++	**0.30**	++
	10	**-0.24**	--	**-0.24**	--	-0.02		-0.03		0.05		0.04	
Scientific Literacy	7	0.15	+	0.16	+	**0.24**		**0.29**		**0.26**		**0.32**	++
	8	**-0.24**	--	**-0.24**	--	-0.15		-0.12		-0.10		-0.06	
	9	0.19	+	0.13	+	**0.39**		**0.32**		**0.41**	++	**0.38**	
	10	**0.23**	++	**0.24**	++	**-0.33**		**-0.35**		**-0.25**		**-0.28**	

2.2.3.2 Europe

In the region of Europe, as shown in Table 20, IB students outperformed non-IB students in Mathematical Literacy and Writing tasks at Grade 5 based on the broad definition of non-IB students, in Reading at Grade 5, with differences that were small to medium as indicated by Cohen's *d*. On the other hand, non-IB students outperformed IB students in Mathematical Literacy at Grades 4, 7 (based on narrow definition of non-IB students) and 8 (based on narrow definition of non-IB students), in Reading at Grade 4, in Narrative Writing at Grade 4 and 6 (based on the broad definition of non-IB students) and Expository Writing at Grade 4 and 6 (based on the broad definition of non-IB students) and also at Grade10. In Scientific Literacy non-IB students outperformed IB students at Grades 7 and 8, with small to medium differences.

Taking into account clustering at school level using the multilevel model (Model 1), IB students outperformed non-IB students in Reading and Expository Writing at Grade 5, with medium differences. On the other hand, non-IB students outperformed IB students in Expository Writing at Grade 4 with a medium difference.

After controlling for students' gender and English-Speaking background in the multilevel model (Model 2), IB students outperformed non-IB students in Reading and Expository Writing at Grade 5 (based on the broad definition of non-IB students), with medium differences. On the other hand, non-IB students outperformed IB students in Expository Writing at Grade 4 and in Scientific Literacy at Grade 8 (based on the narrow definition of non-IB students) with medium to large differences.

Table 20 Comparison of Effect Sizes in Europe

Domain	Grade	Non-Model				Model 1				Model 2			
		Broad		Narrow		Broad		Narrow		Broad		Narrow	
		Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.
Mathematical Literacy	3	-0.01		-0.01		0.01		0.01		0.00		0.00	
	4	-0.17	-	-0.17	-	-0.18		-0.18		-0.18		-0.18	

Domain	Grade	Non-Model				Model 1				Model 2			
		Broad		Narrow		Broad		Narrow		Broad		Narrow	
		Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.
	5	0.10	+	0.08		0.08		0.07		0.09		0.08	
	6	-0.01		-0.05		-0.10		-0.12		-0.11		-0.12	
	7	-0.09		-0.12	-	0.07		0.06		0.07		0.06	
	8	-0.09		-0.14	-	-0.16		-0.18		-0.16		-0.18	
	9	0.00		0.00		0.08		0.08		0.08		0.08	
	10	-0.08		-0.08		-0.17		-0.17		-0.18		-0.18	
Reading	3	0.08		0.08		**0.23**		**0.23**		**0.22**		**0.22**	
	4	-0.17	-	-0.17	-	-0.07		-0.07		-0.08		-0.08	
	5	**0.26**	++	**0.21**	++	**0.34**	++	**0.33**	++	**0.31**	++	**0.30**	++
	6	0.04		-0.02		-0.03		-0.06		-0.01		-0.03	
	7	-0.01		-0.05		0.18		0.18		0.14		0.14	
	8	-0.03		-0.08		-0.07		-0.09		-0.09		-0.10	
	9	0.06		0.06		**0.23**		**0.23**		0.19		0.19	
	10	0.06		0.06		0.03		0.03		0.00		0.00	
Narrative Writing	3	0.05		0.05		0.18		0.18		0.18		0.18	
	4	-0.17	-	-0.17	-	-0.15		-0.15		-0.15		-0.15	
	5	0.12	+	0.08		**0.22**		**0.21**		0.19		0.18	
	6	-0.06		-0.13	-	-0.11		-0.13		-0.08		-0.10	
	7	-0.01		-0.03		0.09		0.09		0.05		0.05	
	8	-0.02		-0.07		-0.08		-0.10		-0.09		-0.10	
	9	-0.02		-0.02		0.10		0.10		0.07		0.07	
	10	-0.16	-	-0.16	-	-0.11		-0.11		-0.11		-0.11	
Expository Writing	3	-0.07		-0.07		0.07		0.07		0.07		0.07	
	4	**-0.31**	--	**-0.31**	--	**-0.29**	--	**-0.29**	--	**-0.29**	--	**-0.29**	--
	5	0.13	+	0.08		**0.29**	++	**0.28**	++	**0.26**	++	**0.25**	
	6	-0.03		-0.10	-	-0.05		-0.08		-0.03		-0.05	
	7	0.02		-0.03		0.11		0.10		0.07		0.07	
	8	0.00		-0.07		-0.03		-0.07		-0.04		-0.08	
	9	0.09		0.09		0.18		0.18		0.14		0.14	
	10	-0.15	-	-0.15	-	-0.03		-0.03		-0.04		-0.04	
Scientific Literacy	7	-0.13	-	**-0.24**	--	-0.10		-0.12		-0.14		-0.16	
	8	-0.19	-	**-0.43**	--	**-0.41**		**-0.53**		**-0.43**		**-0.56**	---
	9	0.06		0.06		**0.32**		**0.32**		**0.32**		**0.32**	
	10	0.01		0.01		n/a		n/a		n/a		n/a	

2.2.3.3 The Middle East

In the region of the Middle East, as shown in Table 21, IB students outperformed non-IB students in Mathematical Literacy and Reading at Grades 3-9, in Writing tasks at Grades 3-10, and in Scientific Literacy at Grades 7-9. The differences were small to medium in Mathematical Literacy, medium to large in Reading and Scientific Literacy, and large in Writing tasks.

After taking into account of clustering at school level using the multilevel model (Model 1), IB students outperformed non-IB students in Narrative Writing at Grades 5, 7, 8 and9, and in Expository Writing at Grades 3-9, with large differences. After controlling for students' gender and English-Speaking background in the multilevel model (Model 2), IB students outperformed non-IB students in Reading at Grade 5 with a medium difference, in Narrative Writing at Grades 5, 7, 8 and 9 and in Expository Writing at Grades 3-9 with large differences. There were negative effect sizes in Mathematical Literacy and Reading at Grade 10 from the results of both multilevel models. However, these differences were not statistically significant.

Table 21 Comparison of Effect Sizes in the Middle East

Domain	Grade	Non-Model				Model 1				Model 2			
		Broad		Narrow		Broad		Narrow		Broad		Narrow	
		Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.
Mathematical Literacy	3	0.12	+	0.13	+	0.06		0.06		0.07		0.06	
	4	0.16	+	0.16	+	0.13		0.13		0.13		0.13	
	5	0.11	+	0.12	+	0.15		0.15		0.15		0.15	
	6	0.10	+	0.12	+	0.00		0.00		0.01		0.01	
	7	**0.22**	++	**0.25**	++	0.06		0.06		0.06		0.06	
	8	0.13	+	0.14	+	-0.08		-0.08		-0.07		-0.07	
	9	**0.30**	++	**0.30**	++	0.09		0.09		0.10		0.10	
	10	0.01		0.01		**-0.50**		**-0.50**		**-0.48**		**-0.48**	
Reading	3	**0.29**	++	**0.28**	++	**0.24**		**0.24**		**0.24**		**0.24**	
	4	**0.46**	++	**0.46**	++	**0.43**		**0.44**		**0.42**		**0.42**	
	5	**0.32**	++	**0.32**	++	**0.42**		**0.42**		**0.44**	++	**0.44**	++
	6	**0.21**	++	**0.23**	++	0.17		0.17		0.19		0.19	
	7	**0.27**	++	**0.28**	++	0.12		0.12		0.14		0.14	
	8	**0.40**	++	**0.40**	++	0.20		0.20		**0.21**		**0.21**	
	9	**0.51**	+++	**0.54**	+++	**0.27**		**0.27**		**0.28**		**0.28**	
	10	-0.06		-0.06		**-0.24**		**-0.24**		-0.14		-0.14	
Narrative Writing	3	**0.35**	++	**0.35**	++	**0.42**		**0.42**		**0.49**		**0.49**	
	4	**0.64**	+++	**0.64**	+++	**0.69**		**0.69**		**0.68**		**0.68**	
	5	**0.52**	+++	**0.52**	+++	**0.60**	+++	**0.60**	+++	**0.68**	+++	**0.68**	+++
	6	**0.62**	+++	**0.62**	+++	**0.57**		**0.57**		**0.58**		**0.58**	
	7	**0.89**	+++	**0.89**	+++	**0.77**	+++	**0.77**	+++	**0.85**	+++	**0.85**	+++
	8	**0.97**	+++	**0.97**	+++	**0.65**	+++	**0.65**	+++	**0.68**	+++	**0.68**	+++
	9	**0.89**	+++	**0.89**	+++	**0.74**	+++	**0.74**	+++	**0.75**	+++	**0.75**	+++
	10	**1.06**	+++	**1.06**	+++	**0.78**		**0.78**		**0.80**		**0.80**	
Expository Writing	3	**0.69**	+++	**0.69**	+++	**0.80**	+++	**0.80**	+++	**0.83**	+++	**0.83**	+++
	4	**1.11**	+++	**1.11**	+++	**1.03**	+++	**1.03**	+++	**1.07**	+++	**1.07**	+++
	5	**0.94**	+++	**0.94**	+++	**1.03**	+++	**1.03**	+++	**1.03**	+++	**1.03**	+++
	6	**1.04**	+++	**1.04**	+++	**0.88**	+++	**0.88**	+++	**0.90**	+++	**0.90**	+++
	7	**1.11**	+++	**1.11**	+++	**0.90**	+++	**0.90**	+++	**0.97**	+++	**0.97**	+++
	8	**1.40**	+++	**1.40**	+++	**0.96**	+++	**0.96**	+++	**1.00**	+++	**1.00**	+++
	9	**1.21**	+++	**1.21**	+++	**0.92**	+++	**0.92**	+++	**0.91**	+++	**0.91**	+++
	10	**1.23**	+++	**1.23**	+++	**0.65**		**0.65**		**0.71**		**0.71**	
Scientific Literacy	7	**0.26**	++	**0.33**	++	**0.25**		**0.25**		**0.25**		**0.25**	
	8	**0.24**	++	**0.25**	++	0.06		0.06		0.06		0.06	
	9	**0.62**	+++	**0.64**	+++	**0.34**		**0.34**		**0.28**		**0.28**	

2.2.3.4 Africa

In the region of Africa, as shown in Table 22, IB students outperformed non-IB students in Mathematical Literacy and Narrative Writing at Grades 7-9, in Reading at Grades 3-9, and in the Expository Writing task at Grade 4 and Grades 7-10, with small to large differences. On the other hand, non-IB students performed better than IB students in Mathematical Literacy at Grade 4 based on the broad definition of non-IB students. There were negative effect sizes in Scientific Literacy at Grade 8, but they were not statistically significant.

After taking into account clustering at school level using the multilevel model (Model 1), IB students outperformed non-IB students in Mathematical Literacy, Reading and Expository Writing at Grade 9, and in Narrative Writing at Grade 8 based on the narrow definition of non-IB students, with medium to large differences. After controlling for students' gender and English-Speaking background in the multilevel model (Model 2), IB students outperformed non-IB students in Mathematical Literacy at Grade 9 with medium differences. Note that multilevel modelling was not applicable in Scientific Literacy at Grade 8 and Mathematical Literacy, Reading and Writing tasks at Grade 10 due to small ICCs (< 0.05). The results

of multilevel Model 2 were not reported in Reading and Narrative Writing at Grade 9 and Expository Writing at Grades 9 and 10 due to failure to converge during model fitting.

Table 22 Comparison of Effect Sizes in Africa

Domain	Grade	Non-Model				Model 1				Model 2			
		Broad		Narrow		Broad		Narrow		Broad		Narrow	
		Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.
Mathematical Literacy	3	-0.09		-0.06		**-0.25**		-0.09		**-0.27**		-0.15	
	4	-0.12	-	-0.10		-0.15		0.03		-0.17		0.00	
	5	0.03		0.06		-0.05		0.09		-0.03		0.10	
	6	0.07		0.09		-0.03		0.14		-0.05		0.11	
	7	0.14	+	0.16	+	0.19		**0.24**		0.12		0.16	
	8	0.17	+	0.18	+	0.13		**0.25**		0.02		0.18	
	9	**0.22**	++	**0.22**	++	**0.49**	++	**0.49**	++	**0.49**	++	**0.49**	++
	10	0.12		0.12		n/a		n/a		n/a		n/a	
Reading	3	0.15	+	0.18	+	-0.05		0.14		-0.06		0.09	
	4	0.12	+	0.14	+	**0.23**		**0.39**		0.18		**0.32**	
	5	0.15	+	0.17	+	0.17		**0.26**		0.16		**0.23**	
	6	0.17	+	0.18	+	0.00		0.15		-0.06		0.02	
	7	**0.32**	++	**0.33**	++	**0.46**		**0.50**		**0.24**		**0.27**	
	8	**0.42**	++	**0.43**	++	**0.52**		**0.62**		**0.43**		**0.54**	
	9	**0.30**	++	**0.30**	++	**0.70**	+++	**0.70**	+++	n/a		n/a	
	10	0.12		0.12		n/a		n/a		n/a		n/a	
Narrative Writing	3	-0.08		-0.06		**-0.36**		**-0.30**		**-0.41**		**-0.36**	
	4	-0.06		-0.04		-0.12		-0.01		-0.15		-0.05	
	5	0.08		0.08		-0.16		-0.07		-0.17		-0.09	
	6	0.08		0.09		-0.11		-0.11		-0.17		**-0.21**	
	7	**0.24**	++	**0.25**	++	**0.26**		**0.27**		0.13		0.14	
	8	**0.39**	++	**0.42**	++	**0.29**		**0.38**	++	0.16		**0.21**	
	9	**0.22**	++	**0.22**	++	**0.38**		**0.38**		n/a		n/a	
	10	0.13		0.13		n/a		n/a		n/a		n/a	
Expository Writing	3	0.05		0.08		**-0.45**		**-0.38**		**-0.48**		**-0.41**	
	4	**0.22**	++	**0.24**	++	**0.22**		**0.33**		**0.20**		**0.29**	
	5	-0.02		-0.01		0.03		0.04		0.01		0.01	
	6	0.11		0.10		-0.12		-0.06		-0.15		-0.13	
	7	0.17	+	0.18	+	0.02		0.03		-0.09		-0.09	
	8	**0.42**	++	**0.45**	++	**0.21**		**0.36**		0.12		**0.25**	
	9	**0.31**	++	**0.31**	++	**0.50**	++	**0.50**	++	n/a		n/a	
	10	**0.55**	+++	**0.55**	+++	**0.92**		**0.92**		n/a		n/a	
Scientific Literacy	8	-0.15		-0.15		n/a		n/a		n/a		n/a	

2.2.3.5 The Americas

In the Americas region, as shown in Table 23, IB students outperformed non-IB students in Mathematical Literacy at Grades 3, 5 and 7, in Reading at Grades 3, 5, 6,7, and 9 (based on narrow definition of non-IB students), in Narrative Writing at Grades 3, 5, 6, 7 and 8, in Expository Writing at Grades 3, 5, 6, 7 and 9 (based on the narrow definition of non-IB students), and in Scientific Literacy at Grade 7, with small to large differences. On the other hand, non-IB students performed better than IB students in Mathematical Literacy at Grades 8 and 9 (based on the broad definition of non-IB students), and in Reading and Narrative Writing at Grade 9 based on the broad definition of non-IB students.

After taking into account clustering at school level using the multilevel model (Model 1), IB students outperformed non-IB students in Reading at Grade 7 based on the narrow definition of non-IB students, and in Expository Writing at Grade 3, with large differences. After controlling for students' gender and English-Speaking background in the multilevel model (Model 2), IB students outperformed non-IB students in Reading at Grade 7 based on the narrow definition of non-IB students, and in Expository Writing at

Grade 3, with large differences. There were negative effect sizes in Mathematical Literacy Grades 4, 6 and 8 and in Reading and Writing tasks at Grade 4 from the results of both multilevel models. However, these differences were not statistically significant.

Table 23 Comparison of Effect Sizes in the Americas

Domain	Grade	Non-Model				Model 1				Model 2			
		Broad		Narrow		Broad		Narrow		Broad		Narrow	
		Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.
Mathematical Literacy	3	**0.24**	++	**0.24**	++	**0.39**		**0.39**		**0.37**		**0.37**	
	4	0.05		0.05		**-0.27**		**-0.27**		**-0.24**		**-0.24**	
	5	0.14	+	0.14	+	**0.23**		**0.23**		-0.04		-0.04	
	6	-0.07		-0.07		**-0.20**		**-0.20**		-0.18		-0.18	
	7	0.15	+	**0.37**	++	0.13		**0.35**		-0.01		0.18	
	8	**-0.46**	--	**-0.46**	--	**-0.23**		**-0.23**		**-0.26**		**-0.26**	
	9	-0.19	-	0.11		0.02		0.15		-0.09		0.00	
Reading	3	**0.22**	++	**0.22**	++	**0.54**		**0.54**		**0.42**		**0.42**	
	4	0.06		0.06		-0.03		-0.03		**-0.29**		**-0.29**	
	5	**0.34**	++	**0.34**	++	**0.53**		**0.53**		0.16		0.16	
	6	**0.47**	++	**0.47**	++	**0.23**		**0.23**		0.16		0.16	
	7	**0.32**	++	**0.50**	+++	**0.68**		**0.87**	+++	**0.49**		**0.62**	+++
	8	0.17		0.17		**0.31**		**0.31**		0.02		0.02	
	9	**-0.21**	--	0.13	+	**0.39**		**0.59**		**0.27**		**0.36**	
Narrative Writing	3	0.17	+	0.17	+	**0.40**		**0.40**		**0.26**		**0.26**	
	4	-0.03		-0.03		-0.12		-0.12		**-0.41**		**-0.41**	
	5	0.12	+	0.12	+	**0.32**		**0.32**		-0.02		-0.02	
	6	**0.59**	+++	**0.59**	+++	0.18		0.18		0.07		0.07	
	7	**0.22**	++	**0.34**	++	**0.51**		**0.64**		0.16		**0.29**	
	8	**0.24**	++	**0.24**	++	**0.48**		**0.48**		n/a		n/a	
	9	-0.17	-	0.09		0.13		**0.25**		0.07		0.13	
Expository Writing	3	0.18	+	0.18	+	**0.68**	+++	**0.68**	+++	**0.57**	+++	**0.57**	+++
	4	0.07		0.07		**-0.23**		**-0.23**		**-0.47**		**-0.47**	
	5	**0.24**	++	**0.24**	++	**0.45**		**0.45**		0.17		0.17	
	6	**0.63**	+++	**0.63**	+++	**0.39**		**0.39**		**0.32**		**0.32**	
	7	**0.30**	++	**0.44**	++	**0.68**		**0.83**		**0.60**		**0.76**	
	8	0.16		0.16		**0.37**		**0.37**		n/a		n/a	
	9	-0.03		**0.23**	++	**0.33**		**0.47**		**0.25**		**0.32**	
Scientific Literacy	7	**0.53**	+++	**0.86**	+++	**0.77**		**1.09**		0.19		**0.42**	

In summary, the regional analysis of magnitude of effects indicated that there was evidence based on the test of statistical significance and Cohen's *d* that IB students outperformed the non-IB students in the majority of comparison groups in the Middle East (94%), Africa (55%) and the Americas (62%) with small to large differences in effect size. However, only 8% of comparison groups in the Asia-Pacific and 7% of comparison groups in Europe showed IB students significantly outperformed non-IB students with small to medium differences based on Cohen's *d*. After controlling for data clustering at schools, IB students significantly outperformed non-IB students in a smaller number of comparisons, before and after controlling for student characteristics, respectively: in the Middle East (31% and 34%), Africa (11% and 12%) and the Americas (5% and 5%) with medium to large differences, and in Europe (6% and 4%) and Asia-Pacific (3% and 13%) with small to medium differences..

2.2.4 Country Analysis of Student Performance

This section presents the results of country analysis of student performance by region. For country analysis, number of international school students within grades can be quite small in some countries. It is necessary to remove the countries by grade with small sample sizes when comparing ISA performance between IB students and non-IB students. Two data inclusion criteria were used to filter out the IB and non-IB subgroups with small sample sizes. Both the criteria had to be satisfied for data inclusion. The data inclusion criteria is applicable to any subgroup analysis. Despite the data inclusion criteria, samples collected for this study were convenient samples based on schools participating the ISA assessments during 2017-2018 and they were not representative of IB schools and non-IB schools in each country. Therefore cautions must be taken in making inference from the results of this section.

- Criterion 1: For inclusion, there must be at least two schools at a grade level within a subgroup.
- Criterion 2: For inclusion, there must be at least 50 students at a grade level within a subgroup.

A total of 24 countries or economies were included in this analysis: Cambodia, China, Hong Kong SAR, India, Indonesia, Japan, Malaysia, Philippines, Republic of Korea, Singapore, Thailand, and Vietnam in the Asia-Pacific, Germany, Italy, Norway, Spain, Switzerland and United Kingdom in Europe, Oman, Saudi Arabia, and United Arab Emirates in the Middle East, Tanzania in Africa, and Brazil and United States in the Americas. This section presents summarised comparison results for each country. For each country, the summarised results present the number of comparisons where IB schools outperformed non-IB schools, the number of comparisons where non-IB schools outperformed IB schools and the number of non-significant differences. The detailed results of each country can be found in Appendix 5. The number of schools and students in each country are shown in Appendix 6.

Results were reported only for two grade levels (Grades 5 and 7) for Cambodia. In Cambodia, no difference exists in data between the broad definition and the narrow definition of non-IB students. In Cambodia, 8 of the comparisons were made based on the statistical significance test and Cohen's *d*, of which 7 reported no significant differences. IB students outperformed non-IB peers in only 1 comparison, namely in Expository Writing at Grade 5 with medium difference. After taking into account clustering at school level using the multilevel model (Model 1), all 5 comparisons[2] reported no significant differences. Comparing to the results of Model 1, no significant difference was found after controlling students' gender and English-Speaking background in the multilevel model (Model 2).

In China, 32 comparisons were made based on Cohen's *d* for each definition of non-IB students, of which 17 reported no significant differences. IB students outperformed non-IB peers in 7 comparisons, namely in Mathematical Literacy at Grade 8, Reading at Grade 6, Narrative Writing at Grades 6 and 7, and Expository Writing at Grades 6-8, with effect sizes ranged from small to medium. In addition, based on the narrow definition of non-IB students, IB students performed better than non-IB students in Reading at Grade 7 with a small difference. After taking into account clustering at school level using the multilevel model (Model 1), all 32 comparisons reported no significant differences. The comparison results after controlling for students' gender and English-Speaking background in the multilevel model (Model 2) were similar to the results of Model 1. No significant difference was found between the broad definition and narrow definition of non-IB students based on the multilevel models.

Results were reported only for PYP levels for Hong Kong SAR. In Hong Kong SAR, 15 comparisons were made based on Cohen's *d* for each definition of non-IB students. In all these comparisons, non-IB students outperformed IB students with medium to large differences. No significant difference was found between the broad definition and narrow definition of non-IB students. After taking into account clustering at school level using the multilevel model (Model 1), 8 out of 15 comparisons reported no significant differences. Non-IB students outperformed IB students in the other 7 comparisons with medium to large differences,

[2] Comparing to the number of comparison based on Cohen's *d*, 2 comparisons were not applicable to multilevel models due to small ICCs. One additional comparison was not applicable due to failure to converge during model fitting.

namely in Mathematical Literacy and Reading at Grades 3 and 4, and in Narrative Writing at Grades 3-5. After controlling for students' gender and English-Speaking background in the multilevel model (Model 2), 7 out of 15 comparisons reported no significant differences. Non-IB students outperformed IB students in the other 8 comparisons with medium to large differences, namely in Mathematical Literacy at Grades 3 and 4, and in Reading and Narrative Writing at Grades 3-5.

In India, no difference exists in data between the broad definition and the narrow definition of non-IB students. In India, 24 comparisons were made based on Cohen's *d*, of which 11 reported no significant differences. IB students outperformed non-IB peers in 13 comparisons, namely in Mathematical Literacy at Grade 8, Reading at Grades 3-7, Narrative Writing at Grades 4-8 and Expository Writing at Grades 7 and 8, with effect sizes ranged from medium to large. After taking into account clustering at school level using the multilevel model (Model 1), all comparisons reported no significant differences between IB students and non-IB students. Comparing to the results of Model 1, no significant difference was found after controlling for students' gender and English-Speaking background in the multilevel model (Model 2).

In Indonesia, 27 comparisons were made based on Cohen's *d* for each definition of non-IB students, of which 12 reported no significant differences. IB students outperformed non-IB peers in 6 comparisons, namely in Mathematical Literacy at Grade 9, Narrative Writing and Expository Writing at Grades 3 and 4, and Scientific Literacy at Grade 7 with effect sizes ranged from small to large. No significant difference was found between the broad definition and narrow definition of non-IB students. After taking into account clustering at school level using the multilevel model (Model 1), all comparisons reported no significant differences between IB students and non-IB students. After controlling for students' gender and English-Speaking background in the multilevel model (Model 2), all comparisons reported no significant differences. No significant difference was found between the broad definition and narrow definition of non-IB students based on the multilevel models.

In Japan, 28 comparisons were made based on Cohen's *d* for each definition of non-IB students, of which 4 reported no significant differences. IB students outperformed non-IB peers in 5 comparisons, namely in Mathematical Literacy at Grades 6 and 9, in Reading, Narrative Writing and Expository Writing at Grade 9 with effect sizes ranged from medium to large. In addition, based on the narrow definition of non-IB students, IB students performed better than non-IB students in Reading at Grade 6 with a medium difference. After taking into account clustering at school level using the multilevel model (Model 1), all comparisons reported no significant differences based on the broad definition of non-IB students. Based on the narrow definition of non-IB students, IB students outperformed non-IB peers in Mathematical Literacy at Grade 9 with a large difference. After controlling for students' gender and English-Speaking background in the multilevel model (Model 2), IB students still outperformed non-IB peers in Mathematical Literacy at Grade 9 with a large difference based on the narrow definition of non-IB students.

Results were reported only for three PYP grade levels (grades 4-6) for Malaysia. In Malaysia, no difference exists in data between the broad definition and the narrow definition of non-IB students. In Malaysia, 8 comparisons were made based on Cohen's *d*, of which 3 reported no significant differences. Non-IB students outperformed IB students in the other 5 comparisons with medium to large differences, namely in Mathematical Literacy and Reading at Grades 4 and 6, and in Expository Writing at Grade 4. After taking into account clustering at school level using the multilevel model (Model 1), 3 comparisons were made, of which 2 reported no significant differences. Non-IB students outperformed IB students in one comparison with large differences, namely in Expository Writing at Grade 4. Comparing to the results of Model 1, no significant difference was found after controlling for students' gender and English-Speaking background in the multilevel model (Model 2).

Results were reported only for two PYP grade levels (grades 3 and 6) for the Philippines. In the Philippines, no difference exists in data between the broad definition and the narrow definition of non-IB students. Eight comparisons were made based on Cohen's *d*, of which 3 reported no significant differences. IB students outperformed non-IB peers in 5 comparisons, namely in Mathematical Literacy and Expository Writing at Grade 3, Reading at Grades 3 and 6, and Narrative Writing at Grade 6, with effect sizes ranging from

medium to large. After taking into account clustering at school level using the multilevel model (Model 1), all 4 comparisons reported no significant differences. After controlling for students' gender and English-Speaking background in the multilevel model (Model 2), all comparisons reported no significant differences.

Results were reported only for three grade levels (Grades 3, 5 and 8) for the Republic of Korea. In the Republic of Korea, no difference exists in data between the broad definition and the narrow definition of non-IB students. Twelve comparisons were made based on Cohen's *d*, of which 8 reported no significant differences. After taking into account clustering at school level using the multilevel model (Model 1), all 5 comparisons reported no significant differences. Comparing to the results of Model 1, no significant difference was found after controlling for students' gender and English-Speaking background in the multilevel model (Model 2).

In Singapore, no difference exists in data between the broad definition and the narrow definition of non-IB students. Twenty-eight comparisons were made based on Cohen's *d*. Non-IB students outperformed IB students in all comparisons with medium to large differences. After taking into account clustering at school level using the multilevel model (Model 1), 24 comparisons were made, of which 14 reported no significant differences. Non-IB students outperformed IB students in the other 10 comparisons with large differences, namely in Mathematical Literacy at Grades 8 and 9, in Reading at Grades 5-9, in Narrative Writing at Grades 5 and 9, and in Expository Writing at Grade 4. After controlling for students' gender and English-Speaking background in the multilevel model (Model 2), 22 comparisons were made, of which 15 reported no significant differences. Non-IB students outperformed IB students in the other 7 comparisons with medium to large differences, namely in Mathematical Literacy at Grades 8 and 9, in Reading at Grades 5-8, and in Expository Writing at Grade 4.

In Thailand, no difference exists in data between the broad definition and the narrow definition of non-IB students in Grades 3, 4, 5 and 7. The Grade 9 data was only available for the broad definition of non-IB students. In Thailand, 20 of comparisons were made based on Cohen's *d*, of which 10 reported no significant differences. IB students outperformed non-IB peers in 4 comparisons, namely in Mathematical Literacy, Reading and Writing tasks at Grade 9 based on the broad definition of non-IB students, with effect sizes ranging from medium to large. After taking into account clustering at school level using the multilevel model (Model 1), 16 of comparisons were made, of which 15 reported no significant differences. IB students outperformed non-IB peers in 1 comparison, namely in Expository Writing at Grade 5, with large differences. Comparing to the results of Model 1, no significant difference was found after controlling for students' gender and English-Speaking background in the multilevel model (Model 2).

Results were reported only for two PYP grade levels (Grades 3 and 5) for Vietnam. In Vietnam, no difference exists in data between the broad definition and the narrow definition of non-IB students. Eight comparisons were made based on Cohen's *d*, of which 2 reported no significant differences. IB students outperformed non-IB peers in 6 comparisons, namely in Mathematical Literacy at Grade 5, Reading and Expository Writing at Grades 3 and 5, and Narrative Writing at Grade 3, with effect sizes ranging from small to large. After taking into account clustering at school level using the multilevel model (Model 1), 7 out of 8 comparisons reported no significant differences. IB students outperformed non-IB peers in only 1 comparison, namely in Reading at Grade 3 with large difference. After controlling for students' gender and English-Speaking background in the multilevel model (Model 2), 6 out of 8 comparisons reported no significant differences. IB students outperformed non-IB peers in 2 comparisons, namely in Reading at Grade 3 and in Expository Writing at Grade 5 with large differences.

Table 24 summarises the comparison results for each of twelves countries in the Asia-Pacific. It shows the number of comparisons where IB schools outperformed non-IB schools, the number of comparisons where non-IB schools outperformed IB schools and the number of non-significant differences, for each definition of non-IB students ("B" and "N" represents the broad definition and the narrow definition respectively).

Table 24 Summarised Comparison Results by Domain within a Country in Asia-Pacific

Country	Domain	Grade levels Compared	Non-Model						Model 1						Model 2					
			IB Better		Non-IB Better		No Difference		IB Better		Non-IB Better		No Difference		IB Better		Non-IB Better		No Difference	
			B	N	B	N	B	N	B	N	B	N	B	N	B	N	B	N	B	N
Cambodia	Mathematical Literacy	5 and 7	0	0	0	0	2	2	0	0	0	0	2	2	0	0	0	0	2	2
	Reading	5 and 7	0	0	0	0	2	2	0	0	0	0	2	2	0	0	0	0	2	2
	Narrative Writing	5 and 7	0	0	0	0	2	2	0	0	0	0	1	1	0	0	0	0	1	1
	Expository Writing	5 and 7	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
China	Mathematical Literacy	3 to 10	1	1	1	2	6	5	0	0	0	0	8	8	0	0	0	0	8	8
	Reading	3 to 10	1	2	3	3	4	3	0	0	0	0	8	8	0	0	0	0	8	8
	Narrative Writing	3 to 10	2	2	3	3	3	3	0	0	0	0	8	8	0	0	0	0	8	8
	Expository Writing	3 to 10	3	3	1	1	4	4	0	0	0	0	8	8	0	0	0	0	8	8
Hong Kong SAR	Mathematical Literacy	3 to 5	0	0	3	3	0	0	0	0	2	2	1	1	0	0	2	2	1	1
	Reading	3 to 6	0	0	4	4	0	0	0	0	2	3	2	1	0	0	3	3	1	1
	Narrative Writing	3 to 6	0	0	4	4	0	0	0	0	3	3	1	1	0	0	3	3	1	1
	Expository Writing	3 to 6	0	0	4	4	0	0	0	0	0	0	4	4	0	0	0	0	4	4
India	Mathematical Literacy	3 to 8	1	1	0	0	5	5	0	0	0	0	5	5	0	0	0	0	5	5
	Reading	3 to 8	5	5	0	0	1	1	0	0	0	0	6	6	0	0	0	0	6	6
	Narrative Writing	3 to 8	5	5	0	0	1	1	0	0	0	0	5	5	0	0	0	0	5	5
	Expository Writing	3 to 8	2	2	0	0	4	4	0	0	0	0	6	6	0	0	0	0	6	6
Indonesia	Mathematical Literacy	3 to 9	1	1	2	2	4	4	0	0	0	0	7	7	0	0	0	0	6	6
	Reading	3 to 8	0	0	5	5	1	1	0	0	0	0	3	3	0	0	0	0	3	3
	Narrative Writing	3 to 8	2	2	1	1	3	3	0	0	0	0	5	5	0	0	0	0	5	5
	Expository Writing	3 to 8	2	2	1	1	3	3	0	0	0	0	5	5	0	0	0	0	5	5
	Scientific Literacy	7 and 8	1	1	0	0	1	1	0	0	0	0	1	1	0	0	0	0	0	0
Japan	Mathematical Literacy	3 to 9	2	2	5	4	0	1	0	1	0	0	7	6	0	1	0	0	7	6
	Reading	3 to 9	1	2	3	3	3	2	0	0	0	0	7	7	0	0	0	0	7	7
	Narrative Writing	3 to 9	1	1	5	5	1	1	0	0	0	1	7	6	0	0	0	0	7	7
	Expository Writing	3 to 9	1	1	6	6	0	0	0	0	0	1	7	6	0	0	0	1	7	6
Malaysia	Mathematical Literacy	4 to 6	0	0	2	2	1	1	0	0	0	0	2	2	0	0	0	0	2	2
	Reading	4 to 6	0	0	2	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Narrative Writing	4	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Expository Writing	4	0	0	1	1	0	0	0	0	1	1	0	0	0	0	1	1	0	0
Philippines	Mathematical Literacy	3 and 6	1	1	0	0	1	1	0	0	0	0	1	1	0	0	0	0	2	2
	Reading	3 and 6	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Narrative Writing	3 and 6	1	1	0	0	1	1	0	0	0	0	1	1	0	0	0	0	1	1

Country	Domain	Grade levels Compared	Non-Model						Model 1						Model 2					
			IB Better		Non-IB Better		No Difference		IB Better		Non-IB Better		No Difference		IB Better		Non-IB Better		No Difference	
			B	N	B	N	B	N	B	N	B	N	B	N	B	N	B	N	B	N
	Expository Writing	3 and 6	1	1	0	0	1	1	0	0	0	0	2	2	0	0	0	0	2	2
Republic of Korea	Mathematical Literacy	3, 5 and 8	0	0	1	1	2	2	0	0	0	0	0	0	0	0	0	0	0	0
	Reading	3, 5 and 8	0	0	1	1	2	2	0	0	0	0	2	2	0	0	0	0	2	2
	Narrative Writing	3, 5 and 8	0	0	1	1	2	2	0	0	0	0	1	1	0	0	0	0	1	1
	Expository Writing	3, 5 and 8	0	0	1	1	2	2	0	0	0	0	2	2	0	0	0	0	2	2
Singapore	Mathematical Literacy	3 to 9	0	0	7	7	0	0	0	0	2	2	3	3	0	0	2	2	3	3
	Reading	3 to 9	0	0	7	7	0	0	0	0	5	5	2	2	0	0	4	4	2	2
	Narrative Writing	3 to 9	0	0	7	7	0	0	0	0	2	2	4	4	0	0	0	0	5	5
	Expository Writing	3 to 9	0	0	7	7	0	0	0	0	1	1	5	5	0	0	1	1	5	5
Thailand	Mathematical Literacy	3 to 5, 7 and 9	1	0	4	4	0	1	0	0	0	0	4	5	0	0	0	0	4	5
	Reading	3 to 5, 7 and 9	1	0	0	0	4	5	0	0	0	0	4	5	0	0	0	0	4	5
	Narrative Writing	3 to 5, 7 and 9	1	0	2	2	2	3	0	0	0	0	4	5	0	0	0	0	4	5
	Expository Writing	3 to 5, 7 and 9	1	0	0	0	4	5	1	1	0	0	3	4	1	1	0	0	3	4
Vietnam	Mathematical Literacy	3 and 5	1	1	0	0	1	1	0	0	0	0	2	2	0	0	0	0	2	2
	Reading	3 and 5	2	2	0	0	0	0	1	1	0	0	1	1	1	1	0	0	1	1
	Narrative Writing	3 and 5	1	1	0	0	1	1	0	0	0	0	2	2	0	0	0	0	2	2
	Expository Writing	3 and 5	2	2	0	0	0	0	0	0	0	0	2	2	1	1	0	0	1	1

In Germany, no difference exists in data between the broad definition and the narrow definition of non-IB students. Thirty-two comparisons were made based on Cohen's *d*, of which 8 reported no significant differences. IB students outperformed non-IB peers in 24 comparisons, namely in Mathematical Literacy and Narrative Writing at Grade 3 and Grades5-9, Reading at Grades 3-9, and Expository Writing at Grades 5-9, with effect sizes ranging from small to large. After taking into account clustering at school level using the multilevel model (Model 1), 29 comparisons were made, of which 21 reported no significant differences. IB students outperformed non-IB peers in 8 comparisons, namely in Mathematical Literacy and Expository Writing at Grades 5 and 6, Reading at Grades 5, 7 and 9, and Narrative Writing at Grade 5, with effect sizes ranging from medium to large. After controlling for students' gender and English-Speaking background in the multilevel model (Model 2), 23 out of 29 comparisons reported no significant differences. IB students outperformed non-IB peers in 6 comparisons, namely in Mathematical Literacy and Expository Writing at Grades 5 and 6, Reading and Narrative Writing at Grade 5, with effect sizes ranging from medium to large.

In Italy, no difference exists in data between the broad definition and the narrow definition of non-IB students. Twenty-four comparisons were made based on Cohen's *d*, of which 9 reported no significant differences. IB students outperformed non-IB peers in 14 comparisons, namely in Mathematical Literacy at Grades 3-5, Reading at Grades 5, 7 and 9, Narrative Writing and Expository Writing at Grades 3, 5, 7 and 9, with effect sizes ranging from medium to large. After taking into account clustering at school level using the multilevel model (Model 1), 13 comparisons were made, of which 12 reported no significant differences. IB students outperformed non-IB peers in 1 comparison, namely in Reading at Grade 9 with

large differences. After controlling for students' gender and English-Speaking background in the multilevel model (Model 2), all comparisons reported no significant differences.

Results were reported only for three PYP grade levels (Grades 3, 5 and 6) for Norway. In Norway, no difference exists in data between the broad definition and the narrow definition of non-IB students. In Norway, 8 comparisons were made based on Cohen's *d*, of which 1 reported no significant difference. Non-IB students outperformed IB students in the other 7 comparisons with medium to large differences, namely in Mathematical Literacy and Reading at Grades 3, 5 and 6, and in Expository Writing at Grade 6. After taking into account clustering at school level using the multilevel model (Model 1), 6 comparisons were made, of which 5 reported no significant differences. Non-IB students outperformed IB students in only one comparisons with large differences, namely in Mathematical Literacy at Grade 6. After controlling for students' gender and English-Speaking background in the multilevel model (Model 2), all 5 comparisons reported no significant differences.

Results were reported only for three PYP grade levels (Grades 3, 5 and 6) for Spain. In Spain, no difference exists in data between the broad definition and the narrow definition of non-IB students. Ten comparisons were made based on Cohen's d. IB students outperformed non-IB peers in all comparisons, namely in Mathematical Literacy and Reading at Grades 3, 5 and 6, Narrative Writing and Expository Writing at Grades 3 and 5 with large differences. After taking into account clustering at school level using the multilevel model (Model 1), 5 out of 10 comparisons reported no significant differences. IB students outperformed non-IB peers in 5 comparisons, namely in Mathematical Literacy at Grades 3 and 5, Reading and Writing tasks at Grade 3 with large differences. Comparing to the results of Model 1, no significant difference was found after controlling for students' gender and English-Speaking background in the multilevel model (Model 2).

In Switzerland, no difference exists in data between the broad definition and the narrow definition of non-IB students except at Grade 5. No significant difference was found between the broad definition and narrow definition of non-IB students at grade 5. Thirty-two comparisons were made based on Cohen's *d*, of which 18 reported no significant differences. Non-IB students outperformed IB students in the other 14 comparisons with small to large differences, namely in Mathematical Literacy at Grades 3-8, in Reading at Grade 3, in Narrative Writing at Grades 3 and 5, and in Expository Writing at Grades 3-6. After taking into account clustering at school level using the multilevel model (Model 1), 31 comparisons were made, of which 25 reported no significant differences. Non-IB students outperformed IB students in the other 6 comparisons with medium to large differences, namely in Mathematical Literacy at Grades 3, 5 and 8, in Reading at Grade 10, and in Expository Writing at Grades 3 and 4. Comparing to the results of Model 1, no significant difference was found after controlling for students' gender and English-Speaking background in the multilevel model (Model 2).

Results were reported only for one MYP grade level (Grade 8) in the United Kingdom. No difference exists in data between the broad definition and the narrow definition of non-IB students. Four comparisons were made based on Cohen's *d*, of which 4 reported no significant differences. Multilevel models were not applicable due to small ICCs.

Table 25 summarises the comparison results for each of six countries in Europe.

Table 25 Summarise Comparison Results by Domain within a Country in Europe

Country	Domain	Grade levels Compared	Non-Model						Model 1						Model 2					
			IB Better		Non-IB Better		No Difference		IB Better		Non-IB Better		No Difference		IB Better		Non-IB Better		No Difference	
			B	N	B	N	B	N	B	N	B	N	B	N	B	N	B	N	B	N
Germany	Mathematical Literacy	3 to 10	6	6	0	0	2	2	2	2	0	0	6	6	2	2	0	0	6	6
	Reading	3 to 10	7	7	0	0	1	1	3	3	0	0	4	4	1	1	0	0	6	6

Country	Domain	Grade levels Compared	Non-Model						Model 1						Model 2					
			IB Better		Non-IB Better		No Difference		IB Better		Non-IB Better		No Difference		IB Better		Non-IB Better		No Difference	
			B	N	B	N	B	N	B	N	B	N	B	N	B	N	B	N	B	N
	Narrative Writing	3 to 10	6	6	0	0	2	2	1	1	0	0	6	6	1	1	0	0	6	6
	Expository Writing	3 to 10	5	5	0	0	3	3	2	2	0	0	5	5	2	2	0	0	5	5
Italy	Mathematical Literacy	3 to 7, and 9	3	3	0	0	3	3	0	0	0	0	3	3	0	0	0	0	3	3
	Reading	3 to 7, and 9	3	3	0	0	3	3	1	1	0	0	1	1	0	0	0	0	1	1
	Narrative Writing	3 to 7, and 9	4	4	1	1	1	1	0	0	0	0	4	4	0	0	0	0	4	4
	Expository Writing	3 to 7, and 9	4	4	0	0	2	2	0	0	0	0	4	4	0	0	0	0	4	4
Norway	Mathematical Literacy	3, 5 and 6	0	0	3	3	0	0	0	0	1	1	2	2	0	0	0	0	3	3
	Reading	3, 5 and 6	0	0	3	3	0	0	0	0	0	0	2	2	0	0	0	0	1	1
	Narrative Writing	6	0	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0	1	1
	Expository Writing	6	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spain	Mathematical Literacy	3, 5 and 6	3	3	0	0	0	0	2	2	0	0	1	1	2	2	0	0	1	1
	Reading	3, 5 and 6	3	3	0	0	0	0	1	1	0	0	2	2	1	1	0	0	2	2
	Narrative Writing	3 and 5	2	2	0	0	0	0	1	1	0	0	1	1	1	1	0	0	1	1
	Expository Writing	3 and 5	2	2	0	0	0	0	1	1	0	0	1	1	1	1	0	0	1	1
Switzerland	Mathematical Literacy	3 to 10	0	0	6	6	2	2	0	0	3	3	5	5	0	0	3	3	5	5
	Reading	3 to 10	0	0	1	1	7	7	0	0	1	1	7	7	0	0	1	1	7	7
	Narrative Writing	3 to 10	0	0	2	2	6	6	0	0	0	0	7	7	0	0	0	0	7	7
	Expository Writing	3 to 10	0	0	5	5	3	3	0	0	2	2	6	6	0	0	2	2	6	6
United Kingdom	Mathematical Literacy	8	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Reading	8	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Narrative Writing	8	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Expository Writing	8	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0

Results were reported for only three PYP grade levels (Grades 3-5) for Oman. In Oman, no difference exists in data between the broad definition and the narrow definition of non-IB students. Twelve comparisons were made based on Cohen's *d*, of which 5 reported no significant differences. IB students outperformed non-IB peers in 5 comparisons, namely in Mathematical Literacy and Writing tasks at Grade 5, and Reading at Grades 4 and 5, with effect sizes ranging from medium to large. After taking into account clustering at school level using the multilevel model (Model 1), 5 comparisons were made, of which 2 reported no significant differences. After controlling for students' gender and English-Speaking background in the multilevel model (Model 2), 1 out of 3 comparisons reported no significant differences.

Results were reported for only three PYP grade levels (Grades 3, 5 and 6) for Saudi Arabia. In Saudi Arabia, no difference exists in data between the broad definition and the narrow definition of non-IB students. Six comparisons were made based on Cohen's *d*, of which 1 reported no significant difference. IB students outperformed non-IB peers in 4 comparisons, namely in Mathematical Literacy at Grade 6 and Reading at Grades 3, 5 and 6 with effect sizes ranging from medium to large. After taking into account clustering at school level using the multilevel model (Model 1), all 5 comparisons reported no significant differences.

Comparing to the results of Model 1, no significant difference was found after controlling for students' gender and English-Speaking background in the multilevel model (Model 2).

In the United Arab Emirates, 21 comparisons were made based on Cohen's *d* for each definition of non-IB students. IB students outperformed non-IB peers in all comparisons, namely in Mathematical Literacy and Reading at Grades 3-9, Narrative Writing and Expository Writing at Grades 5 and 6, and Scientific Literacy at Grades 7-9, with effect sizes ranging from small to large. Comparing to the results based on the broad definition of non-IB students, IB students outperformed non-IB students in Mathematical Literacy at Grade 7 with a medium effect size based on the narrow definition of non-IB students. After taking into account clustering at school level using the multilevel model (Model 1), 21 comparisons were made, of which 19 reported no significant differences. IB students outperformed non-IB peers in 2 comparisons, namely in Reading and Expository Writing at Grade 5 with large differences. Comparing to the results of Model 1, no significant difference was found after controlling for students' gender and English-Speaking background in the multilevel model (Model 2). No significant difference was found between the broad definition and narrow definition of non-IB students based on the multilevel models.

Results were reported for only one PYP grade level (Grade 3) for Tanzania. In Tanzania, no difference exists in data between the broad definition and the narrow definition of non-IB students. Four comparisons were made based on Cohen's *d*, of which 3 reported no significant differences. IB students outperformed non-IB peers in only 1 comparison, namely in Reading at Grade 3 with medium difference. After taking into account clustering at school level using the multilevel model (Model 1), 3 comparisons were made, of which 2 reported no significant differences. After controlling for students' gender and English-Speaking background in the multilevel model (Model 2), 1 out of 2 comparisons reported no significant differences.

Results were reported for only one PYP grade level (grades 3) for Brazil. In Brazil, no difference exists in data between the broad definition and the narrow definition of non-IB students. In Brazil, 4 comparisons were made based on Cohen's *d*, of which 1 reported no significant difference. After taking into account clustering at school level using the multilevel model (Model 1), 3 comparisons were made, of which all reported no significant differences. Comparing to the results of Model 1, no significant difference was found after controlling for students' gender and English-Speaking background in the multilevel model (Model 2).

Results were reported for only three PYP grade levels (Grades 3-5) for the United States. In the United States, no difference exists in data between the broad definition and the narrow definition of non-IB students. Twelve comparisons were made based on Cohen's *d*, of which 10 reported no significant differences. IB students outperformed non-IB peers in only 1 comparison, namely in Expository Writing at Grade 3 with a small difference. After taking into account clustering at school level using the multilevel model (Model 1), 10 comparisons were made, of which all comparisons reported no significant differences. After controlling for students' gender and English-Speaking background in the multilevel model (Model 2), no comparison reported significant differences.

Table 26 summarises the comparison results for each of six countries in the Middle East, Africa and the Americas.

Table 26 Summarise Comparison Results by Domain within a Country in the Middle East, Africa and Americas

Country	Domain	Grade levels Compared	Non-Model						Model 1						Model 2					
			IB Better		Non-IB Better		No Difference		IB Better		Non-IB Better		No Difference		IB Better		Non-IB Better		No Difference	
			B	N	B	N	B	N	B	N	B	N	B	N	B	N	B	N	B	N
Oman	Mathematical Literacy	3 to 5	1	1	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0
	Reading	3 to 5	2	2	0	0	1	1	0	0	1	1	1	1	0	0	0	0	1	1

Country	Domain	Grade levels Compared	Non-Model						Model 1						Model 2					
			IB Better		Non-IB Better		No Difference		IB Better		Non-IB Better		No Difference		IB Better		Non-IB Better		No Difference	
			B	N	B	N	B	N	B	N	B	N	B	N	B	N	B	N	B	N
	Narrative Writing	3 to 5	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Expository Writing	3 to 5	1	1	1	1	1	1	0	0	2	2	1	1	0	0	2	2	0	0
Saudi Arabia	Mathematical Literacy	3, 5 and 6	1	1	1	1	1	1	0	0	0	0	3	3	0	0	0	0	3	3
	Reading	3, 5 and 6	3	3	0	0	0	0	0	0	0	0	2	2	0	0	0	0	2	2
United Arab Emirates	Mathematical Literacy	3 to 9	7	7	0	0	0	0	0	0	0	0	7	7	0	0	0	0	7	7
	Reading	3 to 9	7	7	0	0	0	0	1	1	0	0	6	6	1	1	0	0	6	6
	Narrative Writing	5 and 6	2	2	0	0	0	0	0	0	0	0	2	2	0	0	0	0	2	2
	Expository Writing	5 and 6	2	2	0	0	0	0	1	1	0	0	1	1	1	1	0	0	1	1
	Scientific Literacy	7 to 9	3	3	0	0	0	0	0	0	0	0	3	3	0	0	0	0	3	3
Tanzania	Mathematical Literacy	3	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Reading	3	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
	Narrative Writing	3	0	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0	1	1
	Expository Writing	3	0	0	0	0	1	1	0	0	1	1	0	0	0	0	1	1	0	0
Brazil	Mathematical Literacy	3	0	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0	1	1
	Reading	3	0	0	1	1	0	0	0	0	0	0	1	1	0	0	0	0	1	1
	Narrative Writing	3	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Expository Writing	3	0	0	1	1	0	0	0	0	0	0	1	1	0	0	0	0	1	1
United States	Mathematical Literacy	3 to 5	0	0	1	1	2	2	0	0	0	0	1	1	0	0	0	0	0	0
	Reading	3 to 5	0	0	0	0	3	3	0	0	0	0	3	3	0	0	0	0	1	1
	Narrative Writing	3 to 5	0	0	0	0	3	3	0	0	0	0	3	3	0	0	0	0	0	0
	Expository Writing	3 to 5	1	1	0	0	2	2	0	0	0	0	3	3	0	0	0	0	0	0

2.3 How do the Grades 9 and 10 ISA scores of IB students align with PISA benchmarks?

In order to examine how the grades 9 and 10 IB students compared with PISA results, the IB students' ISA results were compared with PISA means. Because all ISA tests were equated, all tests could be compared between grades and across calendar years within a tested domain. Only Mathematical Literacy, Reading and Scientific Literacy results were used for this analysis as there was no comparable PISA result for writing tasks. Multilevel modelling was not applicable because PISA data was not available for multilevel modelling.

Table 27 lists the Grade 9 and Grade 10 IB student performance in Mathematical Literacy, Reading and Scientific Literacy aggregated during 2017-2018. The results showed that ISA means were all significantly higher than the PISA 2015 means (OECD, 2016) in both Mathematical Literacy, Reading and Scientific Literacy. The effect sizes in all three domains were large. The effect sizes in Mathematical Literacy were 1.11 at grade 9 and 1.32 at grade 10. The effect sizes in Reading were slightly smaller on average compared to the effect sizes of Mathematical Literacy and they were 0.58 at grade 9 and 0.78 at grade 10. The effect sizes in Scientific Literacy were similar to the effect sizes of Mathematical Literacy and they were 1.10 at grade 9 and 1.46 at grade 10. The results are not surprising because PISA results were based on performance of representative samples from all types of schools from each participating country.

Figure 1 to Figure 3 represent the grade 9 and grade 10 IB student performance distributions together with OECD countries and partner countries' PISA performance for Mathematical Literacy, Reading and Scientific Literacy, respectively. Each bar shows the performance range of between 5th to 95th percentiles. The mean scores are also presented on the graph as a horizontal line.

Table 27 IB Schools Grade 9 and Grade 10 Student Performance in Mathematical Literacy, Reading and Scientific Literacy Relative to OECD PISA Performance

Domain	Grade Level	IB			Effect Size	Sig. of Diff.
		N	Mean	S.D.		
Mathematical Literacy	9	7,067	587	87	1.11	+++
	10	3,481	604	83	1.32	+++
Reading	9	7,132	545	82	0.58	+++
	10	3,450	563	83	0.78	+++
Scientific Literacy	9	1,811	592	84	1.10	+++
	10	1,118	624	85	1.46	+++

* Effect Size was calculated using OECD PISA 2015 results (mean =490, S.D..=89 for Mathematics, Mean=493, S.D.=96 for Reading, and Mean=493, S.D.=94 for Science), OECD (2016)

In Mathematics, the average PISA scores of OECD countries were in the range 408 to 532, and the average PISA scores of partner countries were in the range 328 to 564, OECD (2016). The IB grade 9 and grade 10 average scores were 587 and 604, respectively. Figure 1 shows that the average performance of IB students in both Grade 9 and Grade 10 were above the OECD mean, and above average performance of all the countries that participated in PISA Mathematics.

In Reading, the average scale scores of OECD countries were in the range of 423 to 537, and the average PISA scores of partner countries were in the range of 347 to 536. As the average scale scores of IB students were 545 and 563 in grade 9 and 10, respectively,

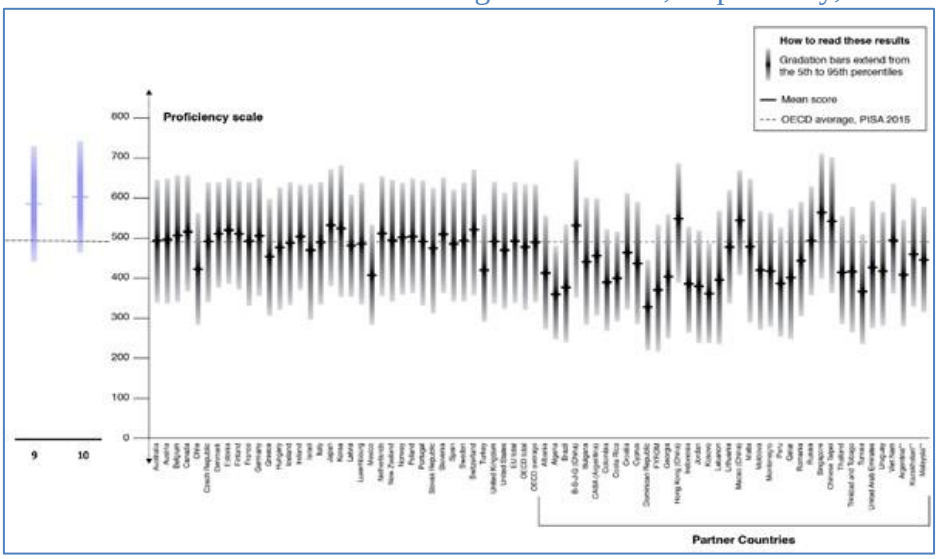


Figure 2 shows that the average performance of IB students was above the average performance of all the countries that participated in PISA Reading.

In Scientific Literacy, the average scale scores of OECD countries were in the range 416 to 538, and the average PISA scores of partner countries were in the range 332 to 556. The average scale scores of IB students were 592 and 624 in grade 9 and 10, respectively. Figure 3 clearly shows that the average performance of IB students was above all of the PISA countries' means.

Figure 1 IB Schools Grade 9 and Grade 10 Performance in Mathematical Literacy

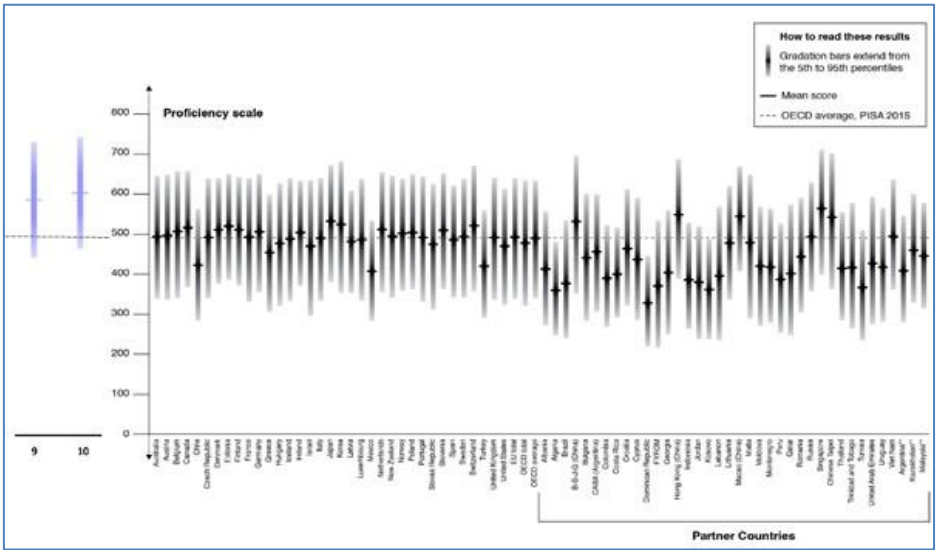


Figure 2 IB Schools Grade 9 and Grade 10 Performance in Reading

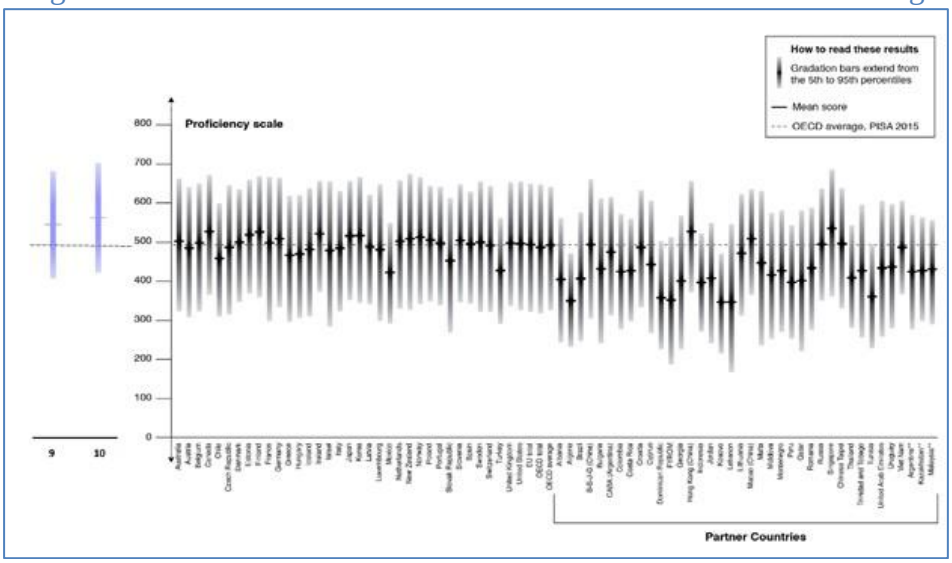
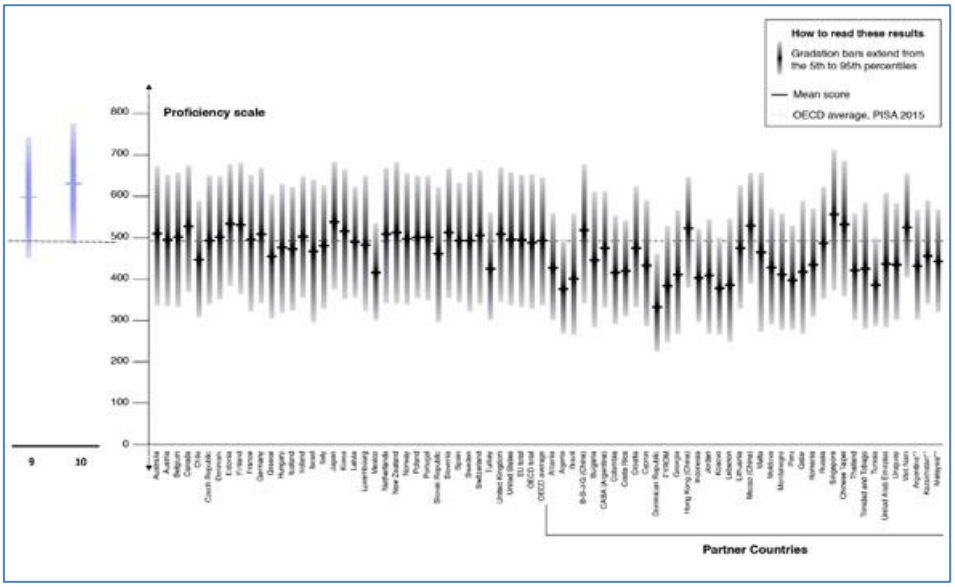


Figure 3 IB Schools Grade 9 and Grade 10 Performance in Scientific Literacy



2.4 Effect of the Length of IB Authorization

The length of IB school authorization may influence performance of IB students. In order to consider the hierarchical nature of the data with students nested within schools, multilevel models (or hierarchical linear models) were used in the investigation of the effects of length of IB school authorization on performance. Two-level multilevel models were fitted by domain and grade to IB schools data. The results of multilevel modelling would inform whether the length of IB authorization for PYP and for MYP has statistically significant effect. The specifications of multilevel models are shown as below:

Model 1:

Level-1: $Y_{ij}=\beta_{0j}+e_{tij}$

Level-2: $\beta_{0j}=\gamma_{00}+\gamma_{01}*(IB\_Length_j)+\mu_{0j}$

Model 2:

Level-1: $Y_{ij}=\beta_{0j}+\beta_{1j}*(Female_{ij})+\beta_{2j}*(ESB_{ij})+e_{tij}$

Level-2: $\beta_{0j}=\gamma_{00}+\gamma_{01}*(IB\_Length_j)+\mu_{0j}$

$\beta_{1j}=\gamma_{10}$

$\beta_{2j}=\gamma_{20}$

where IB_length_j is the length (in years) of IB authorization of school *j*.

In the first multilevel model (Model 1), Level 1 is the student-level model, and Level 2 is the school-level model. Y_{ij} represents the performance outcome (ISA domain score) of student *i* in school *j* on one of the five domains. At Level 2, IB_Length_j is the length (in years) of IB authorization of school *j*. The school-level adjusted mean β_{0j} is regressed on IB_Length_j to estimate the effect of length of IB authorization.

In the second multilevel model (Model 2), the outcome variable Y_{ij} is also regressed on students' gender (Female) and language background (ESB) at Level 1. At Level 2, the school-level adjusted mean β_{0j}, after controlling for gender and language background effects, is regressed on IB_Length_j to estimate the effect of length of IB authorization. These analyses were undertaken with SPSS Mixed procedure (SPSS, 2005). A total of 72 models were fitted.

Table 28 shows the effects of length of IB authorization on school performance. After taking into account data clustering (Model 1), for every additional year of PYP authorization there is a half-unit to two-unit increase in school performance for Mathematical Literacy except for Grade 3, six-unit to nine-unit increase for Reading, three-unit to four-unit increase for Expository Writing, and less than a half-unit increase for Narrative Writing at Grade 6. After further controlling for student characteristics (i.e. gender and English-speaking background) in the multilevel models (Model 2), the effects of IB authorization get slightly smaller for Reading, with the magnitude of the changes being less than a half-unit. In both multilevel models, for every additional year of PYP authorization, there is a less than one-unit decrease in Mathematical Literacy at Grade 3 and in Narrative Writing at Grades 4 and 5. The length of PYP authorization was found to have no statistically significant effect in Narrative Writing at Grade 6.

For every additional year of MYP authorization, after taking into account data clustering (Model 1), there is a two-unit to four-unit increase in school performance for Mathematical Literacy, one-unit to six-unit increase for Reading, two-unit to four-unit increase for Expository Writing, one-unit increase for Narrative Writing at Grade 10, and one-unit to four-unit increase for Scientific Literacy at Grades 7-9. After further controlling for student characteristics (i.e. gender and English-speaking background) in the multilevel models (Model 2), the effects of IB authorization get slightly smaller in Reading and Expository Writing, in Narrative Writing at Grade 10 and in Scientific Literacy at Grade 8, but the effects get slightly larger in Scientific Literacy Grades 9 and 10. The magnitude of these changes was less than one unit. The length of MYP authorization was found to have no statistically significant effect for Narrative Writing at Grades 7-9, Scientific Literacy at Grade 10, and Reading at Grade 10 (only based on the Model 2 results).

Table 28 Effect of Length of IB Authorization on ISA Performance

Domain	Grade	Model 1			Model 2		
		Slope (Length of IB Authorization)	SE	p Value	Slope (Length of IB Authorization)	SE	p Value
Mathematical Literacy	3	-0.7	0.2	0.00	-0.8	0.2	0.00
	4	0.5	0.3	0.03	0.6	0.3	0.03
	5	2.2	0.2	0.00	2.2	0.2	0.00
	6	1.8	0.3	0.00	1.8	0.3	0.00
	7	1.9	0.2	0.00	1.9	0.2	0.00
	8	3.5	0.3	0.00	3.5	0.3	0.00
	9	4.3	0.3	0.00	4.4	0.3	0.00
	10	3.7	0.4	0.00	3.8	0.4	0.00
Reading	3	8.7	0.2	0.00	8.4	0.2	0.00
	4	5.6	0.3	0.00	5.4	0.3	0.00
	5	6.8	0.2	0.00	6.4	0.2	0.00
	6	5.6	0.3	0.00	5.1	0.3	0.00
	7	6.0	0.3	0.00	5.5	0.3	0.00
	8	5.7	0.3	0.00	5.2	0.3	0.00
	9	2.8	0.3	0.00	2.5	0.2	0.00
	10	1.0	0.4	0.01	0.6	0.4	0.10
Narrative Writing	3	-0.2	0.1	0.25	-0.2	0.1	0.20
	4	-0.4	0.2	0.04	-0.3	0.2	0.05
	5	-0.9	0.2	0.00	-0.9	0.2	0.00
	6	0.3	0.2	0.12	0.4	0.2	0.08
	7	-0.2	0.2	0.35	-0.3	0.2	0.15
	8	0.3	0.2	0.23	0.2	0.2	0.34
	9	-0.1	0.2	0.77	0.0	0.2	0.87
	10	1.0	0.3	0.00	0.7	0.3	0.02
Expository Writing	3	3.3	0.1	0.00	3.3	0.1	0.00
	4	3.3	0.2	0.00	3.3	0.2	0.00
	5	3.5	0.1	0.00	3.5	0.1	0.00
	6	4.1	0.2	0.00	4.1	0.2	0.00
	7	2.8	0.2	0.00	2.7	0.2	0.00
	8	4.0	0.2	0.00	3.8	0.2	0.00
	9	2.4	0.2	0.00	2.3	0.2	0.00
	10	2.1	0.3	0.00	1.7	0.3	0.00
Scientific Literacy	7	2.6	0.9	0.01	2.6	0.9	0.00
	8	1.5	0.6	0.01	1.3	0.6	0.02
	9	4.2	1.1	0.00	4.8	1.1	0.00
	10	-0.3	0.9	0.78	0.1	0.9	0.88

In summary, the multilevel analysis was conducted to evaluate the effects of length of IB authorization on school performance. The multilevel analysis indicated that there was some evidence to support that positive effects of length of IB authorization existed on school performance in Mathematical Literacy, Reading, Expository Writing and Scientific Literacy.

CONCLUSION

This investigation on ISA assessment data in 2017-18 and 2018-19 indicated that there was evidence that at a global level analysis, PYP and MYP students generally performed better than students from non-IB schools in the ISA assessment areas at many grade levels, based on the Cohen's *d*. After taking into account clustering at school level using the multilevel models, there are a smaller number of significant differences between IB and non-IB students from the results of multilevel models compared to the results based on the Cohen's *d*. The effect sizes between the two definitions of non-IB students were also mostly similar for each multilevel model. The multilevel modelling of student performance among PYP and MYP students showed evidence that, on a global level, the PYP and the MYP students performed better than students from non-IB schools in the ISA assessment areas at a number of grade levels. The difference in Expository Writing was significant at Grades 3, 5, 7 and 9 with effect sizes > 0.20, whereas the difference in Scientific Literacy was significant at Grades 9 and 10 with effect sizes > 0.35. In addition, IB students outperformed non-IB students in Reading at Grades 3, 5 and 9 with effect sizes > 0.2, in Narrative Writing at Grades 3, 5, 7 and 9 with effect sizes > 0.1, in Mathematical Literacy at Grade 9 with effect sizes > 0.2. There was no evidence to indicate IB students did not perform well in comparison to the non-IB students.

The regional analysis of magnitude of effects indicated that there was evidence based on Cohen's *d* that IB students outperformed the non-IB students in majority of comparison groups in the Middle East (94%), Africa (55%) and the Americas (62%) with small to large differences in effect size. However, only 8% of comparison groups in the Asia-Pacific and 7% of comparison groups in Europe showed IB students significantly outperformed non-IB students with small to medium differences based on Cohen's *d*. After controlling for data clustering at schools, IB students significantly outperformed non-IB students in a smaller number of comparisons before and after controlling for student characteristics, respectively: in the Middle East (31% and 34%), Africa (11% and 12%) and the Americas (5% and 5%) with medium to large differences, and in Europe (6% and 4%) and Asia-pacific (3% and 13%) with small to medium differences..

The sub-strands analysis found that, after controlling for data clustering at schools with or without controlling for student characteristics, IB students performed better than non-IB students for all five domains in all sub-strands at Grade 9 (except for the broad definition of non-IB students in Model 1 of Mathematical Literacy), with mostly small to medium differences. In Mathematical Literacy, IB students outperformed non-IB students in Space and Shape at Grades 3, 5 and 9, in Uncertainty and Data at Grades 5 and 9, with small to medium differences. In Reading, IB students outperformed non-IB students in all sub-strands at Grades 3, 5 and 9 with small to medium differences and in Reflect and Evaluate with small differences. In Narrative Writing, IB students outperformed non-IB students in the Content criterion and in Language at Grades 3, 5, 7 and 9; and in Spelling at Grades 3 and 9. In Expository Writing, IB students outperformed non-IB students in Content and in Structure and Organisation at Grades 3, 5, 7, 8 and 9; and in Language at Grades 3, 5, 7 and 9. In Scientific Literacy, IB students performed better than non-IB students in Evaluate and design scientific enquiry at Grades 7, 9 and 10, in Explain phenomena scientifically at Grade 10, and in Interpret data and evidence scientifically at Grades 9 and 10, with medium to large effect sizes. However, non-IB students outperformed IB students in sub-strands of Mathematical Literacy, Reading and in the language criteria of Narrative Writing at Grade 10, with small to medium differences based on Cohen's *d*. However, these differences were not statistically significant based on the results of multilevel modelling.

The multilevel analysis was conducted to evaluate the effects of length of IB authorization on school performance. The multilevel analysis indicated that there was some evidence to support that positive effects of length of IB authorization existed on school performance in Mathematical Literacy, Reading, Expository Writing and Scientific Literacy. For every additional year of PYP authorization there is a half-unit to two-unit increase in school performance in Mathematical Literacy except for Grade 3, six to nine-unit increase in Reading, three to four-unit increase in Expository Writing, and less than a half-unit increase in Narrative Writing at Grade 6. For every additional year of MYP authorization, there is a two to four-unit increase in school performance in Mathematical Literacy, one-unit to six-unit increase in Reading, two-unit to four-unit increase in Expository Writing, one-unit increase in Narrative Writing at Grade 10, and one-unit to

four-unit increase in Scientific Literacy at Grades 7 to 9. After further controlling for student characteristics (i.e. gender and English-speaking background) in the multilevel models, the effects of IB authorization can get slightly smaller by less than one unit.

This investigation was conducted with limited background information about schools and students. ISA performance data were not census data, and schools participating in each country were not a random sample. Caution must be exercised in drawing conclusions from these results. As schools can choose to participate ISA assessments, the results of this study were only applicable to the sample of schools that participated. In the comparison of the outcomes of students, cohort performances or country performances, there were many other factors, such as students' socio- economic backgrounds, school size, school type, the numbers and qualifications of teachers in a school, sources of funding and any selective enrolment policies among others that may influence student performance to some extent. No data concerning these factors were collected and therefore were not available to this analysis.

REFERENCES

ACER (2017). *Guide to ISA Reports for October 2017 Administration, Appendix 5 Explanation of Terms*. Melbourne: The Australian Council *for* Educational Research.

Adams, R.J, Wu, M.L, and Wilson, M.R. (2015). *ConQuest 4*. [computer program] Camberwell: Australian Council for Educational Research.

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences*. Routledge.

Hallberg, K., Williams, R., Swanlund, A., and Eno, J. (2018). Short Comparative Interrupted Time Series Using Aggregate School-Level Data in Education Research. *Educational Researcher* 47(5), 295–306

Hox, J. J. (2010). *Multilevel analysis: Techniques and applications*. Great Britain: Routledge.

Lorah, J. (2018). Effect size measures for multilevel models: Definition, interpretation, and TIMSS example. *Large-Scale Assessments in Education*, 6(8).

Muthén, B. O. and Satorra, A. (1995). Complex sample data in structural equation modeling. *Sociological Methodology*, 25, 267-316.

OECD (2016). *PISA 2015 Results (Volume I), Excellence and Equity in Education*, Paris: Organisation for Economic Co-operation and Development.

Rasch, G (1980). *Probabilistic Models for Some Intelligence and Attainment Tests*. Chicago: MESA Press (original work published 1960).

Snijders, T. A. B., & Bosker, R. J. (2012). *Multilevel analysis: An introduction to basic and advanced multilevel modeling*. Thousand Oaks: Sage Publishing.

Somers, M., Zhu, P., Jacob, R., Bloom, H. (2013). The Validity and Precision of the Comparative Interrupted Time Series Design and the Difference-in-Difference Design in Educational Evaluation. Working Paper: Manpower Demonstration Research Corporation.

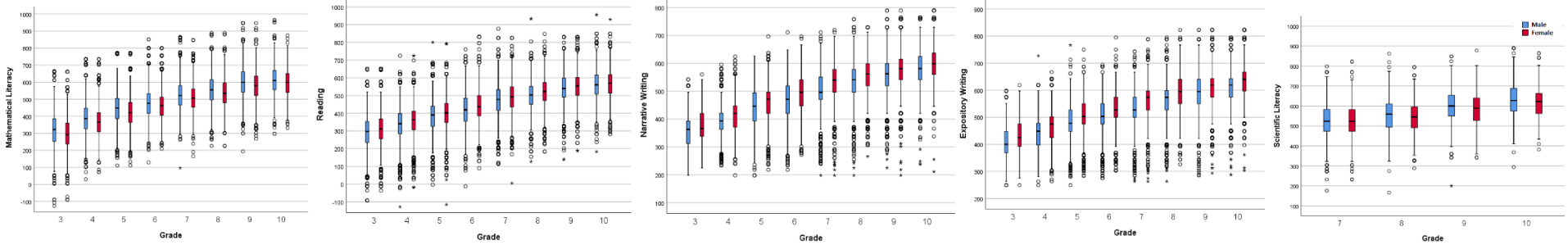
SPSS (2005). Linear Mixed-Effects Modeling in SPSS: An Introduction to the MIXED Procedure. Technical Report.

Tan, L. & Bibby, Y. (2010). *IB PYP and MYP student performance on the International Schools' Assessment (ISA)*. Melbourne: Australian Council *for* Educational Research.

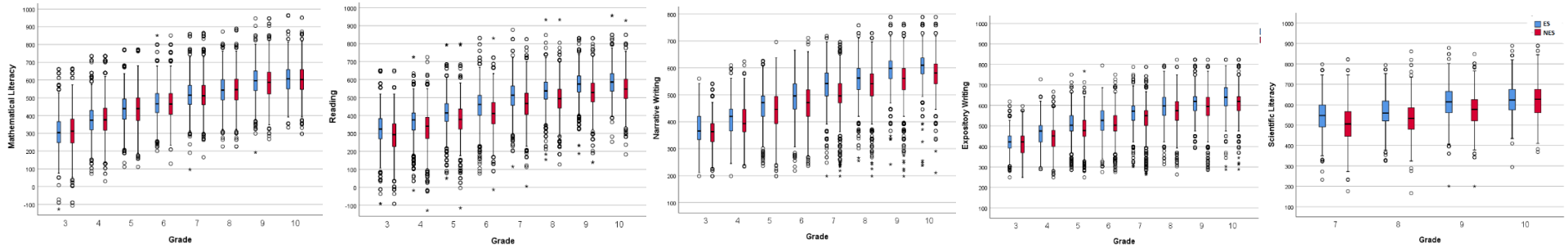
Tan, L. & Bibby, Y. (2011). *IB PYP and MYP student performance on the International Schools' Assessment (ISA)*. Melbourne: Australian Council *for* Educational Research.

Appendix 1: Boxplots of Non-modelled Performance of IB Students and Non-IB students by Gender and by English-Speaking Background

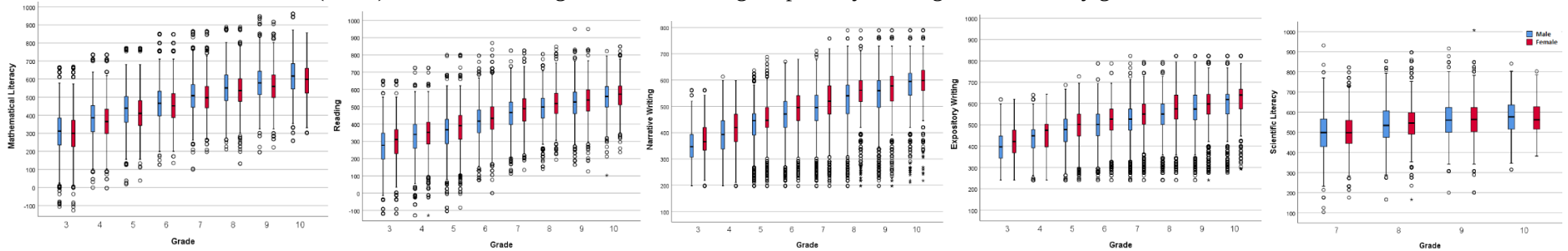
Performance of IB students in Maths, Reading, Narrative Writing, Expository Writing and Science by gender. Red color represents female students and blue color represents male students.



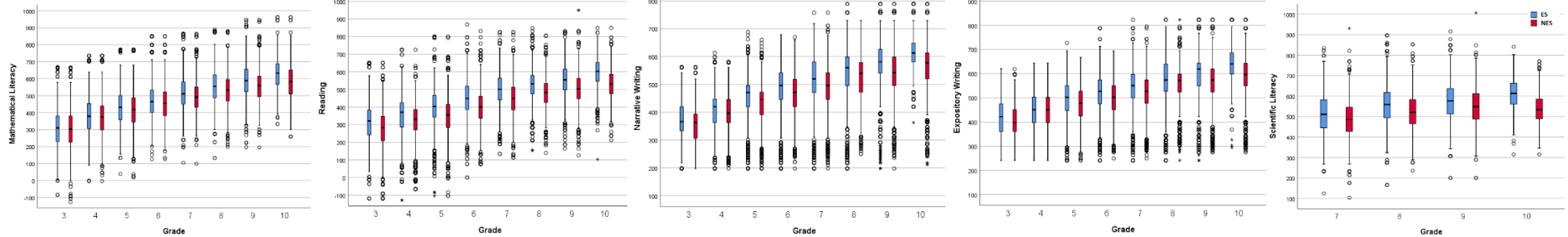
Performance of IB students in Maths, Reading, Narrative Writing, Expository Writing and Science by English-speaking background. Red color represents students from English-speaking background and blue color represents students from non-English-speaking background.



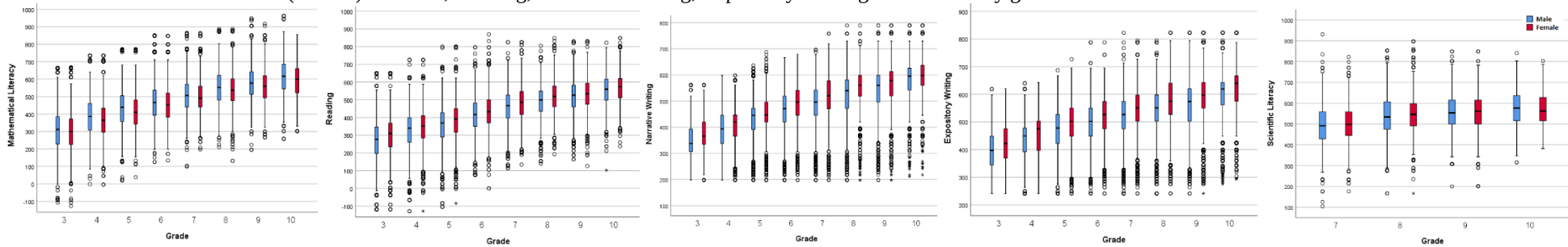
Performance of Non-IB students (broad) in Maths, Reading, Narrative Writing, Expository Writing and Science by gender



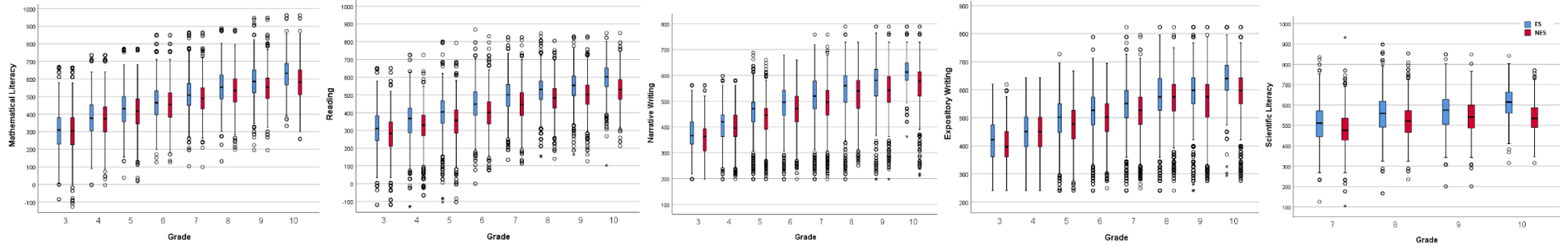
Performance of Non-IB students (broad) in Maths, Reading, Narrative Writing, Expository Writing and Science by English-speaking background



Performance of Non-IB students (narrow) in Maths, Reading, Narrative Writing, Expository Writing and Science by gender



Performance of Non-IB students (narrow) in Maths, Reading, Narrative Writing, Expository Writing and Science by English-speaking background



Appendix 2: Regression Coefficients of IB Status from Multilevel Models

Overall

Domain	Grade	ICC		Model 1										Model 2									
				Broad					Narrow					Broad					Narrow				
		Broad	Narrow	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.
Mathematical Literacy	3	0.32	0.32	7.5	7.2	0.30	0.07		8.9	7.2	0.22	0.09		7.8	7.2	0.28	0.08		9.2	7.2	0.20	0.09	
	4	0.27	0.27	-3.1	6.9	0.65	-0.03		-0.9	6.9	0.90	-0.01		-3.0	6.9	0.66	-0.03		-0.8	6.9	0.91	-0.01	
	5	0.29	0.29	10.2	6.2	0.10	0.10		11.4	6.2	0.07	0.12		10.7	6.2	0.09	0.11		11.9	6.3	0.06	0.12	
	6	0.30	0.30	-4.8	7.2	0.51	-0.05		-3.5	7.3	0.63	-0.04		-4.4	7.2	0.54	-0.05		-3.1	7.3	0.67	-0.03	
	7	0.30	0.29	9.7	6.9	0.16	0.11		12.2	6.8	0.07	0.14		9.7	6.9	0.16	0.11		12.2	6.8	0.07	0.14	
	8	0.28	0.28	2.7	8.2	0.74	0.03		4.6	8.3	0.58	0.05		2.5	8.3	0.76	0.03		4.4	8.4	0.60	0.05	
	9	0.29	0.28	19.8	7.3	0.01	0.22	++	22.6	7.2	0.00	0.25	++	20.4	7.3	0.01	0.22	++	23.2	7.2	0.00	0.26	++
	10	0.29	0.29	-4.1	10.5	0.70	-0.05		-4.7	10.6	0.66	-0.05		-3.6	10.4	0.73	-0.04		-4.1	10.5	0.69	-0.05	
Reading	3	0.29	0.29	25.8	6.8	0.00	0.26	++	27.6	6.8	0.00	0.28	++	23.7	6.6	0.00	0.24	++	25.5	6.6	0.00	0.26	++
	4	0.28	0.28	7.5	7.4	0.31	0.08		9.7	7.5	0.19	0.10		6.7	7.1	0.35	0.07		8.9	7.2	0.22	0.09	
	5	0.23	0.23	28.7	6.4	0.00	0.29	++	29.8	6.4	0.00	0.30	++	25.7	5.9	0.00	0.26	++	26.7	5.9	0.00	0.27	++
	6	0.23	0.22	1.4	7.2	0.84	0.01		3.8	7.2	0.59	0.04		2.4	6.9	0.73	0.02		4.5	6.9	0.51	0.05	
	7	0.29	0.28	14.0	7.5	0.06	0.15		17.2	7.4	0.02	0.18	+	12.5	7.0	0.08	0.13		15.5	7.0	0.03	0.17	+
	8	0.26	0.26	3.1	7.3	0.67	0.04		3.7	7.4	0.61	0.04		3.0	6.7	0.65	0.04		3.8	6.9	0.58	0.04	
	9	0.30	0.28	20.5	7.5	0.01	0.24	++	22.0	7.3	0.00	0.26	++	18.5	6.9	0.01	0.21	++	20.1	6.7	0.00	0.24	++
	10	0.22	0.22	0.6	9.3	0.94	0.01		1.1	9.3	0.90	0.01		1.9	8.4	0.82	0.02		2.1	8.4	0.80	0.02	
Narrative Writing	3	0.27	0.27	9.9	3.8	0.01	0.17	+	10.9	3.9	0.01	0.18	+	9.1	3.8	0.02	0.16	+	10.1	3.8	0.01	0.17	+
	4	0.26	0.26	-0.7	4.7	0.89	-0.01		0.3	4.8	0.95	0.00		-0.7	4.6	0.88	-0.01		0.3	4.7	0.94	0.01	
	5	0.27	0.26	11.3	4.5	0.01	0.16	+	12.3	4.5	0.01	0.18	+	10.0	4.3	0.02	0.14	+	10.8	4.4	0.01	0.16	+
	6	0.22	0.22	3.6	5.3	0.50	0.05		5.1	5.4	0.35	0.07		4.6	5.2	0.38	0.06		6.0	5.3	0.26	0.08	
	7	0.27	0.27	14.2	5.9	0.02	0.19	+	16.2	5.9	0.01	0.21	++	13.6	5.7	0.02	0.18	+	15.4	5.7	0.01	0.20	++
	8	0.24	0.25	6.6	6.2	0.29	0.09		7.2	6.3	0.26	0.09		8.0	6.0	0.19	0.11		8.8	6.2	0.16	0.12	
	9	0.27	0.26	20.3	6.3	0.00	0.27	++	21.7	6.3	0.00	0.29	++	19.0	6.0	0.00	0.25	++	20.4	6.0	0.00	0.27	++
	10	0.21	0.21	7.1	7.0	0.32	0.10		6.4	7.0	0.36	0.09		7.4	6.4	0.25	0.10		6.6	6.4	0.31	0.09	
	3	0.35	0.35	13.9	4.3	0.00	0.23	++	15.1	4.3	0.00	0.25	++	13.4	4.3	0.00	0.22	++	14.7	4.3	0.00	0.25	++

Domain	Grade	ICC		Model 1										Model 2									
				Broad					Narrow					Broad					Narrow				
		Broad	Narrow	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.
Expository Writing	4	0.36	0.36	-1.7	5.3	0.75	-0.03		-0.5	5.4	0.93	-0.01		-1.7	5.3	0.75	-0.03		-0.5	5.3	0.93	-0.01	
	5	0.35	0.35	20.1	4.9	0.00	0.29	++	20.6	4.9	0.00	0.30	++	19.1	4.8	0.00	0.27	++	19.6	4.8	0.00	0.28	++
	6	0.30	0.29	5.8	5.8	0.32	0.08		8.0	5.9	0.18	0.11		6.4	5.7	0.27	0.09		8.4	5.9	0.15	0.12	
	7	0.33	0.33	16.1	6.4	0.01	0.21	++	17.8	6.4	0.01	0.23	++	15.6	6.3	0.01	0.21	++	17.3	6.3	0.01	0.23	++
	8	0.30	0.30	13.9	6.7	0.04	0.18	+	15.1	6.7	0.03	0.19	+	14.9	6.6	0.03	0.19	+	16.2	6.7	0.02	0.21	++
	9	0.33	0.32	30.4	7.2	0.00	0.37	++	31.1	7.2	0.00	0.38	++	29.1	7.1	0.00	0.36	++	29.7	7.1	0.00	0.37	++
	10	0.21	0.21	12.1	7.8	0.13	0.16		11.9	7.9	0.13	0.15		12.2	7.5	0.11	0.16		11.8	7.5	0.12	0.15	
Scientific Literacy	7	0.33	0.30	20.7	12.8	0.11	0.23		26.4	12.1	0.03	0.29	++	19.0	12.6	0.13	0.21		24.7	12.0	0.04	0.27	++
	8	0.31	0.31	-1.4	13.3	0.92	-0.02		0.3	13.6	0.98	0.00		-1.1	13.1	0.93	-0.01		0.9	13.4	0.95	0.01	
	9	0.29	0.25	35.0	12.8	0.01	0.40	++	37.3	11.7	0.00	0.44	++	31.4	12.4	0.01	0.36	++	33.8	11.5	0.00	0.40	++
	10	0.35	0.35	49.3	17.6	0.01	0.59	+++	51.1	17.7	0.01	0.61	+++	50.2	16.5	0.01	0.60	+++	51.5	16.6	0.00	0.61	+++

Appendix 3: Regression Coefficients of IB Status from Multilevel Models by Region

Asia-Pacific

Domain	Grade	ICC		Model 1										Model 2									
				Broad					Narrow					Broad					Narrow				
		Broad	Narrow	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.
Mathematical Literacy	3	0.23	0.23	-6.5	8.8	0.46	-0.07		-6.0	9.0	0.51	-0.06		-6.5	8.7	0.46	-0.07		-5.9	8.8	0.50	-0.06	
	4	0.19	0.19	-18.3	8.7	0.04	-0.19	-	-17.4	9.1	0.06	-0.19		-19.3	8.6	0.03	-0.20	--	-18.6	8.9	0.04	-0.20	-
	5	0.17	0.17	-3.7	7.3	0.61	-0.04		-3.4	7.5	0.65	-0.04		-3.0	7.4	0.69	-0.03		-2.5	7.5	0.74	-0.03	
	6	0.15	0.16	-19.8	8.0	0.02	-0.22	--	-20.1	8.5	0.02	-0.22	--	-19.1	8.2	0.02	-0.21	--	-19.4	8.7	0.03	-0.22	--
	7	0.17	0.17	-1.3	8.5	0.88	-0.01		0.1	8.7	0.99	0.00		-2.1	8.5	0.80	-0.02		-1.0	8.8	0.91	-0.01	
	8	0.18	0.18	-10.3	10.0	0.30	-0.12		-8.6	10.3	0.41	-0.10		-11.3	10.1	0.27	-0.13		-9.7	10.5	0.36	-0.11	
	9	0.23	0.22	18.2	11.0	0.10	0.20		20.9	11.2	0.07	0.23		19.0	10.9	0.09	0.21		22.2	11.1	0.05	0.24	++
	10	0.21	0.21	-12.2	14.0	0.39	-0.14		-14.8	14.3	0.31	-0.17		-11.0	13.9	0.44	-0.13		-13.4	14.2	0.35	-0.16	
Reading	3	0.22	0.22	15.7	8.6	0.07	0.17		17.5	8.8	0.05	0.19	+	13.9	8.2	0.09	0.15		15.7	8.3	0.06	0.17	
	4	0.22	0.23	-18.7	9.6	0.06	-0.21		-17.8	10.0	0.08	-0.20		-17.7	9.2	0.06	-0.20		-16.5	9.6	0.09	-0.19	
	5	0.17	0.17	8.1	8.5	0.35	0.09		9.4	8.6	0.27	0.10		7.1	7.9	0.37	0.08		8.5	7.9	0.28	0.09	
	6	0.17	0.17	-16.4	9.5	0.09	-0.18		-12.4	10.0	0.22	-0.13		-13.1	9.2	0.16	-0.14		-8.8	9.5	0.36	-0.10	
	7	0.25	0.25	-1.9	10.9	0.86	-0.02		2.5	11.0	0.82	0.03		2.0	10.2	0.85	0.02		6.6	10.2	0.52	0.07	
	8	0.26	0.26	-15.0	11.2	0.18	-0.18		-15.2	11.5	0.19	-0.18		-8.8	10.1	0.39	-0.10		-7.6	10.4	0.47	-0.09	
	9	0.29	0.29	16.7	12.6	0.19	0.19		15.5	13.0	0.24	0.18		22.8	11.1	0.04	0.26	++	24.8	11.4	0.03	0.29	++
	10	0.19	0.19	-8.8	13.8	0.53	-0.11		-7.9	14.1	0.58	-0.10		-1.0	12.5	0.94	-0.01		-0.5	12.8	0.97	-0.01	
Narrative Writing	3	0.18	0.18	0.4	4.5	0.93	0.01		1.1	4.6	0.82	0.02		-0.2	4.4	0.97	0.00		0.4	4.5	0.93	0.01	
	4	0.19	0.19	-10.9	5.4	0.05	-0.19	-	-11.2	5.6	0.05	-0.19	-	-10.5	5.2	0.05	-0.18	-	-10.6	5.4	0.05	-0.18	
	5	0.16	0.15	-1.8	4.8	0.70	-0.03		-1.2	4.8	0.80	-0.02		-2.6	4.5	0.56	-0.04		-2.0	4.6	0.65	-0.03	
	6	0.16	0.16	-3.6	6.4	0.57	-0.05		-1.2	6.6	0.86	-0.02		-1.9	6.2	0.76	-0.03		0.7	6.4	0.91	0.01	
	7	0.21	0.21	0.5	7.4	0.95	0.01		2.0	7.6	0.79	0.03		3.3	7.0	0.63	0.05		5.2	7.1	0.47	0.07	
	8	0.21	0.22	-4.2	7.6	0.58	-0.06		-5.3	7.9	0.50	-0.08		0.5	7.2	0.94	0.01		0.4	7.5	0.96	0.01	
	9	0.28	0.28	14.2	10.0	0.16	0.20		13.3	10.5	0.21	0.18		18.7	8.7	0.04	0.26	++	19.9	9.1	0.03	0.28	++
	10	0.16	0.16	0.0	9.0	1.00	0.00		-1.8	9.1	0.85	-0.03		4.5	8.2	0.58	0.07		2.7	8.2	0.74	0.04	
	3	0.20	0.20	6.7	4.6	0.15	0.12		7.7	4.7	0.10	0.14		6.4	4.6	0.16	0.11		7.5	4.7	0.11	0.13	

Domain	Grade	ICC		Model 1										Model 2									
				Broad					Narrow					Broad					Narrow				
		Broad	Narrow	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.
Expository Writing	4	0.24	0.25	-14.4	6.0	0.02	-0.25	--	-14.3	6.2	0.02	-0.25	--	-13.9	5.8	0.02	-0.24	--	-13.7	6.1	0.03	-0.23	--
	5	0.22	0.22	5.3	5.3	0.32	0.09		5.7	5.3	0.29	0.09		5.0	5.1	0.33	0.08		5.2	5.2	0.32	0.08	
	6	0.23	0.23	-6.6	7.2	0.36	-0.10		-4.2	7.6	0.58	-0.07		-5.6	7.0	0.43	-0.09		-3.2	7.4	0.67	-0.05	
	7	0.24	0.24	0.9	7.8	0.91	0.01		2.2	8.0	0.79	0.03		2.8	7.6	0.71	0.04		4.5	7.8	0.57	0.06	
	8	0.21	0.21	0.6	7.5	0.93	0.01		1.2	7.6	0.87	0.02		4.3	7.3	0.56	0.06		5.3	7.4	0.48	0.08	
	9	0.26	0.26	20.9	10.1	0.04	0.28	++	17.1	10.4	0.10	0.23		25.0	9.2	0.01	0.33	++	22.7	9.5	0.02	0.30	++
	10	0.14	0.14	-1.2	9.9	0.91	-0.02		-2.0	10.0	0.85	-0.03		3.6	10.0	0.72	0.05		2.6	10.2	0.80	0.04	
Scientific Literacy	7	0.14	0.13	21.2	13.2	0.12	0.24		25.9	13.0	0.06	0.29		23.4	13.5	0.09	0.26		28.5	13.2	0.04	0.32	++
	8	0.16	0.16	-13.0	15.4	0.41	-0.15		-10.1	16.0	0.53	-0.12		-8.5	15.6	0.59	-0.10		-4.8	16.1	0.77	-0.06	
	9	0.23	0.22	34.2	18.0	0.07	0.39		27.6	18.5	0.15	0.32		35.9	16.0	0.03	0.41	++	32.8	17.0	0.07	0.38	
	10	0.15	0.15	-28.8	29.1	0.34	-0.33		-31.1	30.7	0.33	-0.35		-21.8	29.7	0.47	-0.25		-24.7	31.2	0.44	-0.28	

Europe

Domain	Grade	ICC		Model 1										Model 2									
				Broad					Narrow					Broad					Narrow				
		Broad	Narrow	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.
Mathematical Literacy	3	0.26	0.26	0.5	11.3	0.96	0.01		0.5	11.3	0.96	0.01		-0.1	11.3	0.99	0.00		-0.1	11.3	0.99	0.00	
	4	0.19	0.19	-15.6	10.1	0.13	-0.18		-15.6	10.1	0.13	-0.18		-15.6	10.1	0.13	-0.18		-15.6	10.1	0.13	-0.18	
	5	0.20	0.20	7.2	9.0	0.43	0.08		6.5	9.1	0.48	0.07		7.5	8.7	0.40	0.09		6.8	8.8	0.44	0.08	
	6	0.16	0.16	-8.2	9.0	0.36	-0.10		-9.7	9.0	0.29	-0.12		-8.4	8.8	0.34	-0.11		-9.8	8.8	0.27	-0.12	
	7	0.19	0.19	5.3	9.3	0.57	0.07		4.5	9.4	0.63	0.06		5.1	9.3	0.59	0.07		4.3	9.3	0.64	0.06	
	8	0.11	0.12	-12.8	9.7	0.19	-0.16		-14.5	9.8	0.15	-0.18		-12.9	10.0	0.20	-0.16		-14.5	10.1	0.16	-0.18	
	9	0.19	0.19	6.2	10.0	0.54	0.08		6.2	10.0	0.54	0.08		6.9	10.0	0.49	0.08		6.9	10.0	0.49	0.08	
	10	0.21	0.21	-13.7	14.4	0.35	-0.17		-13.7	14.4	0.35	-0.17		-14.5	14.3	0.32	-0.18		-14.5	14.3	0.32	-0.18	
Reading	3	0.27	0.27	22.6	12.4	0.07	0.23		22.6	12.4	0.07	0.23		22.0	12.0	0.07	0.22		22.0	12.0	0.07	0.22	
	4	0.18	0.18	-6.2	11.0	0.58	-0.07		-6.2	11.0	0.58	-0.07		-6.9	10.0	0.49	-0.08		-6.9	10.0	0.49	-0.08	
	5	0.21	0.21	32.9	11.0	0.00	0.34	++	31.6	11.1	0.01	0.33	++	29.3	10.1	0.00	0.31	++	28.4	10.1	0.01	0.30	++
	6	0.16	0.15	-3.0	11.1	0.79	-0.03		-5.1	11.0	0.64	-0.06		-1.1	10.2	0.92	-0.01		-2.7	10.2	0.79	-0.03	
	7	0.20	0.20	15.5	10.5	0.14	0.18		15.1	10.6	0.16	0.18		12.5	9.6	0.19	0.14		12.3	9.7	0.21	0.14	
	8	0.13	0.13	-5.2	9.0	0.56	-0.07		-6.4	9.2	0.49	-0.09		-6.7	7.7	0.39	-0.09		-7.6	7.9	0.34	-0.10	
	9	0.22	0.22	18.9	10.9	0.09	0.23		18.9	10.9	0.09	0.23		15.5	10.1	0.13	0.19		15.5	10.1	0.13	0.19	
	10	0.13	0.13	2.3	12.8	0.86	0.03		2.3	12.8	0.86	0.03		0.2	11.9	0.99	0.00		0.2	11.9	0.99	0.00	
Narrative Writing	3	0.24	0.24	10.2	6.5	0.12	0.18		10.2	6.5	0.12	0.18		9.9	6.3	0.12	0.18		9.9	6.3	0.12	0.18	
	4	0.18	0.18	-8.9	6.7	0.19	-0.15		-8.9	6.7	0.19	-0.15		-9.1	6.3	0.15	-0.15		-9.1	6.3	0.15	-0.15	
	5	0.26	0.26	14.1	7.6	0.07	0.22		13.5	7.7	0.08	0.21		12.0	7.4	0.11	0.19		11.5	7.4	0.13	0.18	
	6	0.16	0.16	-6.7	7.5	0.37	-0.11		-8.0	7.5	0.29	-0.13		-5.2	7.0	0.46	-0.08		-6.1	7.1	0.39	-0.10	
	7	0.20	0.20	6.0	8.4	0.48	0.09		5.9	8.5	0.49	0.09		3.4	8.0	0.67	0.05		3.4	8.1	0.68	0.05	
	8	0.16	0.16	-5.1	7.8	0.52	-0.08		-6.0	8.0	0.46	-0.10		-5.5	7.0	0.44	-0.09		-6.3	7.2	0.39	-0.10	
	9	0.17	0.17	6.7	8.0	0.40	0.10		6.7	8.0	0.40	0.10		4.2	7.6	0.58	0.07		4.2	7.6	0.58	0.07	
	10	0.09	0.09	-6.0	6.8	0.38	-0.11		-6.0	6.8	0.38	-0.11		-6.4	6.1	0.31	-0.11		-6.4	6.1	0.31	-0.11	
Expository Writing	3	0.29	0.29	3.7	6.9	0.60	0.07		3.7	6.9	0.60	0.07		3.6	6.9	0.61	0.07		3.6	6.9	0.61	0.07	
	4	0.22	0.22	-15.9	6.8	0.02	-0.29	--	-15.9	6.8	0.02	-0.29	--	-16.0	6.5	0.02	-0.29	--	-16.0	6.5	0.02	-0.29	--
	5	0.33	0.33	18.5	8.4	0.03	0.29	++	17.8	8.4	0.04	0.28	++	16.4	8.2	0.05	0.26	++	15.8	8.2	0.06	0.25	

Domain	Grade	ICC		Model 1										Model 2									
				Broad					Narrow					Broad					Narrow				
		Broad	Narrow	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.
	6	0.21	0.20	-3.1	8.0	0.70	-0.05		-4.6	8.0	0.57	-0.08		-1.9	7.9	0.81	-0.03		-3.2	7.9	0.68	-0.05	
	7	0.23	0.23	6.9	8.3	0.41	0.11		6.3	8.4	0.46	0.10		4.8	8.0	0.55	0.07		4.2	8.1	0.60	0.07	
	8	0.15	0.15	-2.0	7.7	0.80	-0.03		-4.0	7.6	0.59	-0.07		-2.7	7.0	0.70	-0.04		-4.6	6.9	0.51	-0.08	
	9	0.22	0.22	12.1	9.5	0.21	0.18		12.1	9.5	0.21	0.18		9.3	9.3	0.32	0.14		9.3	9.3	0.32	0.14	
	10	0.11	0.11	-1.9	9.0	0.84	-0.03		-1.9	9.0	0.84	-0.03		-2.6	8.1	0.75	-0.04		-2.6	8.1	0.75	-0.04	
Scientific Literacy	7	0.20	0.21	-8.0	18.5	0.67	-0.10		-10.0	19.0	0.61	-0.12		-11.8	17.3	0.50	-0.14		-13.2	17.8	0.47	-0.16	
	8	0.16	0.19	-33.3	19.3	0.11	-0.41		-41.0	19.8	0.06	-0.53		-34.9	18.8	0.09	-0.43		-43.4	19.6	0.05	-0.56	---
	9	0.16	0.16	27.1	19.6	0.19	0.32		27.1	19.6	0.19	0.32		26.9	19.2	0.18	0.32		26.9	19.2	0.18	0.32	
	10	0.01	0.01	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a	

The Middle East

Domain	Grade	ICC		Model 1										Model 2									
				Broad					Narrow					Broad					Narrow				
		Broad	Narrow	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.
Mathematical Literacy	3	0.50	0.50	7.0	34.8	0.84	0.06		7.0	34.8	0.84	0.06		7.1	35.0	0.84	0.07		7.1	35.0	0.84	0.06	
	4	0.37	0.37	12.3	22.8	0.59	0.13		12.3	22.8	0.59	0.13		12.2	22.8	0.60	0.13		12.2	22.8	0.60	0.13	
	5	0.48	0.48	14.3	25.5	0.58	0.15		14.3	25.5	0.58	0.15		14.5	25.5	0.57	0.15		14.5	25.5	0.57	0.15	
	6	0.51	0.51	0.0	27.8	1.00	0.00		0.0	27.8	1.00	0.00		0.9	28.0	0.97	0.01		0.9	28.0	0.97	0.01	
	7	0.46	0.46	5.0	24.7	0.84	0.06		5.0	24.7	0.84	0.06		4.9	24.6	0.84	0.06		4.9	24.6	0.84	0.06	
	8	0.39	0.39	-6.9	25.6	0.79	-0.08		-6.9	25.6	0.79	-0.08		-6.7	25.6	0.79	-0.07		-6.7	25.6	0.79	-0.07	
	9	0.40	0.40	8.3	26.1	0.75	0.09		8.3	26.1	0.75	0.09		8.5	26.0	0.75	0.10		8.5	26.0	0.75	0.10	
	10	0.50	0.50	-44.5	42.6	0.32	-0.50		-44.5	42.6	0.32	-0.50		-43.3	43.0	0.34	-0.48		-43.3	43.0	0.34	-0.48	
Reading	3	0.42	0.42	25.5	31.2	0.42	0.24		25.5	31.2	0.42	0.24		25.2	31.5	0.43	0.24		25.2	31.5	0.43	0.24	
	4	0.31	0.31	42.0	22.9	0.08	0.43		42.0	22.9	0.08	0.44		40.9	23.4	0.09	0.42		40.9	23.4	0.09	0.42	
	5	0.27	0.27	40.3	21.0	0.06	0.42		40.3	21.0	0.06	0.42		42.6	19.9	0.04	0.44	++	42.6	19.9	0.04	0.44	++
	6	0.29	0.29	16.5	21.2	0.44	0.17		16.5	21.2	0.44	0.17		18.8	21.0	0.38	0.19		18.8	21.0	0.38	0.19	
	7	0.40	0.40	11.3	26.6	0.67	0.12		11.3	26.6	0.67	0.12		13.8	26.3	0.60	0.14		13.8	26.3	0.60	0.14	
	8	0.28	0.28	16.9	19.7	0.40	0.20		16.9	19.7	0.40	0.20		17.4	19.3	0.37	0.21		17.4	19.3	0.37	0.21	
	9	0.34	0.34	24.1	24.0	0.32	0.27		24.1	24.0	0.32	0.27		24.1	22.8	0.30	0.28		24.1	22.8	0.30	0.28	
	10	0.38	0.38	-22.9	36.0	0.54	-0.24		-22.9	36.0	0.54	-0.24		-13.7	33.5	0.69	-0.14		-13.7	33.5	0.69	-0.14	
Narrative Writing	3	0.34	0.34	24.7	18.7	0.20	0.42		24.7	18.7	0.20	0.42		28.9	19.2	0.15	0.49		28.9	19.2	0.15	0.49	
	4	0.40	0.40	45.1	21.7	0.05	0.69		45.1	21.7	0.05	0.69		44.2	21.9	0.06	0.68		44.2	21.9	0.06	0.68	
	5	0.36	0.36	43.8	20.1	0.04	0.60	+++	43.8	20.1	0.04	0.60	+++	49.4	21.2	0.03	0.68	+++	49.4	21.2	0.03	0.68	+++
	6	0.33	0.33	44.0	22.1	0.06	0.57		44.0	22.1	0.06	0.57		44.2	22.1	0.06	0.58		44.2	22.1	0.06	0.58	
	7	0.31	0.31	63.5	21.7	0.01	0.77	+++	63.5	21.7	0.01	0.77	+++	69.7	22.8	0.01	0.85	+++	69.7	22.8	0.01	0.85	+++
	8	0.30	0.30	57.1	26.6	0.05	0.65	+++	57.1	26.6	0.05	0.65	+++	60.3	27.7	0.04	0.68	+++	60.3	27.7	0.04	0.68	+++
	9	0.29	0.29	62.0	23.7	0.02	0.74	+++	62.0	23.7	0.02	0.74	+++	63.3	24.7	0.02	0.75	+++	63.3	24.7	0.02	0.75	+++
	10	0.36	0.36	68.9	38.6	0.14	0.78		68.9	38.6	0.14	0.78		71.0	39.1	0.13	0.80		71.0	39.1	0.13	0.80	
Expository Writing	3	0.50	0.50	46.9	21.4	0.04	0.80	+++	46.9	21.4	0.04	0.80	+++	48.2	21.5	0.04	0.83	+++	48.2	21.5	0.04	0.83	+++
	4	0.63	0.63	66.7	27.4	0.03	1.03	+++	66.7	27.4	0.03	1.03	+++	69.7	28.6	0.03	1.07	+++	69.7	28.6	0.03	1.07	+++
	5	0.48	0.48	71.4	19.9	0.00	1.03	+++	71.4	19.9	0.00	1.03	+++	71.6	20.1	0.00	1.03	+++	71.6	20.1	0.00	1.03	+++
	6	0.43	0.43	64.8	21.8	0.01	0.88	+++	64.8	21.8	0.01	0.88	+++	66.2	22.4	0.01	0.90	+++	66.2	22.4	0.01	0.90	+++
	7	0.44	0.44	74.4	26.2	0.01	0.90	+++	74.4	26.2	0.01	0.90	+++	80.3	27.8	0.01	0.97	+++	80.3	27.8	0.01	0.97	+++
	8	0.41	0.41	83.2	27.3	0.01	0.96	+++	83.2	27.3	0.01	0.96	+++	85.9	28.2	0.01	1.00	+++	85.9	28.2	0.01	1.00	+++
	9	0.43	0.43	82.8	31.1	0.02	0.92	+++	82.8	31.1	0.02	0.92	+++	81.8	31.2	0.02	0.91	+++	81.8	31.2	0.02	0.91	+++
	10	0.27	0.27	57.7	30.0	0.10	0.65		57.7	30.0	0.10	0.65		63.4	28.2	0.06	0.71		63.4	28.2	0.06	0.71	
Scientific Literacy	7	0.36	0.36	23.7	30.3	0.44	0.25		23.7	30.3	0.44	0.25		23.5	29.5	0.43	0.25		23.5	29.5	0.43	0.25	
	8	0.40	0.40	5.9	34.8	0.87	0.06		5.9	34.8	0.87	0.06		5.4	34.4	0.88	0.06		5.4	34.4	0.88	0.06	
	9	0.28	0.28	29.2	29.8	0.34	0.34		29.2	29.8	0.34	0.34		24.5	29.3	0.41	0.28		24.5	29.3	0.41	0.28	

Africa

Domain	Grade	ICC		Model 1										Model 2									
				Broad					Narrow					Broad					Narrow				
		Broad	Narrow	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.
Mathematical Literacy	3	0.35	0.30	-22.5	30.2	0.47	-0.25		-8.5	28.1	0.77	-0.09		-24.6	25.4	0.35	-0.27		-13.2	23.9	0.59	-0.15	
	4	0.28	0.19	-12.9	25.7	0.62	-0.15		2.6	21.6	0.91	0.03		-15.0	24.8	0.55	-0.17		-0.3	21.3	0.99	0.00	
	5	0.14	0.09	-4.3	18.1	0.82	-0.05		7.8	15.0	0.61	0.09		-2.9	17.6	0.87	-0.03		8.8	14.6	0.56	0.10	
	6	0.18	0.09	-2.8	21.3	0.90	-0.03		11.6	15.9	0.48	0.14		-4.0	21.7	0.86	-0.05		9.5	16.5	0.57	0.11	
	7	0.07	0.07	13.6	12.5	0.32	0.19		17.1	11.6	0.19	0.24		8.6	10.7	0.45	0.12		11.5	10.3	0.30	0.16	
	8	0.14	0.11	10.4	24.0	0.68	0.13		19.3	21.6	0.40	0.25		1.5	26.2	0.96	0.02		14.1	24.1	0.57	0.18	
	9	0.10	0.10	39.3	13.4	0.03	0.49	++	39.3	13.4	0.03	0.49	++	39.2	14.0	0.03	0.49	++	39.2	14.0	0.03	0.49	++
	10	0.02	0.02	n/a	n/a	n/a	n/a	++	n/a	n/a	n/a	n/a	++	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a	
Reading	3	0.24	0.17	-4.2	26.0	0.87	-0.05		13.1	21.5	0.56	0.14		-5.7	19.1	0.77	-0.06		8.5	14.7	0.57	0.09	
	4	0.23	0.19	19.0	25.1	0.46	0.23		32.3	22.5	0.17	0.39		15.4	21.8	0.49	0.18		26.2	20.2	0.22	0.32	
	5	0.09	0.08	14.3	15.4	0.37	0.17		21.0	14.7	0.17	0.26		13.5	14.5	0.36	0.16		19.0	14.1	0.19	0.23	
	6	0.22	0.14	0.4	27.6	0.99	0.00		13.1	23.1	0.58	0.15		-5.2	25.6	0.84	-0.06		2.1	22.1	0.93	0.02	
	7	0.15	0.15	35.3	19.5	0.12	0.46		38.4	19.1	0.09	0.50		18.5	14.7	0.24	0.24		20.2	14.8	0.20	0.27	
	8	0.25	0.25	35.9	25.9	0.20	0.52		43.0	25.8	0.13	0.62		30.0	25.3	0.27	0.43		37.3	25.9	0.18	0.54	
	9	0.10	0.10	47.4	9.4	0.01	0.70	+++	47.4	9.4	0.01	0.70	+++	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a	
	10	0.00	0.00	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a	
Narrative Writing	3	0.26	0.25	-20.1	13.9	0.17	-0.36		-16.9	14.1	0.25	-0.30		-22.8	12.1	0.08	-0.41		-20.0	12.4	0.13	-0.36	
	4	0.24	0.22	-7.2	15.7	0.65	-0.12		-0.7	15.3	0.97	-0.01		-8.4	14.0	0.56	-0.15		-2.8	13.8	0.84	-0.05	
	5	0.14	0.12	-9.8	11.6	0.41	-0.16		-4.4	11.0	0.69	-0.07		-10.3	11.2	0.37	-0.17		-5.3	10.8	0.63	-0.09	
	6	0.05	0.06	-6.7	10.8	0.54	-0.11		-6.6	11.7	0.58	-0.11		-10.5	8.8	0.25	-0.17		-12.7	9.6	0.21	-0.21	
	7	0.10	0.10	15.1	12.3	0.27	0.26		15.9	12.4	0.25	0.27		7.8	9.5	0.43	0.13		8.0	9.5	0.42	0.14	
	8	0.07	0.06	16.9	10.4	0.14	0.29		21.6	9.5	0.04	0.38	++	9.0	7.2	0.25	0.16		12.2	7.0	0.12	0.21	
	9	0.07	0.07	21.5	10.8	0.09	0.38		21.5	10.8	0.09	0.38		n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a	
	10	0.00	0.00	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a	
Expository Writing	3	0.33	0.32	-25.6	16.8	0.15	-0.45		-21.4	17.0	0.23	-0.38		-27.3	15.5	0.10	-0.48		-23.4	15.8	0.16	-0.41	
	4	0.20	0.18	13.1	13.7	0.35	0.22		19.6	13.1	0.16	0.33		11.9	11.7	0.33	0.20		17.1	11.4	0.15	0.29	
	5	0.10	0.10	1.9	9.9	0.85	0.03		2.2	10.2	0.83	0.04		0.4	10.0	0.97	0.01		0.6	10.3	0.96	0.01	
	6	0.08	0.07	-7.5	11.5	0.53	-0.12		-3.7	11.4	0.75	-0.06		-9.0	9.1	0.34	-0.15		-7.9	9.2	0.41	-0.13	
	7	0.12	0.12	1.3	14.6	0.93	0.02		1.6	14.8	0.92	0.03		-5.5	10.6	0.62	-0.09		-5.7	10.7	0.61	-0.09	
	8	0.15	0.12	12.9	15.5	0.43	0.21		21.3	13.2	0.14	0.36		7.3	12.8	0.58	0.12		14.9	11.8	0.24	0.25	
	9	0.08	0.08	30.0	10.2	0.04	0.50	++	30.0	10.2	0.04	0.50	++	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a	
	10	0.22	0.22	61.1	20.8	0.07	0.92		61.1	20.8	0.07	0.92		n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a	
Scientific Literacy	8	0.02	0.02	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a	

The Americas

Domain	Grade	ICC		Model 1										Model 2									
				Broad					Narrow					Broad					Narrow				
		Broad	Narrow	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.	Slope (IB)	SE	p Value	Effect Size	Sig. of Diff.
Mathematical Literacy	3	0.26	0.26	34.4	21.8	0.13	0.39		34.4	21.8	0.13	0.39		32.8	21.2	0.14	0.37		32.8	21.2	0.14	0.37	
	4	0.18	0.18	-23.5	24.4	0.36	-0.27		-23.5	24.4	0.36	-0.27		-20.9	22.4	0.37	-0.24		-20.9	22.4	0.37	-0.24	
	5	0.34	0.34	20.4	26.5	0.45	0.23		20.4	26.5	0.45	0.23		-3.5	23.1	0.88	-0.04		-3.5	23.1	0.88	-0.04	
	6	0.14	0.14	-16.4	26.2	0.55	-0.20		-16.4	26.2	0.55	-0.20		-14.6	27.0	0.62	-0.18		-14.6	27.0	0.62	-0.18	
	7	0.40	0.25	10.5	32.0	0.75	0.13		25.5	21.8	0.26	0.35		-0.8	28.8	0.98	-0.01		13.2	20.4	0.52	0.18	
	8	0.13	0.13	-17.8	28.5	0.56	-0.23		-17.8	28.5	0.56	-0.23		-20.1	30.4	0.54	-0.26		-20.1	30.4	0.54	-0.26	
	9	0.33	0.20	1.4	30.8	0.97	0.02		11.7	22.9	0.62	0.15		-7.4	26.1	0.78	-0.09		0.0	19.2	1.00	0.00	
Reading	3	0.31	0.31	51.9	25.4	0.05	0.54		51.9	25.4	0.05	0.54		40.1	23.7	0.10	0.42		40.1	23.7	0.10	0.42	
	4	0.34	0.34	-2.5	36.1	0.95	-0.03		-2.5	36.1	0.95	-0.03		-24.4	21.9	0.29	-0.29		-24.4	21.9	0.29	-0.29	
	5	0.31	0.31	51.0	30.4	0.11	0.53		51.0	30.4	0.11	0.53		15.5	25.6	0.55	0.16		15.5	25.6	0.55	0.16	
	6	0.39	0.39	21.7	53.0	0.69	0.23		21.7	53.0	0.69	0.23		14.6	43.2	0.75	0.16		14.6	43.2	0.75	0.16	
	7	0.40	0.32	59.8	32.9	0.09	0.68		72.1	25.3	0.01	0.87	+++	43.0	28.7	0.16	0.49		51.8	22.9	0.04	0.62	+++
	8	0.21	0.21	21.8	31.0	0.51	0.31		21.8	31.0	0.51	0.31		1.2	18.3	0.95	0.02		1.2	18.3	0.95	0.02	
	9	0.43	0.32	32.9	37.3	0.39	0.39		44.5	29.4	0.15	0.59		23.1	32.0	0.48	0.27		27.6	23.8	0.26	0.36	
Narrative Writing	3	0.25	0.25	21.5	12.3	0.09	0.40		21.5	12.3	0.09	0.40		14.0	11.4	0.23	0.26		14.0	11.4	0.23	0.26	
	4	0.31	0.31	-7.3	23.8	0.77	-0.12		-7.3	23.8	0.77	-0.12		-24.9	15.1	0.14	-0.41		-24.9	15.1	0.14	-0.41	
	5	0.30	0.30	21.4	18.9	0.27	0.32		21.4	18.9	0.27	0.32		-1.5	15.8	0.92	-0.02		-1.5	15.8	0.92	-0.02	
	6	0.34	0.34	11.7	33.8	0.74	0.18		11.7	33.8	0.74	0.18		4.8	24.3	0.85	0.07		4.8	24.3	0.85	0.07	
	7	0.37	0.33	36.6	26.8	0.19	0.51		44.7	23.9	0.08	0.64		11.2	20.2	0.59	0.16		20.1	20.2	0.34	0.29	
	8	0.21	0.21	29.7	27.2	0.32	0.48		29.7	27.2	0.32	0.48		n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a	
	9	0.27	0.18	9.0	26.1	0.73	0.13		16.9	21.0	0.43	0.25		4.9	24.3	0.84	0.07		9.1	19.0	0.64	0.13	
Expository Writing	3	0.36	0.36	38.4	13.6	0.01	0.68	+++	38.4	13.6	0.01	0.68	+++	32.0	13.0	0.02	0.57	+++	32.0	13.0	0.02	0.57	+++
	4	0.45	0.45	-13.8	26.5	0.62	-0.23		-13.8	26.5	0.62	-0.23		-28.6	21.6	0.22	-0.47		-28.6	21.6	0.22	-0.47	
	5	0.41	0.41	30.5	21.5	0.17	0.45		30.5	21.5	0.17	0.45		11.5	19.8	0.56	0.17		11.5	19.8	0.56	0.17	
	6	0.29	0.29	24.8	28.5	0.41	0.39		24.8	28.5	0.41	0.39		20.3	23.3	0.43	0.32		20.3	23.3	0.43	0.32	
	7	0.48	0.45	48.5	31.5	0.14	0.68		57.2	29.0	0.07	0.83		42.5	30.7	0.18	0.60		52.5	29.1	0.09	0.76	
	8	0.14	0.14	23.2	22.3	0.35	0.37		23.2	22.3	0.35	0.37		n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a	
	9	0.28	0.19	24.9	27.7	0.38	0.33		33.2	21.9	0.15	0.47		18.5	24.6	0.46	0.25		23.1	19.3	0.25	0.32	
Scientific Literacy	7	0.46	0.30	66.9	62.9	0.31	0.77		85.3	39.2	0.06	1.09		16.1	54.9	0.78	0.19		33.1	52.3	0.53	0.42	

Appendix 4: List of Countries by Regions

Asia-Pacific	Europe	the Middle East	Africa	The Americas
Cambodia	Albania	Bahrain	Angola	Brazil
China	Austria	Jordan	Cote D'ivoire	British Virgin Islands
Fiji	Belgium	Lebanon	Eritrea	Canada
Hong Kong SAR	Czech Republic	Oman	Gabon	Chile
India	France	Qatar	Ghana	Costa Rica
Indonesia	Germany	Saudi Arabia	Kenya	Mexico
Japan	Italy	United Arab Emirates	Malawi	Netherlands Antilles
Laos	Kyrgyzstan		Mauritania	United States
Malaysia	Luxembourg		Mauritius	
Myanmar	Netherlands		Mozambique	
Negara Brunei Darussalam	Norway		Nigeria	
Papua New Guinea	Poland		South Africa	
Philippines	Portugal		Sudan	
Republic of Korea	Romania		Tanzania	
Singapore	Russian Federation		Uganda	
Sri Lanka	Spain			
Taiwan	Sweden			
Thailand	Switzerland			
Vietnam	Turkey			
	Ukraine			
	United Kingdom			

Appendix 5: Comparison of Effect Sizes by Country

Comparison of Effect Sizes by Country in Asia-Pacific

Country	Domain	Grade	Non-Model				Model 1				Model 2			
			Broad		Narrow		Broad		Narrow		Broad		Narrow	
			Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.
Cambodia	Mathematical Literacy	5	-0.14		-0.14		-0.13		-0.13		0.00		0.00	
		7	0.03		0.03		-0.01		-0.01		0.02		0.02	
	Reading	5	0.19		0.19		0.08		0.08		**0.29**		**0.29**	
		7	-0.08		-0.08		0.03		0.03		0.08		0.08	
	Narrative Writing	5	0.15		0.15		**0.44**		**0.44**		**0.45**		**0.45**	
		7	-0.07		-0.07		n/a		n/a		n/a		n/a	
	Expository Writing	5	**0.43**	++	**0.43**	++	n/a		n/a		n/a		n/a	
		7	-0.07		-0.07		n/a		n/a		n/a		n/a	
China	Mathematical Literacy	3	-0.14	-	-0.15	-	-0.02		-0.12		-0.03		-0.11	
		4	0.04		0.03		0.00		-0.04		-0.02		-0.05	
		5	-0.04		-0.05		-0.06		-0.11		-0.06		-0.11	
		6	0.07		0.07		-0.12		-0.14		-0.10		-0.11	
		7	0.10		0.11		0.00		0.01		0.00		0.00	
		8	0.16	+	0.16	+	0.05		0.05		0.02		0.01	
		9	0.06		0.04		0.10		0.07		0.10		0.08	
		10	-0.15		-0.17	-	-0.12		-0.20		-0.14		**-0.21**	
	Reading	3	-0.17	-	-0.17	-	-0.16		-0.18		-0.16		-0.18	
		4	**-0.30**	--	**-0.30**	--	**-0.41**		**-0.43**		**-0.39**		**-0.40**	
		5	-0.06		-0.06		-0.02		-0.06		-0.03		-0.07	
		6	0.19	+	**0.20**	++	**-0.21**		-0.13		**-0.24**		-0.14	
		7	0.10		0.11	+	0.03		0.10		0.08		0.17	
		8	-0.01		0.00		**-0.23**		-0.16		-0.09		-0.03	
		9	-0.05		-0.05		-0.18		-0.14		0.01		0.10	
		10	**-0.27**	--	**-0.26**	--	**-0.36**		**-0.28**		**-0.22**		-0.18	
	Narrative Writing	3	-0.08		-0.08		-0.09		-0.11		-0.08		-0.11	
		4	-0.16	-	-0.16	-	-0.20		**-0.23**		-0.18		**-0.21**	
		5	-0.10	-	-0.10	-	-0.11		-0.12		-0.12		-0.13	
		6	0.18	+	**0.20**	++	-0.02		0.04		-0.04		0.03	
		7	0.12	+	0.13	+	0.16		0.19		**0.20**		**0.24**	
		8	0.07		0.07		0.00		-0.01		0.11		0.10	
		9	0.07		0.09		0.05		0.11		0.17		**0.26**	
		10	**-0.22**	--	**-0.22**	--	-0.06		-0.09		0.04		-0.02	
	Expository Writing	3	0.02		0.02		-0.04		-0.07		-0.03		-0.07	
		4	0.03		0.03		-0.06		-0.07		-0.06		-0.07	
		5	0.05		0.05		0.10		0.06		0.10		0.05	
		6	**0.44**	++	**0.45**	++	0.15		**0.21**		0.14		0.20	
		7	**0.30**	++	**0.30**	++	**0.28**		**0.29**		**0.29**		**0.32**	
		8	0.17	+	0.18	+	0.04		0.12		0.09		0.17	
		9	0.13		0.13		0.07		0.02		0.18		0.15	
		10	**-0.22**	--	**-0.22**	--	-0.13		-0.13		-0.05		-0.07	

Country	Domain	Grade	Non-Model				Model 1				Model 2			
			Broad		Narrow		Broad		Narrow		Broad		Narrow	
			Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.
Hong Kong	Mathematical Literacy	3	**-0.70**	---	**-0.74**	---	**-0.68**	---	**-0.72**	---	**-0.64**	---	**-0.69**	---
		4	**-0.53**	---	**-0.57**	---	**-0.53**	---	**-0.56**	---	**-0.49**	--	**-0.52**	---
		5	**-0.50**	---	**-0.53**	---	-0.18		**-0.24**		-0.13		-0.19	
	Reading	3	**-0.50**	---	**-0.53**	---	**-0.43**	--	**-0.49**	--	**-0.45**	--	**-0.51**	---
		4	**-0.45**	--	**-0.48**	--	**-0.62**	---	**-0.75**	---	**-0.65**	---	**-0.77**	---
		5	**-0.43**	--	**-0.44**	--	**-0.34**		**-0.37**	--	**-0.35**	--	**-0.38**	--
		6	**-0.32**	--	**-0.31**	--	**-0.37**		**-0.38**		**-0.29**		**-0.31**	
	Narrative Writing	3	**-0.48**	--	**-0.49**	--	**-0.48**	--	**-0.51**	---	**-0.49**	--	**-0.51**	---
		4	**-0.37**	--	**-0.38**	--	**-0.47**	--	**-0.46**	--	**-0.48**	--	**-0.47**	--
		5	**-0.38**	--	**-0.39**	--	**-0.39**	--	**-0.38**	--	**-0.40**	--	**-0.38**	--
		6	**-0.43**	--	**-0.39**	--	**-0.38**		**-0.29**		**-0.44**		**-0.38**	
	Expository Writing	3	**-0.56**	---	**-0.57**	---	-0.19		**-0.22**		**-0.20**		**-0.23**	
		4	**-0.46**	--	**-0.46**	--	**-0.36**		**-0.34**		**-0.37**		**-0.34**	
		5	**-0.43**	--	**-0.45**	--	-0.12		-0.12		-0.14		-0.13	
		6	**-0.36**	--	**-0.30**	--	**-0.32**		**-0.27**		**-0.33**		**-0.26**	
India	Mathematical Literacy	3	-0.04		-0.04		n/a		n/a		n/a		n/a	
		4	0.04		0.04		**0.49**		**0.49**		**0.33**		**0.33**	
		5	0.09		0.09		0.05		0.05		0.00		0.00	
		6	0.12		0.12		**0.34**		**0.34**		**0.42**		**0.42**	
		7	0.09		0.09		-0.09		-0.09		-0.01		-0.01	
		8	**0.31**	++	**0.31**	++	0.05		0.05		0.06		0.06	
	Reading	3	**0.30**	++	**0.30**	++	**0.67**		**0.67**		**0.64**		**0.64**	
		4	**0.38**	++	**0.38**	++	**0.61**		**0.61**		**0.76**		**0.76**	
		5	**0.37**	++	**0.37**	++	**0.23**		**0.23**		**0.39**		**0.39**	
		6	**0.39**	++	**0.39**	++	**0.24**		**0.24**		0.20		0.20	
		7	**0.32**	++	**0.32**	++	-0.01		-0.01		-0.10		-0.10	
		8	0.17		0.17		0.02		0.02		-0.06		-0.06	
	Narrative Writing	3	0.14		0.14		n/a		n/a		n/a		n/a	
		4	**0.26**	++	**0.26**	++	**0.58**		**0.58**		**0.77**		**0.77**	
		5	**0.20**	++	**0.20**	++	**0.24**		**0.24**		**0.30**		**0.30**	
		6	**0.30**	++	**0.30**	++	**0.34**		**0.34**		**0.26**		**0.26**	
		7	**0.59**	+++	**0.59**	+++	**0.33**		**0.33**		**0.30**		**0.30**	
		8	**0.35**	++	**0.35**	++	**0.29**		**0.29**		**0.23**		**0.23**	
	Expository Writing	3	-0.19		-0.19		**0.23**		**0.23**		**0.21**		**0.21**	
		4	**-0.21**		**-0.21**		0.11		0.11		**0.41**		**0.41**	
		5	0.09		0.09		0.02		0.02		0.13		0.13	
		6	0.17		0.17		0.14		0.14		0.08		0.08	
		7	**0.34**	++	**0.34**	++	0.09		0.09		0.03		0.03	
		8	**0.57**	+++	**0.57**	+++	**0.69**		**0.69**		**0.62**		**0.62**	
Indonesia	Mathematical Literacy	3	-0.12		-0.12		**-0.41**		**-0.41**		**-0.41**		**-0.41**	
		4	-0.12		-0.12		**-0.42**		**-0.42**		**-0.41**		**-0.41**	
		5	**-0.25**	--	**-0.25**	--	**-0.46**		**-0.46**		n/a		n/a	
		6	**-0.28**	--	**-0.31**	--	**-0.47**		**-0.52**		**-0.48**		**-0.53**	

Country	Domain	Grade	Non-Model				Model 1				Model 2			
			Broad		Narrow		Broad		Narrow		Broad		Narrow	
			Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.
		7	-0.03		-0.03		0.20		0.20		0.19		0.19	
		8	-0.06		-0.06		-0.06		-0.06		-0.07		-0.07	
		9	**0.61**	+++	**0.61**	+++	**0.78**		**0.78**		**0.68**		**0.68**	
	Reading	3	**-0.23**	--	**-0.23**	--	-0.17		-0.17		-0.16		-0.16	
		4	**-0.35**	--	**-0.35**	--	n/a		n/a		n/a		n/a	
		5	**-0.23**	--	**-0.23**	--	n/a		n/a		n/a		n/a	
		6	-0.19	-	**-0.23**	--	n/a		n/a		n/a		n/a	
		7	-0.12		-0.12		0.20		0.20		0.18		0.18	
		8	**-0.27**	--	**-0.27**	--	**-0.29**		**-0.29**		**-0.21**		**-0.21**	
	Narrative Writing	3	**0.29**	++	**0.29**	++	0.04		0.04		0.01		0.01	
		4	**0.33**	++	**0.33**	++	0.10		0.10		0.06		0.06	
		5	-0.11		-0.11		n/a		n/a		n/a		n/a	
		6	-0.16	-	**-0.21**	--	0.05		-0.06		0.16		0.04	
		7	-0.06		-0.06		**0.29**		**0.29**		**0.30**		**0.30**	
		8	-0.05		-0.05		0.08		0.08		0.15		0.15	
	Expository Writing	3	**0.51**	+++	**0.51**	+++	0.13		0.13		0.11		0.11	
		4	0.17	+	0.17	+	-0.03		-0.03		-0.07		-0.07	
		5	-0.12		-0.12		n/a		n/a		n/a		n/a	
		6	-0.17	-	**-0.21**	--	-0.20		**-0.26**		-0.12		-0.18	
		7	-0.02		-0.02		**0.33**		**0.33**		**0.32**		**0.32**	
		8	-0.10		-0.10		-0.11		-0.11		-0.06		-0.06	
	Scientific Literacy	7	**0.31**	++	**0.31**	++	**0.22**		**0.22**		n/a		n/a	
		8	0.19		0.19		n/a		n/a		n/a		n/a	
Japan	Mathematical Literacy	3	**-0.42**	--	**-0.42**	--	**-0.36**		**-0.39**		**-0.36**		**-0.40**	
		4	**-0.57**	---	**-0.57**	---	**-0.43**		**-0.44**		**-0.41**		**-0.41**	
		5	**-0.29**	--	**-0.31**	--	-0.20		**-0.24**		-0.17		-0.20	
		6	**0.26**	++	**0.30**	++	0.18		**0.33**		0.17		**0.32**	
		7	**-0.21**	--	**-0.23**	--	-0.18		**-0.20**		-0.17		**-0.21**	
		8	**-0.27**	--	-0.19		-0.17		0.03		**-0.26**		-0.04	
		9	**0.45**	++	**0.97**	+++	**0.42**		**1.17**	+++	**0.40**		**1.13**	+++
	Reading	3	-0.14		-0.15		-0.08		-0.12		-0.09		-0.12	
		4	**-0.33**	--	**-0.32**	--	**-0.20**		-0.17		**-0.23**		-0.20	
		5	-0.05		-0.03		-0.02		0.08		-0.07		0.00	
		6	0.19		**0.25**	++	**0.20**		**0.37**		**0.23**		**0.38**	
		7	**-0.46**	--	**-0.43**	--	**-0.30**		-0.18		**-0.26**		-0.17	
		8	**-0.33**	--	**-0.43**	--	**-0.44**		**-0.60**		**-0.34**		**-0.36**	
		9	**0.52**	+++	**0.74**	+++	0.19		**0.49**		0.14		**0.47**	
	Narrative Writing	3	**-0.51**	---	**-0.51**	---	**-0.33**		**-0.37**		**-0.32**		**-0.34**	
		4	**-0.50**	---	**-0.52**	---	**-0.29**		**-0.37**		**-0.31**		**-0.38**	
		5	**-0.40**	--	**-0.42**	--	**-0.20**		**-0.28**		**-0.21**		**-0.31**	
		6	-0.16		-0.15		-0.03		0.01		0.02		0.06	
		7	**-0.49**	--	**-0.47**	--	**-0.30**		**-0.22**		**-0.26**		-0.19	
		8	**-0.46**	--	**-0.54**	---	**-0.49**		**-0.67**	---	**-0.38**		**-0.48**	
		9	**0.39**	++	**0.44**	++	**0.22**		**0.36**		0.20		**0.35**	

Country	Domain	Grade	Non-Model				Model 1				Model 2			
			Broad		Narrow		Broad		Narrow		Broad		Narrow	
			Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.
	Expository Writing	3	**-0.37**	--	**-0.37**	--	-0.03		0.00		-0.03		0.02	
		4	**-0.65**	---	**-0.66**	---	**-0.49**		**-0.55**		**-0.51**		**-0.56**	---
		5	**-0.42**	--	**-0.42**	--	**-0.30**		**-0.29**		**-0.29**		**-0.29**	
		6	**-0.33**	--	**-0.30**	--	**-0.23**		-0.13		-0.18		-0.09	
		7	**-0.62**	---	**-0.62**	---	**-0.34**		**-0.29**		**-0.33**		**-0.27**	
		8	**-0.53**	---	**-0.61**	---	**-0.57**		**-0.75**	---	**-0.37**		**-0.50**	
		9	**0.39**	++	**0.43**	++	**0.36**		**0.35**		**0.36**		**0.35**	
Malaysia	Mathematical Literacy	4	**-0.32**	--	**-0.32**	--	**-0.76**		**-0.76**		**-0.76**		**-0.76**	
		5	-0.14		-0.14		0.01		0.01		0.02		0.02	
		6	**-0.74**	---	**-0.74**	---	n/a		n/a		n/a		n/a	
	Reading	4	**-0.37**	--	**-0.37**	--	n/a		n/a		n/a		n/a	
		5	-0.19		-0.19		n/a		n/a		n/a		n/a	
		6	**-0.41**	--	**-0.41**	--	n/a		n/a		n/a		n/a	
	Narrative Writing	4	0.05		0.05		n/a		n/a		n/a		n/a	
	Expository Writing	4	**-0.66**	---	**-0.66**	---	**-1.28**	---	**-1.28**	---	**-1.26**	---	**-1.26**	---
Philippines	Mathematical Literacy	3	**0.29**	++	**0.29**	++	n/a		n/a		**0.96**		**0.96**	
		6	0.07		0.07		-0.14		-0.14		-0.13		-0.13	
	Reading	3	**0.61**	+++	**0.61**	+++	n/a		n/a		n/a		n/a	
		6	**0.39**	++	**0.39**	++	n/a		n/a		n/a		n/a	
	Narrative Writing	3	0.16		0.16		n/a		n/a		n/a		n/a	
		6	**0.36**	++	**0.36**	++	**0.95**		**0.95**		**0.87**		**0.87**	
	Expository Writing	3	**0.30**	++	**0.30**	++	**0.55**		**0.55**		**0.60**		**0.60**	
		6	0.04		0.04		**0.68**		**0.68**		**0.54**		**0.54**	
Republic of Korea	Mathematical Literacy	3	**-0.25**		**-0.25**		n/a		n/a		n/a		n/a	
		5	-0.13		-0.13		n/a		n/a		n/a		n/a	
		8	**-0.55**	---	**-0.55**	---	n/a		n/a		n/a		n/a	
	Reading	3	0.16		0.16		n/a		n/a		n/a		n/a	
		5	-0.11		-0.11		0.08		0.08		0.02		0.02	
		8	**-0.42**	--	**-0.42**	--	0.02		0.02		-0.17		-0.17	
	Narrative Writing	3	-0.01		-0.01		n/a		n/a		n/a		n/a	
		5	-0.11		-0.11		n/a		n/a		n/a		n/a	
		8	**-0.40**	--	**-0.40**	--	**-0.38**		**-0.38**		**-0.44**		**-0.44**	
	Expository Writing	3	-0.01		-0.01		n/a		n/a		n/a		n/a	
		5	**-0.22**		**-0.22**		**-0.23**		**-0.23**		**-0.26**		**-0.26**	
		8	**-0.57**	---	**-0.57**	---	**-0.71**		**-0.71**		**-0.76**		**-0.76**	
Singapore	Mathematical Literacy	3	**-0.26**	--	**-0.26**	--	n/a		n/a		n/a		n/a	
		4	**-0.29**	--	**-0.29**	--	n/a		n/a		n/a		n/a	
		5	**-0.32**	--	**-0.32**	--	-0.15		-0.15		**-0.38**		**-0.38**	
		6	**-0.73**	---	**-0.73**	---	**-0.48**		**-0.48**		**-0.47**		**-0.47**	
		7	**-0.91**	---	**-0.91**	---	**-0.63**		**-0.63**		**-0.69**		**-0.69**	
		8	**-0.88**	---	**-0.88**	---	**-0.73**	---	**-0.73**	---	**-0.78**	---	**-0.78**	---
		9	**-1.07**	---	**-1.07**	---	**-1.09**	---	**-1.09**	---	**-1.09**	---	**-1.09**	---

Country	Domain	Grade	Non-Model				Model 1				Model 2			
			Broad		Narrow		Broad		Narrow		Broad		Narrow	
			Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.
	Reading	3	**-0.34**	--	**-0.34**	--	**-0.30**		**-0.30**		-0.15		-0.15	
		4	**-0.34**	--	**-0.34**	--	-0.15		-0.15		0.11		0.11	
		5	**-0.60**	---	**-0.60**	---	**-0.58**	---	**-0.58**	---	**-0.50**	--	**-0.50**	--
		6	**-0.72**	---	**-0.72**	---	**-0.65**	---	**-0.65**	---	**-0.41**	--	**-0.41**	--
		7	**-0.83**	---	**-0.83**	---	**-0.84**	---	**-0.84**	---	**-0.58**	---	**-0.58**	---
		8	**-0.62**	---	**-0.62**	---	**-0.61**	---	**-0.61**	---	**-0.34**	--	**-0.34**	--
		9	**-1.09**	---	**-1.09**	---	**-1.16**	---	**-1.16**	---	n/a		n/a	
	Narrative Writing	3	**-0.37**	--	**-0.37**	--	**-0.60**		**-0.60**		**-0.51**		**-0.51**	
		4	**-0.41**	--	**-0.41**	--	n/a		n/a		n/a		n/a	
		5	**-0.63**	---	**-0.63**	---	**-0.61**	---	**-0.61**	---	**-0.53**		**-0.53**	
		6	**-0.40**	--	**-0.40**	--	**-0.33**		**-0.33**		-0.16		-0.16	
		7	**-0.29**	--	**-0.29**	--	**-0.39**		**-0.39**		-0.02		-0.02	
		8	**-0.41**	--	**-0.41**	--	**-0.28**		**-0.28**		-0.01		-0.01	
		9	**-1.11**	---	**-1.11**	---	**-0.93**	---	**-0.93**	---	n/a		n/a	
	Expository Writing	3	**-0.28**	--	**-0.28**	--	**-0.54**		**-0.54**		**-0.40**		**-0.40**	
		4	**-0.80**	---	**-0.80**	---	**-0.60**	---	**-0.60**	---	**-0.46**	--	**-0.46**	--
		5	**-0.48**	--	**-0.48**	--	**-0.45**		**-0.45**		**-0.36**		**-0.36**	
		6	**-0.46**	--	**-0.46**	--	**-0.28**		**-0.28**		-0.09		-0.09	
		7	**-0.47**	--	**-0.47**	--	**-0.28**		**-0.28**		-0.04		-0.04	
		8	**-0.48**	--	**-0.48**	--	-0.02		-0.02		0.12		0.12	
		9	**-1.24**	---	**-1.24**	---	n/a		n/a		n/a		n/a	
Thailand	Mathematical Literacy	3	**-0.36**	--	**-0.36**	--	0.14		0.14		0.08		0.08	
		4	**-0.42**	--	**-0.42**	--	0.07		0.07		0.07		0.07	
		5	**-0.35**	--	**-0.35**	--	0.08		0.08		0.04		0.04	
		7	**-0.36**	--	**-0.36**	--	**0.28**		**0.28**		**0.25**		**0.25**	
		9	**0.36**	++			n/a		n/a		n/a		n/a	
	Reading	3	-0.09		-0.09		**0.45**		**0.45**		**0.49**		**0.49**	
		4	-0.08		-0.08		**0.58**		**0.58**		**0.60**		**0.60**	
		5	-0.11		-0.11		**0.45**		**0.45**		**0.51**		**0.51**	
		7	-0.06		-0.06		**0.57**		**0.57**		**0.61**		**0.61**	
		9	**0.98**	+++			n/a		n/a		n/a		n/a	
	Narrative Writing	3	-0.18	-	-0.18	-	**0.22**		**0.22**		**0.24**		**0.24**	
		4	-0.03		-0.03		0.08		0.08		0.08		0.08	
		5	-0.17	-	-0.17	-	**0.26**		**0.26**		**0.31**		**0.31**	
		7	-0.11		-0.11		**0.25**		**0.25**		**0.27**		**0.27**	
		9	**0.88**	+++			n/a		n/a		n/a		n/a	
	Expository Writing	3	-0.11		-0.11		**0.42**		**0.42**		**0.44**		**0.44**	
		4	-0.08		-0.08		**0.28**		**0.28**		**0.28**		**0.28**	
		5	-0.01		-0.01		**0.67**	+++	**0.67**	+++	**0.72**	+++	**0.72**	+++
		7	-0.12		-0.12		**0.41**		**0.41**		**0.44**		**0.44**	
		9	**1.17**	+++			n/a		n/a		n/a		n/a	
Vietnam	Mathematical Literacy	3	0.07		0.07		0.00		0.00		-0.04		-0.04	
		5	0.19	+	0.19	+	0.07		0.07		**0.21**		**0.21**	
	Reading	3	**0.70**	+++	**0.70**	+++	**0.72**	+++	**0.72**	+++	**0.62**	+++	**0.62**	+++

Country	Domain	Grade	Non-Model				Model 1				Model 2			
			Broad		Narrow		Broad		Narrow		Broad		Narrow	
			Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.
		5	**0.50**	+++	**0.50**	+++	**0.26**		**0.26**		**0.36**		**0.36**	
	Narrative Writing	3	**0.23**	++	**0.23**	++	0.17		0.17		**0.20**		**0.20**	
		5	0.09		0.09		0.12		0.12		**0.23**		**0.23**	
	Expository Writing	3	**0.24**	++	**0.24**	++	**0.25**		**0.25**		**0.29**		**0.29**	
		5	**0.43**	++	**0.43**	++	**0.54**		**0.54**		**0.61**	+++	**0.61**	+++

Comparison of Effect Sizes by Country in Europe

Country	Domain	Grade	Non-Model				Model 1				Model 2			
			Broad		Narrow		Broad		Narrow		Broad		Narrow	
			Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.
Germany	Mathematical Literacy	3	0.15	+	0.15	+	-0.04		-0.04		-0.04		-0.04	
		4	0.07		0.07		**0.21**		**0.21**		**0.24**		**0.24**	
		5	**0.35**	++	**0.35**	++	**0.65**	+++	**0.65**	+++	**0.61**	+++	**0.61**	+++
		6	**0.31**	++	**0.31**	++	**0.39**	++	**0.39**	++	**0.39**	++	**0.39**	++
		7	**0.27**	++	**0.27**	++	**0.36**		**0.36**		**0.36**		**0.36**	
		8	**0.36**	++	**0.36**	++	**0.38**		**0.38**		**0.37**		**0.37**	
		9	**0.32**	++	**0.32**	++	**0.26**		**0.26**		**0.30**		**0.30**	
		10	0.02		0.02		-0.12		-0.12		-0.13		-0.13	
	Reading	3	**0.37**	++	**0.37**	++	**0.36**		**0.36**		**0.26**		**0.26**	
		4	**0.39**	++	**0.39**	++	**0.50**		**0.50**		**0.43**		**0.43**	
		5	**0.57**	+++	**0.57**	+++	**0.89**	+++	**0.89**	+++	**0.73**	+++	**0.73**	+++
		6	**0.35**	++	**0.35**	++	**0.45**		**0.45**		**0.42**		**0.42**	
		7	**0.36**	++	**0.36**	++	**0.50**	++	**0.50**	++	**0.36**		**0.36**	
		8	**0.44**	++	**0.44**	++	**0.35**		**0.35**		**0.25**		**0.25**	
		9	**0.32**	++	**0.32**	++	**0.52**	+++	**0.52**	+++	**0.29**		**0.29**	
		10	0.10		0.10		n/a		n/a		n/a		n/a	
	Narrative Writing	3	0.12	+	0.12	+	0.06		0.06		0.04		0.04	
		4	0.12		0.12		**0.21**		**0.21**		0.15		0.15	
		5	**0.40**	++	**0.40**	++	**0.55**	+++	**0.55**	+++	**0.51**	+++	**0.51**	+++
		6	**0.24**	++	**0.24**	++	**0.31**		**0.31**		**0.30**		**0.30**	
		7	0.19	+	0.19	+	0.12		0.12		0.03		0.03	
		8	**0.51**	+++	**0.51**	+++	**0.37**		**0.37**		**0.30**		**0.30**	
		9	**0.21**	++	**0.21**	++	0.06		0.06		-0.08		-0.08	
		10	-0.03		-0.03		n/a		n/a		n/a		n/a	
	Expository Writing	3	0.11		0.11		0.06		0.06		0.07		0.07	
		4	0.05		0.05		0.08		0.08		0.04		0.04	
		5	**0.43**	++	**0.43**	++	**0.65**	+++	**0.65**	+++	**0.63**	+++	**0.63**	+++
		6	**0.50**	+++	**0.50**	+++	**0.59**	+++	**0.59**	+++	**0.59**	+++	**0.59**	+++
		7	**0.24**	++	**0.24**	++	**0.28**		**0.28**		**0.21**		**0.21**	
		8	**0.39**	++	**0.39**	++	**0.20**		**0.20**		0.13		0.13	
		9	**0.31**	++	**0.31**	++	n/a		n/a		n/a		n/a	
		10	0.00		0.00		0.06		0.06		0.04		0.04	
Italy	Mathematical Literacy	3	**0.23**	++	**0.23**	++	**0.44**		**0.44**		**0.41**		**0.41**	
		4	**0.31**	++	**0.31**	++	0.02		0.02		0.00		0.00	
		5	**0.32**	++	**0.32**	++	n/a		n/a		n/a		n/a	
		6	-0.01		-0.01		**-0.65**		**-0.65**		**-0.66**		**-0.66**	
		7	0.07		0.07		n/a		n/a		n/a		n/a	
		9	-0.06		-0.06		n/a		n/a		n/a		n/a	
	Reading	3	-0.04		-0.04		**0.65**		**0.65**		**0.68**		**0.68**	
		4	-0.04		-0.04		n/a		n/a		n/a		n/a	
		5	**0.28**	++	**0.28**	++	n/a		n/a		n/a		n/a	
		6	-0.19		-0.19		n/a		n/a		n/a		n/a	
		7	**0.34**	++	**0.34**	++	n/a		n/a		n/a		n/a	

Country	Domain	Grade	Non-Model				Model 1				Model 2			
			Broad		Narrow		Broad		Narrow		Broad		Narrow	
			Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.
		9	**0.32**	++	**0.32**	++	**0.81**	+++	**0.81**	+++	n/a		n/a	
	Narrative Writing	3	**0.22**	++	**0.22**	++	**0.33**		**0.33**		**0.38**		**0.38**	
		4	0.13		0.13		n/a		n/a		n/a		n/a	
		5	**0.49**	++	**0.49**	++	**0.68**		**0.68**		**0.64**		**0.64**	
		6	**-0.29**	--	**-0.29**	--	n/a		n/a		n/a		n/a	
		7	**0.29**	++	**0.29**	++	**0.56**		**0.56**		**0.46**		**0.46**	
		9	**0.34**	++	**0.34**	++	**0.38**		**0.38**		**0.37**		**0.37**	
	Expository Writing	3	**0.53**	+++	**0.53**	+++	**0.59**		**0.59**		**0.63**		**0.63**	
		4	0.18		0.18		0.17		0.17		0.18		0.18	
		5	**0.54**	+++	**0.54**	+++	**0.76**		**0.76**		**0.69**		**0.69**	
		6	-0.05		-0.05		n/a		n/a		n/a		n/a	
		7	**0.41**	++	**0.41**	++	**0.47**		**0.47**		**0.34**		**0.34**	
		9	**0.36**	++	**0.36**	++	n/a		n/a		n/a		n/a	
Norway	Mathematical Literacy	3	**-0.72**	---	**-0.72**	---	**-0.53**		**-0.53**		**-0.54**		**-0.54**	
		5	**-0.93**	---	**-0.93**	---	**-0.86**		**-0.86**		**-0.81**		**-0.81**	
		6	**-0.77**	---	**-0.77**	---	**-0.57**	---	**-0.57**	---	**-0.52**		**-0.52**	
	Reading	3	**-0.51**	---	**-0.51**	---	**-0.54**		**-0.54**		**-0.49**		**-0.49**	
		5	**-0.44**	--	**-0.44**	--	**-0.58**		**-0.58**		n/a		n/a	
		6	**-0.38**	--	**-0.38**	--	n/a		n/a		n/a		n/a	
	Narrative Writing	6	-0.15		-0.15		-0.03		-0.03		-0.04		-0.04	
	Expository Writing	6	**-0.59**	---	**-0.59**	---	n/a		n/a		n/a		n/a	
Spain	Mathematical Literacy	3	**0.80**	+++	**0.80**	+++	**1.21**	+++	**1.21**	+++	**1.14**	+++	**1.14**	+++
		5	**0.83**	+++	**0.83**	+++	**0.98**	+++	**0.98**	+++	**0.95**	+++	**0.95**	+++
		6	**0.57**	+++	**0.57**	+++	0.00		0.00		0.00		0.00	
	Reading	3	**1.18**	+++	**1.18**	+++	**1.73**	+++	**1.73**	+++	**1.56**	+++	**1.56**	+++
		5	**0.94**	+++	**0.94**	+++	**1.11**		**1.11**		**1.02**		**1.02**	
		6	**0.87**	+++	**0.87**	+++	0.00		0.00		0.00		0.00	
	Narrative Writing	3	**0.96**	+++	**0.96**	+++	**1.58**	+++	**1.58**	+++	**1.45**	+++	**1.45**	+++
		5	**0.64**	+++	**0.64**	+++	**1.11**		**1.11**		**1.06**		**1.06**	
	Expository Writing	3	**0.94**	+++	**0.94**	+++	**1.74**	+++	**1.74**	+++	**1.66**	+++	**1.66**	+++
		5	**0.91**	+++	**0.91**	+++	**1.12**		**1.12**		**1.07**		**1.07**	
Switzerland	Mathematical Literacy	3	**-0.59**	---	**-0.59**	---	**-0.71**	---	**-0.71**	---	**-0.69**	---	**-0.69**	---
		4	**-0.35**	--	**-0.35**	--	**-0.58**		**-0.58**		**-0.60**		**-0.60**	
		5	**-0.35**	--	**-0.35**	--	**-0.46**	--	**-0.46**	--	**-0.46**	--	**-0.46**	--
		6	**-0.46**	--	**-0.46**	--	**-0.46**		**-0.46**		**-0.50**		**-0.50**	
		7	**-0.31**	--	**-0.31**	--	-0.12		-0.12		-0.14		-0.14	
		8	**-0.63**	---	**-0.63**	---	**-0.73**	---	**-0.73**	---	**-0.72**	---	**-0.72**	---
		9	-0.13		-0.13		**-0.55**		**-0.55**		**-0.54**		**-0.54**	
		10	-0.06		-0.06		**-0.50**		**-0.50**		**-0.51**		**-0.51**	
	Reading	3	**-0.31**	--	**-0.31**	--	-0.15		-0.15		-0.17		-0.17	
		4	-0.13		-0.13		-0.10		-0.10		-0.14		-0.14	
		5	-0.10		-0.10		-0.05		-0.05		-0.13		-0.13	

Country	Domain	Grade	Non-Model				Model 1				Model 2			
			Broad		Narrow		Broad		Narrow		Broad		Narrow	
			Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.
		6	-0.12		-0.12		-0.18		-0.18		**-0.27**		**-0.27**	
		7	-0.03		-0.03		**0.22**		**0.22**		0.17		0.17	
		8	0.03		0.03		0.07		0.07		-0.07		-0.07	
		9	0.04		0.04		**-0.22**		**-0.22**		**-0.26**		**-0.26**	
		10	-0.12		-0.12		**-0.60**	---	**-0.60**	---	**-0.62**	---	**-0.62**	---
	Narrative Writing	3	**-0.34**	--	**-0.34**	--	**-0.34**		**-0.34**		**-0.37**		**-0.37**	
		4	-0.14		-0.14		n/a		n/a		n/a		n/a	
		5	-0.16	-	-0.15	-	**-0.21**		**-0.21**		**-0.25**		**-0.25**	
		6	0.11		0.11		-0.01		-0.01		-0.01		-0.01	
		7	0.01		0.01		0.10		0.10		0.08		0.08	
		8	-0.03		-0.03		-0.13		-0.13		**-0.23**		**-0.23**	
		9	-0.05		-0.05		**-0.27**		**-0.27**		**-0.29**		**-0.29**	
		10	0.01		0.01		**-0.22**		**-0.22**		**-0.23**		**-0.23**	
	Expository Writing	3	**-0.84**	---	**-0.84**	---	**-0.65**	---	**-0.65**	---	**-0.68**	---	**-0.68**	---
		4	**-0.63**	---	**-0.63**	---	**-0.69**	---	**-0.69**	---	**-0.68**	---	**-0.68**	---
		5	**-0.39**	--	**-0.40**	--	**-0.26**		**-0.26**		**-0.29**		**-0.29**	
		6	-0.18	-	-0.18	-	**-0.36**		**-0.36**		**-0.36**		**-0.36**	
		7	-0.09		-0.09		0.06		0.06		0.02		0.02	
		8	**-0.20**	--	**-0.20**	--	-0.07		-0.07		**-0.21**		**-0.21**	
		9	-0.08		-0.08		**-0.21**		**-0.21**		**-0.23**		**-0.23**	
		10	0.03		0.03		0.04		0.04		0.01		0.01	
United Kingdom	Mathematical Literacy	8	-0.13		-0.13		n/a		n/a		n/a		n/a	
	Reading	8	0.18		0.18		n/a		n/a		n/a		n/a	
	Narrative Writing	8	**-0.28**		**-0.28**		n/a		n/a		n/a		n/a	
	Expository Writing	8	-0.01		-0.01		n/a		n/a		n/a		n/a	

Comparison of Effect Sizes by Country in the Middle East, Africa and the Americas

Country	Domain	Grade	Non-Model				Model 1				Model 2			
			Broad		Narrow		Broad		Narrow		Broad		Narrow	
			Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.
Oman	Mathematical Literacy	3	-0.19		-0.19		n/a		n/a		n/a		n/a	
		4	0.04		0.04		n/a		n/a		n/a		n/a	
		5	**0.60**	+++	**0.60**	+++	n/a		n/a		n/a		n/a	
	Reading	3	-0.03		-0.03		**-1.03**	---	**-1.03**	---	n/a		n/a	
		4	**0.30**	++	**0.30**	++	**-0.62**		**-0.62**		**-0.65**		**-0.65**	
		5	**0.52**	+++	**0.52**	+++	n/a		n/a		n/a		n/a	
	Narrative Writing	3	**-0.36**	--	**-0.36**	--	n/a		n/a		n/a		n/a	
		4	**-0.21**		**-0.21**		n/a		n/a		n/a		n/a	
		5	**0.25**	++	**0.25**	++	n/a		n/a		n/a		n/a	
	Expository Writing	3	**-0.64**	---	**-0.64**	---	**-1.47**	---	**-1.47**	---	**-1.45**	---	**-1.45**	---
		4	-0.08		-0.08		**-0.90**	---	**-0.90**	---	**-0.92**	---	**-0.92**	---
		5	**0.37**	++	**0.37**	++	**-0.65**		**-0.65**		n/a		n/a	
Saudi Arabia	Mathematical Literacy	3	**-0.51**	---	**-0.51**	---	**-0.29**		**-0.29**		**-0.28**		**-0.28**	
		5	-0.15		-0.15		-0.15		-0.15		-0.15		-0.15	
		6	**0.21**	++	**0.21**	++	**0.45**		**0.45**		**0.44**		**0.44**	
	Reading	3	**0.50**	+++	**0.50**	+++	**0.30**		**0.30**		**0.29**		**0.29**	
		5	**0.25**	++	**0.25**	++	0.05		0.05		0.06		0.06	
		6	**0.43**	++	**0.43**	++	n/a		n/a		n/a		n/a	
United Arab Emirates	Mathematical Literacy	3	**0.31**	++	**0.32**	++	**0.36**		**0.36**		**0.27**		**0.27**	
		4	**0.29**	++	**0.29**	++	**0.23**		**0.23**		**0.23**		**0.23**	
		5	**0.34**	++	**0.36**	++	**0.45**		**0.45**		**0.43**		**0.43**	
		6	0.17	+	0.19	+	-0.03		-0.03		0.01		0.01	
		7	0.17	+	**0.20**	++	0.02		0.02		0.02		0.02	
		8	0.18	+	0.19	+	-0.15		-0.15		-0.16		-0.16	
		9	**0.42**	++	**0.43**	++	0.05		0.05		-0.02		-0.02	
	Reading	3	**0.31**	++	**0.30**	++	**0.33**		**0.33**		**0.23**		**0.23**	
		4	**0.52**	+++	**0.52**	+++	**0.49**		**0.49**		**0.49**		**0.49**	
		5	**0.47**	++	**0.47**	++	**0.84**	+++	**0.84**	+++	**0.78**	+++	**0.78**	+++
		6	**0.31**	++	**0.32**	++	**0.24**		**0.24**		**0.26**		**0.26**	
		7	**0.39**	++	**0.40**	++	**0.26**		**0.26**		**0.20**		**0.20**	
		8	**0.63**	+++	**0.63**	+++	**0.28**		**0.28**		**0.35**		**0.35**	
		9	**0.84**	+++	**0.87**	+++	**0.45**		**0.45**		**0.36**		**0.36**	
	Narrative Writing	5	**0.37**	++	**0.37**	++	**0.58**		**0.58**		**0.62**		**0.62**	
		6	**0.35**	++	**0.35**	++	**0.58**		**0.58**		**0.37**		**0.37**	
	Expository Writing	5	**1.18**	+++	**1.18**	+++	**1.29**	+++	**1.29**	+++	**1.21**	+++	**1.21**	+++
		6	**1.08**	+++	**1.08**	+++	**1.10**		**1.10**		**0.65**		**0.65**	
	Scientific Literacy	7	**0.29**	++	**0.36**	++	**0.33**		**0.33**		**0.28**		**0.29**	
		8	**0.24**	++	**0.26**	++	0.03		0.03		0.07		0.06	
		9	**0.65**	+++	**0.67**	+++	**0.39**		**0.39**		**0.31**		**0.31**	
Tanzania	Mathematical Literacy	3	0.16		0.16		n/a		n/a		n/a		n/a	

Country	Domain	Grade	Non-Model				Model 1				Model 2			
			Broad		Narrow		Broad		Narrow		Broad		Narrow	
			Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.	Effect Size	Sig. of Diff.
	Reading	3	**0.39**	++	**0.39**	++	**-0.25**		**-0.25**		n/a		n/a	
	Narrative Writing	3	-0.04		-0.04		**-0.67**		**-0.67**		**-0.73**		**-0.73**	
	Expository Writing	3	**-0.22**		**-0.22**		**-1.63**	---	**-1.63**	---	**-1.70**	---	**-1.70**	---
Brazil	Mathematical Literacy	3	0.00		0.00		-0.03		-0.03		-0.02		-0.02	
	Reading	3	**-0.57**	---	**-0.57**	---	**-0.48**		**-0.48**		**-0.44**		**-0.44**	
	Narrative Writing	3	**-0.40**	--	**-0.40**	--	n/a		n/a		n/a		n/a	
	Expository Writing	3	**-0.31**	--	**-0.31**	--	0.06		0.06		0.03		0.03	
United States	Mathematical Literacy	3	-0.08		-0.08		n/a		n/a		n/a		n/a	
		4	-0.01		-0.01		n/a		n/a		n/a		n/a	
		5	**-0.29**	--	**-0.29**	--	**-0.43**		**-0.43**		n/a		n/a	
	Reading	3	0.00		0.00		-0.02		-0.02		-0.09		-0.09	
		4	0.09		0.09		**0.20**		**0.20**		n/a		n/a	
		5	0.11		0.11		0.06		0.06		n/a		n/a	
	Narrative Writing	3	-0.03		-0.03		-0.09		-0.09		n/a		n/a	
		4	-0.15		-0.15		0.05		0.05		n/a		n/a	
		5	-0.07		-0.07		-0.06		-0.06		n/a		n/a	
	Expository Writing	3	0.18	+	0.18	+	**0.38**		**0.38**		n/a		n/a	
		4	0.16		0.16		**0.41**		**0.41**		n/a		n/a	
		5	0.15		0.15		0.20		0.20		n/a		n/a	

Appendix 6: Number of Students and Schools by Country

Asia-Pacific

Country	Domain	Grade	Schools			Students		
			IB (N)	Non-IB (Broad) (N)	Non-IB (Narrow) (N)	IB (N)	Non-IB (Broad) (N)	Non-IB (Narrow) (N)
Cambodia	Mathematical Literacy	5	201	111	111	2	3	3
		7	227	88	88	2	2	2
	Reading	5	200	110	110	2	3	3
		7	227	88	88	2	2	2
	Narrative Writing	5	201	108	108	2	2	2
		7	227	88	88	2	2	2
	Expository Writing	5	200	107	107	2	2	2
		7	227	88	88	2	2	2
China	Mathematical Literacy	3	1828	1788	1775	18	19	17
		4	1661	927	913	17	15	13
		5	1298	1254	1241	15	19	17
		6	773	524	512	9	13	11
		7	757	503	497	7	12	11
		8	616	376	368	7	11	9
		9	546	291	282	7	11	9
		10	377	232	227	5	8	6
	Reading	3	1826	1837	1824	18	19	17
		4	1658	908	894	17	15	13
		5	1297	1229	1217	15	19	17
		6	773	520	508	9	13	11
		7	754	503	497	7	12	11
		8	613	371	363	7	11	9
		9	558	289	280	7	11	9
		10	369	228	223	5	8	6
	Narrative Writing	3	1845	1806	1793	18	18	16
		4	1670	873	859	17	14	12
		5	1366	1241	1228	15	19	17
		6	865	513	501	10	13	11
		7	862	503	497	8	12	11
		8	727	375	367	8	11	9
		9	617	290	281	8	11	9
		10	460	231	226	6	8	6
	Expository Writing	3	1844	1799	1786	18	18	16
		4	1668	873	859	17	14	12
		5	1362	1228	1216	15	19	17
		6	867	512	500	10	13	11
		7	864	505	499	8	12	11
		8	725	370	362	8	11	9
		9	629	289	280	8	11	9
		10	452	227	222	6	8	6
Hong Kong	Mathematical Literacy	3	2882	1039	929	15	6	5
		4	1665	802	721	11	6	5
		5	2855	905	843	15	7	6
	Reading	3	2936	1038	928	16	6	5

Country	Domain	Grade	Schools			Students		
			IB (N)	Non-IB (Broad) (N)	Non-IB (Narrow) (N)	IB (N)	Non-IB (Broad) (N)	Non-IB (Narrow) (N)
		4	1727	800	718	12	6	5
		5	2916	904	841	16	7	6
		6	159	110	85	2	3	2
	Narrative Writing	3	2954	1039	929	16	6	5
		4	1744	802	721	12	6	5
		5	2915	903	841	16	7	6
		6	168	106	83	2	3	2
	Expository Writing	3	2946	1037	927	16	6	5
		4	1740	795	715	12	6	5
		5	2919	904	841	16	7	6
		6	157	110	85	2	3	2
India	Mathematical Literacy	3	514	105	105	6	2	2
		4	280	111	111	5	2	2
		5	597	152	152	8	2	2
		6	336	176	176	6	2	2
		7	236	256	256	5	3	3
		8	208	286	286	7	2	2
	Reading	3	511	104	104	6	2	2
		4	277	109	109	5	2	2
		5	594	153	153	8	2	2
		6	328	176	176	6	2	2
		7	237	255	255	5	3	3
		8	209	291	291	7	2	2
	Narrative Writing	3	512	104	104	6	2	2
		4	279	111	111	5	2	2
		5	598	143	143	8	2	2
		6	331	176	176	6	2	2
		7	236	257	257	5	3	3
		8	207	284	284	7	2	2
	Expository Writing	3	507	104	104	6	2	2
		4	277	109	109	5	2	2
		5	592	153	153	8	2	2
		6	328	176	176	6	2	2
		7	236	253	253	5	3	3
		8	209	287	287	7	2	2
Indonesia	Mathematical Literacy	3	321	365	365	7	5	5
		4	298	428	428	7	5	5
		5	301	382	382	7	5	5
		6	316	526	504	7	6	5
		7	235	447	447	3	7	7
		8	289	500	500	3	7	7
		9	323	53	53	3	5	5
	Reading	3	317	364	364	7	5	5
		4	296	424	424	7	5	5
		5	298	380	380	7	5	5
		6	315	516	494	7	6	5
		7	234	450	450	3	7	7
		8	289	499	499	3	7	7

Country	Domain	Grade	Schools			Students		
			IB (N)	Non-IB (Broad) (N)	Non-IB (Narrow) (N)	IB (N)	Non-IB (Broad) (N)	Non-IB (Narrow) (N)
	Narrative Writing	3	314	367	367	7	5	5
		4	295	427	427	7	5	5
		5	300	381	381	7	5	5
		6	314	521	499	7	6	5
		7	235	450	450	3	7	7
		8	285	499	499	3	7	7
	Expository Writing	3	316	363	363	7	5	5
		4	292	427	427	7	5	5
		5	298	380	380	7	5	5
		6	315	517	495	7	6	5
		7	235	450	450	3	7	7
		8	289	499	499	3	7	7
	Scientific Literacy	7	144	94	94	2	4	4
		8	183	81	81	2	4	4
Japan	Mathematical Literacy	3	469	272	266	12	6	5
		4	477	282	274	12	6	5
		5	509	211	200	12	6	5
		6	473	137	126	12	5	4
		7	478	134	125	8	6	5
		8	434	160	123	8	6	4
		9	443	95	64	7	4	3
	Reading	3	465	272	266	12	6	5
		4	474	281	272	12	6	5
		5	507	212	202	12	6	5
		6	473	136	125	12	5	4
		7	474	134	125	8	6	5
		8	429	161	124	8	6	4
		9	439	96	64	7	4	3
	Narrative Writing	3	469	389	383	12	7	6
		4	476	391	383	12	7	6
		5	505	310	299	12	7	6
		6	474	196	185	12	6	5
		7	472	196	187	8	7	6
		8	433	221	184	8	7	5
		9	442	122	91	7	5	4
	Expository Writing	3	466	388	382	12	7	6
		4	471	396	387	12	7	6
		5	507	310	300	12	7	6
		6	472	205	194	12	6	5
		7	472	196	187	8	7	6
		8	429	209	187	8	7	5
		9	439	109	91	7	5	4
Malaysia	Mathematical Literacy	4	83	379	379	2	5	5
		5	66	678	678	2	9	9
		6	65	311	311	2	2	2
	Reading	4	83	377	377	2	5	5
		5	68	674	674	2	9	9
		6	67	311	311	2	2	2

Country	Domain	Grade	Schools			Students		
			IB (N)	Non-IB (Broad) (N)	Non-IB (Narrow) (N)	IB (N)	Non-IB (Broad) (N)	Non-IB (Narrow) (N)
	Narrative Writing	4	79	377	377	2	5	5
	Expository Writing	4	82	378	378	2	5	5
Philippines	Mathematical Literacy	3	126	89	89	2	3	3
		6	97	116	116	2	3	3
	Reading	3	125	88	88	2	3	3
		6	93	115	115	2	3	3
	Narrative Writing	3	125	89	89	2	3	3
		6	97	116	116	2	3	3
	Expository Writing	3	125	87	87	2	3	3
		6	93	115	115	2	3	3
Republic of Korea	Mathematical Literacy	3	74	105	105	2	2	2
		5	115	118	118	3	2	2
		8	184	196	196	3	2	2
	Reading	3	74	104	104	2	2	2
		5	114	117	117	3	2	2
		8	185	196	196	3	2	2
	Narrative Writing	3	75	105	105	2	2	2
		5	114	118	118	3	2	2
		8	186	196	196	3	2	2
	Expository Writing	3	74	104	104	2	2	2
		5	114	117	117	3	2	2
		8	185	196	196	3	2	2
Singapore	Mathematical Literacy	3	384	993	993	6	5	5
		4	357	1034	1034	5	4	4
		5	343	1038	1038	5	4	4
		6	348	1134	1134	5	5	5
		7	193	1207	1207	2	5	5
		8	284	1225	1225	3	3	3
		9	171	996	996	2	3	3
	Reading	3	384	997	997	6	5	5
		4	358	1038	1038	5	4	4
		5	344	1038	1038	5	4	4
		6	343	1136	1136	5	5	5
		7	191	1211	1211	2	5	5
		8	273	1227	1227	3	3	3
		9	169	994	994	2	3	3
	Narrative Writing	3	344	691	691	5	4	4
		4	320	740	740	5	3	3
		5	308	759	759	4	3	3
		6	347	1131	1131	5	5	5
		7	193	1204	1204	2	5	5
		8	281	1227	1227	3	3	3
		9	170	999	999	2	3	3
	Expository Writing	3	345	694	694	5	4	4
		4	322	740	740	4	3	3
		5	311	761	761	4	3	3
		6	342	1135	1135	5	5	5

Country	Domain	Grade	Schools			Students		
			IB (N)	Non-IB (Broad) (N)	Non-IB (Narrow) (N)	IB (N)	Non-IB (Broad) (N)	Non-IB (Narrow) (N)
		7	191	1208	1208	2	5	5
		8	273	1226	1226	3	3	3
		9	170	993	993	2	3	3
Thailand	Mathematical Literacy	3	420	653	653	4	7	7
		4	448	437	437	4	6	6
		5	452	711	711	4	7	7
		7	400	307	307	4	4	4
		9	173	127	0	3	2	0
	Reading	3	415	651	651	4	7	7
		4	443	437	437	4	6	6
		5	449	706	706	4	7	7
		7	404	309	309	4	4	4
		9	172	127	0	3	2	0
	Narrative Writing	3	420	330	330	4	6	6
		4	444	104	104	4	5	5
		5	446	368	368	4	6	6
		7	398	307	307	4	4	4
		9	173	127	0	3	2	0
	Expository Writing	3	416	330	330	4	6	6
		4	442	104	104	4	5	5
		5	448	367	367	4	6	6
		7	404	309	309	4	4	4
		9	172	127	0	3	2	0
Vietnam	Mathematical Literacy	3	265	454	454	3	7	7
		5	264	234	234	3	7	7
	Reading	3	263	445	445	3	7	7
		5	261	232	232	3	7	7
	Narrative Writing	3	264	447	447	3	7	7
		5	261	234	234	3	7	7
	Expository Writing	3	265	447	447	3	7	7
		5	260	232	232	3	7	7

Europe

Country	Domain	Grade	Schools			Students		
			IB (N)	Non-IB (Broad) (N)	Non-IB (Narrow) (N)	IB (N)	Non-IB (Broad) (N)	Non-IB (Narrow) (N)
Germany	Mathematical Literacy	3	847	424	424	14	8	8
		4	755	403	403	12	8	8
		5	948	303	303	14	8	8
		6	652	432	432	8	9	9
		7	772	348	348	9	10	10
		8	427	200	200	4	7	7
		9	622	155	155	8	6	6
		10	168	124	124	2	6	6
	Reading	3	835	413	413	14	8	8
		4	749	396	396	12	8	8
		5	934	303	303	14	8	8
		6	649	425	425	8	9	9
		7	769	345	345	9	10	10
		8	419	202	202	4	7	7
		9	616	157	157	8	6	6
		10	166	125	125	2	6	6
	Narrative Writing	3	848	411	411	14	8	8
		4	750	399	399	12	8	8
		5	941	302	302	14	8	8
		6	646	432	432	8	9	9
		7	766	347	347	9	10	10
		8	421	199	199	4	7	7
		9	614	155	155	8	6	6
		10	166	126	126	2	6	6
	Expository Writing	3	842	407	407	14	8	8
		4	751	396	396	12	8	8
		5	933	303	303	14	8	8
		6	650	426	426	8	9	9
		7	771	345	345	9	10	10
		8	418	202	202	4	7	7
		9	613	156	156	8	6	6
		10	166	125	125	2	6	6
Italy	Mathematical Literacy	3	292	148	148	6	3	3
		4	179	115	115	3	3	3
		5	249	186	186	5	4	4
		6	129	104	104	3	2	2
		7	155	189	189	3	5	5
		9	114	128	128	3	4	4
	Reading	3	288	185	185	6	4	4
		4	179	80	80	3	2	2
		5	249	183	183	5	4	4
		6	120	103	103	3	2	2
		7	153	189	189	3	5	5
		9	113	127	127	3	4	4
	Narrative Writing	3	289	185	185	6	4	4
		4	179	82	82	3	2	2
		5	247	184	184	5	4	4
		6	122	104	104	3	2	2
		7	152	188	188	3	5	5
		9	114	129	129	3	4	4

Country	Domain	Grade	Schools			Students		
			IB (N)	Non-IB (Broad) (N)	Non-IB (Narrow) (N)	IB (N)	Non-IB (Broad) (N)	Non-IB (Narrow) (N)
	Expository Writing	3	288	148	148	6	3	3
		4	179	111	111	3	3	3
		5	250	182	182	5	4	4
		6	121	103	103	3	2	2
		7	153	189	189	3	5	5
		9	113	127	127	3	4	4
Norway	Mathematical Literacy	3	53	142	142	3	3	3
		5	54	135	135	3	3	3
		6	147	65	65	5	2	2
	Reading	3	54	137	137	3	3	3
		5	56	135	135	3	3	3
		6	148	65	65	5	2	2
	Narrative Writing	6	85	65	65	3	2	2
	Expository Writing	6	83	65	65	3	2	2
Spain	Mathematical Literacy	3	140	583	583	2	11	11
		5	143	691	691	2	11	11
		6	92	352	352	2	2	2
	Reading	3	134	581	581	2	11	11
		5	142	668	668	2	11	11
		6	93	350	350	2	2	2
	Narrative Writing	3	140	478	478	2	10	10
		5	143	547	547	2	10	10
	Expository Writing	3	134	465	465	2	10	10
		5	145	570	570	2	10	10
Switzerland	Mathematical Literacy	3	403	575	575	4	12	12
		4	276	433	433	4	12	12
		5	457	575	575	5	14	14
		6	312	355	355	4	10	10
		7	345	573	573	5	8	8
		8	449	116	116	5	5	5
		9	345	309	309	5	3	3
		10	333	290	290	4	3	3
	Reading	3	393	565	565	4	12	12
		4	273	428	428	4	12	12
		5	451	587	554	5	16	14
		6	307	353	353	4	10	10
		7	343	577	577	5	8	8
		8	451	116	116	5	5	5
		9	351	310	310	5	3	3
		10	336	286	286	4	3	3
	Narrative Writing	3	399	569	569	4	12	12
		4	274	430	430	4	12	12
		5	457	601	568	5	16	14
		6	310	353	353	4	10	10
		7	344	572	572	5	8	8
		8	445	115	115	5	5	5
		9	346	309	309	5	3	3
		10	333	290	290	4	3	3
	Expository Writing	3	395	567	567	4	12	12
		4	272	430	430	4	12	12
		5	449	594	562	5	16	14

Country	Domain	Grade	Schools			Students		
			IB (N)	Non-IB (Broad) (N)	Non-IB (Narrow) (N)	IB (N)	Non-IB (Broad) (N)	Non-IB (Narrow) (N)
		6	305	351	351	4	10	10
		7	343	576	576	5	8	8
		8	445	116	116	5	5	5
		9	349	310	310	5	3	3
		10	337	286	286	4	3	3
United Kingdom	Mathematical Literacy	8	65	155	155	2	2	2
	Reading	8	66	154	154	2	2	2
	Narrative Writing	8	64	174	174	2	3	3
	Expository Writing	8	66	174	174	2	3	3

The Middle East, Africa and the Americas

Country	Domain	Grade	Schools			Students		
			IB (N)	Non-IB (Broad) (N)	Non-IB (Narrow) (N)	IB (N)	Non-IB (Broad) (N)	Non-IB (Narrow) (N)
Oman	Mathematical Literacy	3	191	166	166	2	2	2
		4	181	138	138	2	2	2
		5	162	120	120	2	2	2
	Reading	3	188	160	160	2	2	2
		4	181	136	136	2	2	2
		5	158	118	118	2	2	2
	Narrative Writing	3	191	164	164	2	2	2
		4	180	137	137	2	2	2
		5	162	117	117	2	2	2
	Expository Writing	3	189	158	158	2	2	2
		4	180	137	137	2	2	2
		5	160	118	118	2	2	2
Saudi Arabia	Mathematical Literacy	3	245	257	257	2	6	6
		5	399	274	274	3	8	8
		6	235	183	183	2	4	4
	Reading	3	241	255	255	2	6	6
		5	393	270	270	3	8	8
		6	230	181	181	2	4	4
United Arab Emirates	Mathematical Literacy	3	798	4602	4395	4	41	39
		4	756	4359	4099	4	39	37
		5	712	5015	4770	4	43	41
		6	678	4388	4151	4	37	35
		7	458	3982	3756	3	33	31
		8	405	3196	3014	3	29	27
		9	441	3184	3028	3	29	27
	Reading	3	797	4558	4351	4	41	39
		4	751	4339	4079	4	39	37
		5	713	4988	4743	4	43	41
		6	675	4289	4053	4	36	34
		7	461	3861	3635	3	32	30
		8	400	3203	3022	3	27	25
		9	442	3185	3029	3	28	26
	Narrative Writing	5	112	1954	1954	2	20	20
		6	118	1513	1513	2	13	13
	Expository Writing	5	111	1934	1934	2	22	22
		6	111	1501	1501	2	15	15
	Scientific Literacy	7	460	3822	3596	3	31	29
		8	406	2970	2849	3	27	25
		9	443	2941	2846	3	27	25
Tanzania	Mathematical Literacy	3	52	310	310	2	5	5
	Reading	3	52	309	309	2	5	5
	Narrative Writing	3	52	310	310	2	5	5
	Expository Writing	3	52	308	308	2	5	5
Brazil	Mathematical Literacy	3	60	155	155	2	2	2
	Reading	3	59	151	151	2	2	2
	Narrative Writing	3	60	152	152	2	2	2
	Expository Writing	3	59	151	151	2	2	2
United States	Mathematical Literacy	3	188	310	310	5	2	2
		4	176	296	296	4	2	2
		5	191	333	333	5	2	2
	Reading	3	190	310	310	5	2	2
		4	178	294	294	4	2	2
		5	189	333	333	5	2	2
	Narrative Writing	3	188	309	309	5	2	2
		4	175	296	296	4	2	2
		5	191	332	332	5	2	2
	Expository Writing	3	189	308	308	5	2	2
		4	177	292	292	4	2	2
		5	189	332	332	5	2	2

Appendix 7: ISA Sub-strand Description

This Appendix provides detailed descriptions of ISA sub-strands in Mathematical Literacy, Reading, and Writing tasks. The sub-strands are used for comparing IB students to non-IB students in performance on each assessment sub-strand/writing criterion in the analysis section. The following information is extracted from *Guide to ISA Reports for October 2017 Administration*, (ACER, 2017).

Mathematical Literacy Sub-strands

Uncertainty and Data This content area reflects how in real life data is commonly collected, organised, analysed and displayed with a view to making interpretations and forming conclusions. Many decisions are made based upon statistical analysis of data. Real life also contains elements of chance where outcomes are not certain but based upon probabilities. Increasingly decision-making is qualified with a statement of risk and society is presented with more and more information to make sense of.

Quantity This overarching content area also features in the three other domains to varying degrees. It focuses on the need for quantification in order to organise the world. It is not hard to find examples of quantification in our day-to-day living. We use money, make measurements, estimate and calculate. Increasingly we make use of technology to assist us but we also still perform many calculations mentally and approximately. Quantitative reasoning requires number sense: that is, having a feel for the magnitude of numbers, using strategies and tools appropriately, and being able to check solutions for reasonableness.

Space and Shape Shapes and constructions are all around us physically as real objects but also as representations in the form of photographs, maps and diagrams. Constructing and interpreting such representations is an important skill. Using known geometric shapes whose mathematical properties are known to model more complex shapes is an important problem-solving tool. Knowledge and appreciation of the beauty and function of geometric shapes and spaces has applications reaching from art to advertising.

Change and Relationships Noticing and using patterns in number and shapes, and finding and describing relationships between variables lies at the heart of mathematics. As organisms or populations grow and as stock markets ebb and flow, we describe the patterns in words, in tables and sometimes in algebraic notation. Commonly we chart the changes in graphical form. These descriptions can be linear, non-linear, cyclic and exponential to name but a few. Being able to link between these various representations and use the language, notation and algorithms of change and relationships is critical to making sense of the patterns in our world.

Reading Sub-strands

Access and Retrieve is defined as locating one or more pieces of information in a text.

Integrate and Interpret texts is defined as constructing meaning and drawing inferences from one or more parts of a text.

Reflect and Evaluate is defined as relating a text to one's experience, knowledge and ideas.

Criteria for Narrative Writing (Narrative)

Narrative/Reflective – Content criterion is about the quality and range of ideas presented, the development of plot, characters and setting, and the writer's sense of audience and purpose. It also encompasses the overall shaping of the piece.

Narrative/Reflective – Language criterion deals with sentence and paragraph structure, vocabulary and punctuation, and the writer's voice.
Narrative/Reflective – Spelling criterion takes into account students' knowledge of phonetic and visual spelling patterns and the range of words attempted, as well as correctness of spelling.

Criteria for Expository Writing (Exposition or Argument)

Exposition/Argument – Content criterion looks at the depth and range of ideas presented, and at the quality of reasoning demonstrated in the ability to provide evidence and logical argumentation in support of a position.

Exposition/Argument – ESOL Language (English for Speakers of Other Languages) criterion is applied to all students' writing regardless of their language background, but focuses on the grammatical correctness and command of English syntax, as well as sentence fluency and variation, and vocabulary.

Exposition/Argument – Structure and Organisation criterion deals with the overall structure of the writing, for example the presence of a clear introduction, development and conclusion; and its internal coherence, such as linking between and within paragraphs.

Scientific Literacy Sub-strands

Evaluate and design scientific enquiry - This competency focuses on the ability to understand the goals and processes of scientific enquiry in generating empirical data and reliable knowledge about the natural world. Awareness is needed of methods of data collection by observation or experiment, in the laboratory or in the field and how this leads to the development of models and hypotheses. Skills demonstrated by those with this competency include the identification of questions that can be explored scientifically; proposal and evaluation of methods for exploring a given question scientifically; and awareness of the methods used by scientists to ensure reliability of data, to acknowledge and minimise measurement error; and ensure conclusions are objective and can be generalised.

Explain phenomena scientifically - Demonstrating this competency involves recall and application of appropriate scientific knowledge in a given situation. The competency includes describing or interpreting phenomena and predicting changes. It also involves explaining the societal implications of scientific knowledge and may involve recognising or identifying appropriate descriptions, explanations, hypotheses and predictions.

Interpret data and evidence scientifically - Analysing and evaluating scientific data and evidence in a variety of situations are the main areas emphasised in this competency. Some key aspects of this competency include transforming data from one representation to another; and evaluating scientific arguments, assumptions, evidence and reasoning from different sources (e.g. websites, journals, newspapers, science-related texts). Students may be required to present evidence and decisions through their own words, diagrams or other representations as appropriate. Students are required to make clear and logical connections between evidence and conclusions or decisions.