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NON-COGNITIVE CHARACTERISTICS AND ACADEMIC ACHIEVEMENT IN SOUTHEAST ASIAN COUNTRIES BASED ON PISA 2009, 2012, AND 2015

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Abstract

Non-cognitive characteristics of students in four Southeast Asian countries – Indonesia, Malaysia, Thailand, and Viet Nam – were reviewed based on the PISA 2009, 2012, and 2015 data. Overall, students in this region demonstrated similarities with respect to their non-cognitive dispositions such as learning habits, approaches to learning, motivation for school subject matters and self-beliefs about their abilities.

The non-cognitive characteristics that were most prevalent in the region included enjoyment and instrumental motivation to learn, which were evidenced by the indices of *intrinsic motivation for mathematics* (INTMAT), *instrumental motivation for mathematics* (INSTMOT), *enjoyment in learning of science* (JOYSCIE), and *instrumental motivation in learning science* (INSTSCIE). However, these variables were not strong predictors of student achievement in this region.

The review also revealed that the best non-cognitive predictors of student achievement were metacognitive awareness (METASUM and UNDREM) for reading achievement; self-efficacy, self-concept, and anxiety (MATHEFF, SCMAT, and ANXMAT) for mathematics achievement; and environmental awareness and epistemological beliefs (ENVAWARE and EPIST*)* for science achievement. These variables were also the best predictors, on average, across all PISA participants and economies. However, some region-specific non-cognitive predictors were also noted. These were *intrinsic motivation* (INTMAT) in Malaysia; *perseverance* (PERSEV) in Thailand; and *mathematics intentions* (MATINTFC) in Viet Nam.

Overall, the similarities found in the non-cognitive characteristics among Southeast Asian students suggest that (a) regional collaboration in designing the educational strategies may be beneficial and that (b) an implementation of regional questionnaires in future PISA surveys may be useful to gain an in-depth understanding of achievement-related factors in this region.

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1. Introduction

Quantity, *quality,* and *equity* are often seen as the three broad dimensions of educational outcomes at the system-level. *Quantity* issues include the general public's access to education, compulsory education, basic literacy rate, and school enrolment and dropout rates (UNESCO, 2018[1]). *Quality* issues are linked to student achievement, teacher training, and pupil/teacher ratio as well as provision of individualised instruction and professional development (OECD, 2019[2]; UNESCO, 2018[1]). Concerns about educational *quality* also extend to non-cognitive areas, such as whether students and teachers feel positively about their work, set reasonable and appropriate goals for themselves, and feel efficacious about their future (Lee and Shute, 2010[3]; OECD, 2019[2]). *Equity,* which addresses the issue of whether all individuals with different backgrounds have a fair chance to succeed, has become an increasingly important system-level outcome in recent years (Gonski et al., 2011[4]; Lee et al., 2020[5]; OECD, 2019[2]; UNICEF Office of Research, 2018[6]).

It can be argued that the improvement in educational quality would not be meaningful if quantity issues are not sufficiently addressed within a nation. Further, at the core of the equity concept is to strike a balance between quantity and quality at all levels of education. Countries with more equitable educational outcomes tend to produce better student achievement (OECD, 2019[2]). Thus, these three dimensions – *quantity*, *quality,* and *equity* – are intertwined with one another, and progress in one area may create an impetus to improve the other areas as well.

The present report considers ways to addresses *quality* of educational outcomes of four countries in the Southeast Asian region, Indonesia, Malaysia, Thailand, and Viet Nam, with respect to students' non-cognitive dispositions and tendencies (e.g. attitudes, beliefs, or motivation). These four countries are generally perceived as having achieved some level of success in terms of educational quantity. While there is improvement yet to be made in the upper secondary completion rates (ranging from 51% in Indonesia to 56% in Thailand), the primary school completion rates are greater than 90% in all four countries according to the UNESCO's World Inequality Database [WIDE] on Education (retrieved on May 2020, (UNESCO, n.d.[7])). Their early and regular participation in the international assessments such as the Organisation for Economic Co-operation and Development's (OECD) Programme of International Student Assessment (PISA; Indonesia and Thailand since PISA 2000; Malaysia and Viet Nam since PISA 2009) can be seen as the governments' desire and commitment to improve educational outcomes in the countries.

In this report, the data collected from student questionnaires of PISA cycles in 2009, 2012, and 2015 was reviewed and analysed. While all index-level non-cognitive variables and the questionnaire items constituting those variables were reviewed and analysed, only those that have met the criteria as either prevalent or relevant (described below under the section of "Analytic Approaches: Prevalence and Relevance) were discussed in this report.

A large volume of research literature on students' non-cognitive characteristics has been conducted by researchers working in institutions in Western developed countries. Local research conducted in less developed countries has not gained substantial attention of the international assessment or research communities. Thus, there has been a relative lack of research solely devoted to the understanding of non-cognitive features of students in Southeast Asian countries. Perhaps this is due in part to the past priority given to improving

educational quantity in middle- or low-income countries (Bloem, 2013[8]). The four Southeast Asian countries, however, appear to be at the stage where their current primary concern has re-focused from quantity to quality issues (Dang and Glewwe, 2018[9]; Sua, 2012[10]; Suryahadi and Sambodho, 2013[11]; Tharmmapornphilas, 2013[12]). The intention of this review is to arrive at the policy implications that may be useful for understanding the conditions related to student achievement.

Two central questions addressed in this report are:

- What types of non-cognitive characteristics are prevalent among students in the Southeast Asian region?
- What types of non-cognitive characteristics are relevant predictors of student achievement in reading, mathematics, and science in this region?

Subsequent sections are organised in the following way:

- Non-cognitive variables and reading achievement, based on PISA 2009
- Non-cognitive variables and mathematics achievement, based on PISA 2012
- Non-cognitive variables and science achievement, based on PISA 2015
- Conclusions including summary of key results and policy implications

Analytic approaches: Prevalence and relevance

Two analytic approaches were adopted: (a) examination of *prevalence* of non-cognitive characteristics; and (b) establishment of their *relevance* as predictors of academic achievement in reading, mathematics, and science. For *prevalence*, students' responses to the questionnaire items and index-level scores were analysed and reviewed. In the publicly available PISA data published by OECD, multiple questionnaire items that were supposed to measure the same construct were made into an index. The PISA indices were standardised with the mean set at 0 and the standard deviation set at 1 across the OECD member countries (countries being given equal weight in the standardisation process). A negative value on the PISA index merely indicates that the respondents answered less positively than all the respondents did on average across the OECD member countries. Similarly, a positive value on the PISA index indicates that the respondents answered more positively than all the respondents did on average across the OECD member countries (OECD, 2012[13]). Given this standardisation framework, an index score of 0.30 (one-third of one unit of standard deviation) was seen as a reasonable cut-off point to indicate *prevalence* of the non-cognitive variable measured by the index.

To examine *relevance* of non-cognitive variables as predictors of students' academic achievement, two main statistical approaches were adopted: correlation and simultaneous multiple linear regression. In search of the "best" or "better" non-cognitive variables that can act as predictors of student achievement, an arbitrary cut-off point of r = .20 was used as a threshold for noteworthy associations. This cut-off point is often employed in social sciences studies, following Cohen's (1988[14]) guidelines suggesting that two variables should have a minimum of approximately 5% of the shared variance to claim an association of practical importance (also see (Rice and Harris, 2005[15])).

The prevalence and relevance of non-cognitive characteristics were also determined in a relative sense. That is, reviews included the comparisons of non-cognitive characteristics within country (i.e. across different non-cognitive variables within the country) and

between countries (i.e. for the same non-cognitive variables across different countries). The between-countries analysis, in particular, can reveal whether certain features represent national or regional characteristics.

A brief overview of non-cognitive research

The term "non-cognitive" refers to human characteristics that cannot be explained solely by cognitive or academic achievement (Farkas, 2003[16]; Lee and Shute, 2010[3]). They are seen as: "(a) conceptually independent from cognitive ability, (b) generally accepted as beneficial to the student and to others in society, (c) relatively rank-order stable over time in the absence of exogenous forces, (d) potentially responsive to intervention, and (e) dependent on situational factors for their expression" (Duckworth and Yeager, 2015, p. 239[17]). Non-cognitive characteristics include individuals' disposition and tendencies in the attitudinal, behavioural, motivational, psychological, and social-emotional domains (Lee and Shute, 2010[3]). Typically, non-cognitive assessment does not involve testing of knowledge or skills in cognitive domains, while questionnaire is the most common way to collect non-cognitive data.

Early development of non-cognitive research

Potential benefits of assessing students' non-cognitive characteristics was first introduced by Messick (1979[18]). In his seminal work, twelve non-cognitive features were identified to have educational relevance: experiential background factors, affects, attitudes, interests, motivations/motives, curiosity, temperament, social sensitivity, coping strategies, cognitive styles, creativity, and values (Messick, 1979[18]). Personality and intellect were singled out as the most distinctive characteristics of individual differences, and later "a tripartite view of mental life" was suggested (Messick, 1996, p. 357[19]) emphasising the three broad domains of affection, conation, and cognition. He also recognised that each can be further split into two components: affection divided into emotion and temperament, conation into motivation and volition, and cognition into declarative knowledge and procedural skills (Snow, Corno and Jackson, 1996[20]).

Over the past 25 years, each non-cognitive construct has formed its own stream of research/theoretical traditions. For example, motivation alone has several dominant theories in the educational psychology literature, such as self-determination theory (Ryan and Deci, 2000[21]), expectancy-value theory (Atkinson, 1957[22]; Weiner, 1996[23]; Eccles and Wigfield, 2002[24]; Wigfield and Eccles, 2000[25]), achievement goal theory (Ames, 1992[26]; Dweck and Leggett, 1988[27]; Elliott and Dweck, 1988[28]), self-efficacy theory (Bandura, 1977[29]; Bandura, 1997[30]), and self-concept (Marsh, 1990[31]). Discussion of these theories is beyond the scope of this review, but one common theme emerging from the non-cognitive research has been its response to the needs to articulate the role that non-cognitive disposition plays in understanding students' academic performance outcomes. In this sense, while non-cognitive entities were seen as important in themselves, their relevance to academic or cognitive outcomes has legitimised the effort that goes into non-cognitive research (Lee and Shute, 2010[3]; Messick, 1996[19]; Stankov and Lee, 2014[32]).

Studies of non-cognitive effect sizes

Several recent influential studies synthesise a large number of non-cognitive variables in terms of their predictive validities for student achievement. Those studies include (Hattie, 2008[33]; Richardson, Abraham and Bond, 2012[34]; Stankov and Lee, 2014[32]; Lee and Shute, 2010[3]). Hattie (2008[33]) reported that the student-level constructs with noteworthy

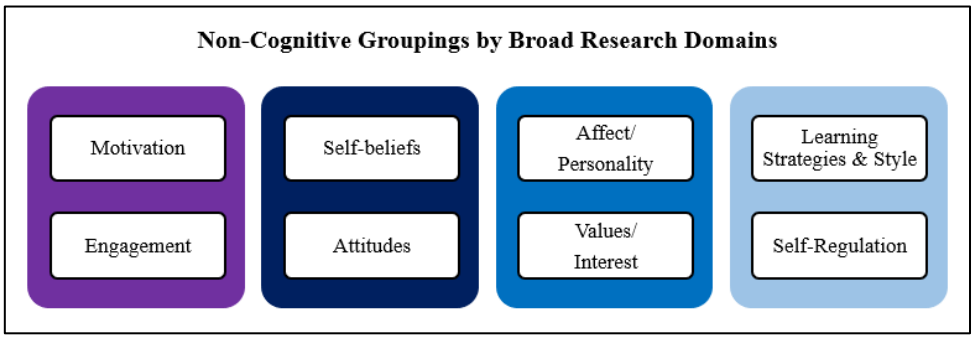
effect sizes for academic achievement were engagement and motivation (Cohen's d = 0.48), self-concept (Cohen's d = 0.43), anxiety (Cohen's d = 0.40), and attitude towards mathematics (Cohen's d = 0.36). Richardson et al.'s (2012) meta-analysis of psychological correlates of academic performance revealed performance self-efficacy, (r = 0.59), grade goal (r = 0.35), effort regulation (r = 0.32), and academic self-efficacy (r = 0.31) to have the largest effect sizes. In Stankov and Lee's (2014[32]) synthesis of non-cognitive constructs from educational, cognitive, and social psychology literature, item-based confidence (r = 0.60), self-efficacy (r = .40s), anxiety (r = .30s) and domain-specific self-concept (r = .20s) formed the upper limit of the predictability structure in what was labelled as the predictability gradient hypothesis (Stankov and Lee, 2014[32]). Further, Lee and Shute's (2010[3]) review of more than 60 non-cognitive constructs concluded that only a dozen variables were associated with students' academic achievement (correlation greater than r = .30), and those variables were grouped into four categories: student engagement, learning strategies, school climate, and social-familial influences. These studies showed that the relevance or utility of non-cognitive variables in predicting student achievement varied widely and that only a handful of them had an empirical basis to claim the predictability for student achievement.

Similar work was conducted using international large-scale assessment data such as PISA or TIMSS (e.g. (Lee, 2014[35]; Lee and Stankov, 2016[36]; Lee, Zhang and Stankov, 2019[37]; Lee and Chen, 2019[38])). For example, Lee and Stankov (2018[39]) reviewed, synthesised, and analysed 65 non-cognitive variables that were measured in the student questionnaires in TIMSS 2003, 2007, and 2011 and in the PISA 2003 and 2012. The analysis revealed that there were only two clusters of non-cognitive variables that showed an effect size greater than a correlation of .20. They were a group of self-beliefs variables (self-efficacy, educational aspiration, self-concept from PISA; self-concept and educational aspiration from TIMSS) and a group relating to school climate (disciplinary climate from PISA; feeling of school safety from TIMSS). The findings were remarkably similar between the PISA and TIMSS assessments and across the five datasets. The hierarchical linear regression (HLM) modelling of PISA 2003 and 2012 datasets also showed that students' self-efficacy (β = .25) and educational aspiration (β = .22) had stronger beta coefficients than family home possessions (β = 11) or parental education (β = 11) in the prediction of students' mathematics achievement.

Non-cognitive constructs at the domain-level

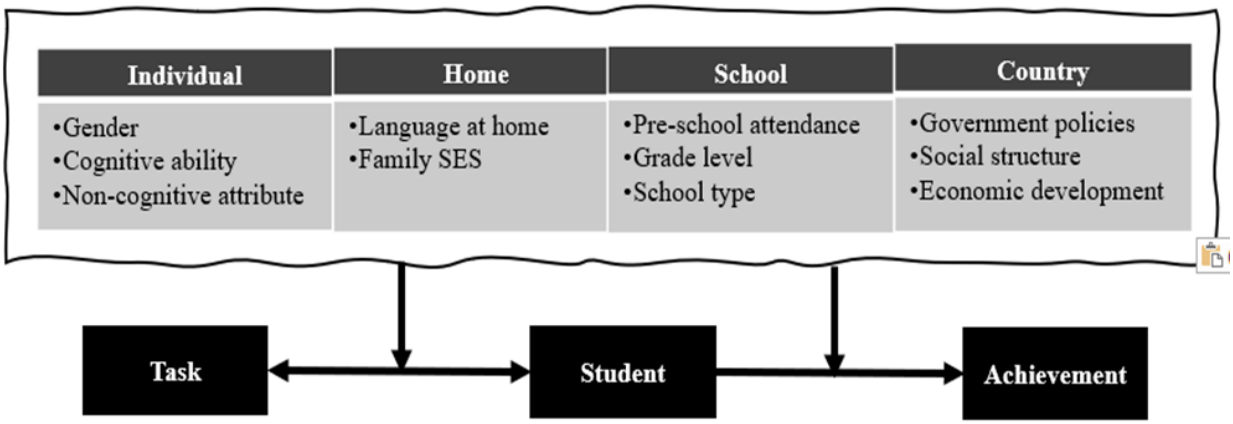
From the non-cognitive constructs directly related to students themselves (rather than school or family influences) included in Richardson et al. (Richardson, Abraham and Bond, 2012[34]), Lee and Shute (2010[3]), and Lee and Stankov (2018[39]), four clusters may be formed to represent an overall structure of non-cognitive profiles (see Figure 1). This non-cognitive schema was employed in this review, as the guidance to understand and organise the results pertaining to the non-cognitive profiles of Southeast Asian students.

Figure 1. A non-cognitive schema



Although the focus of this report is on individual-level non-cognitive characteristics, it is important to make a note of other achievement-related factors from home and school environment and macro-level system- and country-level features. Some specific variables include student demographic background such as gender, home environment often represented by family socio-economic status (SES), school types, and government policies, social structure, and economic development of the country. A simplified version representing these factors is presented in Figure 2. Several variables relating to student demographic background and home and school environment – gender, language use at home, family SES, pre-school attendance, grade-level, and school type – were included in the analyses of this report.

Figure 2. Individual, home, school and country-level influences of student achievement outcomes



Economic, societal, and educational features of Southeast Asian countries

All four Southeast Asian countries of this review – Indonesia, Malaysia, Thailand, and Viet Nam – are categorised as middle-income countries. However, Malaysia and Thailand are classified as upper-middle income countries while Indonesia and Viet Nam belong to lower-middle income countries, according to 2019 World Bank Indicators (http://wdi.worldbank.org/tables). Substantial differences in economic development exist among these nations, with Malaysia (USD 10 590 GNI per capita by the Atlas method) and Thailand (USD 6 610) being richer than Indonesia (USD 3 840) and Viet Nam (USD 2 360). Table 1 presents several indicators of economic, societal, and educational

development for these nations. These countries also differ in terms of the size of total population (ranging from 31 million in Malaysia to 268 million in Indonesia), official languages and main ethnicities, cultural traditions/religions, and major past colonial influences (e.g. Dutch in Indonesia; French and American in Viet Nam).

As mentioned earlier, these four countries appear to have produced satisfactory outcomes in some educational quantity measures such as the population intake in the first grade of primary schooling, primary school enrolment rate and youth and adult literacy rates. However, the overall secondary school enrolment rates are still lower than 90% in Indonesia and Malaysia. Furthermore, the percentages of the population using the Internet were only at 39.8% in Indonesia and 56.8% in Thailand in 2018. Also, the numbers of births given by female adolescents aged 15 to 19 are as high as 47 (per 1 000 women) in Indonesia, 45 in Thailand, and 31 in Viet Nam in 2018. These numbers have serious implications for school enrolment and dropouts of female adolescents, and yet have not improved much since 2010. Given the demographic and educational and economic profiles of these countries, the PISA student populations (i.e. adolescents attending schools) can be seen as relatively privileged groups in the region.

Table 1. Population information: Education, economy, and people

Southeast Asian countries	Indonesia		Malaysia		Thailand		Viet Nam	
	2010	2018	2010	2018	2010	2018	2010	2018
Education								
Intake ratio in first grade of primary: Male	n/a	104	n/a	104	n/a	95	n/a	114
Intake ratio in first grade of primary: Female	n/a	101	n/a	106	n/a	96	n/a	117
Reaching Grade 5: Male	n/a	99	n/a	97	n/a	94	n/a	n/a
Reaching grade 5: Female	n/a	100	n/a	98	n/a	93	n/a	n/a
Transition rate to secondary education: Male	n/a	95	n/a	92	n/a	n/a	n/a	100
Transition rate to secondary education: Female	n/a	87	n/a	90	n/a	n/a	n/a	100
Primary completion rate, total (% of age group)	101	102	97	99	n/a	93	103	110
School enrollment, primary (% gross)	109.2	106.4	99.8	105.3	96.9	99.6	105.7	110.6
School enrollment, secondary (% gross)	76	89	77	82	82	117	n/a	n/a
Youth literacy rate: Male (% of ages 15-24)	n/a	100	n/a	97	n/a	98	n/a	98
Youth literacy rate: Female (% of ages 15-24)	n/a	100	n/a	98	n/a	98	n/a	98
Adult literacy rate: Male (% ages 15 and older)	n/a	97	n/a	96	n/a	95	n/a	96
Adult literacy rate: Female (% ages 15 and older)	n/a	94	n/a	91	n/a	91	n/a	94
Economy								
GDP (current USD) (billions)	755.09	1 042.17	255	358.6	341.1	505	115.9	245.2
GDP growth (annual %)	6.2	5.2	7.4	4.7	7.5	4.1	6.4	7.1
GNI, Atlas method (current USD) (billions)	612.25	1 026.76	233	333.8	308	458.7	110.3	225.9
GNI per capita, Atlas method (current USD)	2 530	3 840	8 260	10 590	4 580	6 610	1 250	2 360
Individuals using the Internet (% of population)	10.9	39.8	56.3	81.2	22.4	56.8	30.7	70.3
People								
Population, total (millions)	241.83	267.66	28.21	31.53	67.2	69.43	87.97	95.54
Population density (people per sq. km)	133.5	147.8	85.9	96	131.5	135.9	283.7	308.1
Life expectancy at birth, total (years)	69	71	74	76	74	77	75	75
Adolescent fertility rate (birth per 1,000 women)	51	47	13	13	48	45	34	31
Mortality rate, under 5 (per 1,000 live births)	34	25	8	8	13	9	23	21

Note: Numbers marked in blue refer to the data gathered in recent but different years than those specified. n/a: non-available.
Source: World Development Indicators 2019 database http://wdi.worldbank.org/tables; accessed on 20 December 2019.

PISA participation of Southeast Asian countries

Indonesia and Thailand participated in PISA 2009, 2012, and 2015, following the international assessment schedule (see Table 2). The survey administration was conducted in the country as scheduled and the response rates set by the PISA international standards were met. Consequently, these countries were included in the country-level analyses in the main OECD reports as well as in the data compendia available in the official PISA website.

Malaysia and Viet Nam on the other hand carried out PISA 2009 in the year 2010. Malaysia data were still included in the international public-release data file of PISA 2009, but that was not the case for Viet Nam. In PISA 2015, Malaysia did not meet the response requirements, in spite of its participation on time. Thus, Malaysia was excluded in the public-release data while their results were still included in the OECD main official reports (OECD, 2016[40]), with footnotes stating "coverage is too small to ensure comparability" or "the PISA 2015 sample for Malaysia did not meet the PISA response-rate standards, so comparisons with 2015 cannot be reported for Malaysia" (p. 81). Thus, adherence to the international schedule and meeting the response rate standards appear to be crucial for the countries to receive a full range of benefits of PISA participation. The analyses conducted for this report were based on the publicly available data that were released in the official OECD website (http://www.oecd.org/pisa/data/). This means that the countries included in the present report include:

- Indonesia, Malaysia, and Thailand from PISA 2009 data
- Indonesia, Malaysia, Thailand, and Viet Nam from PISA 2012 data
- Indonesia, Thailand, and Viet Nam from PISA 2015 data.

Table 2. PISA participation and products of four Southeast Asian countries: 2009, 2012, and 2015

		Indonesia	Malaysia	Thailand	Viet Nam
PISA 2009	Participation	Yes	2010	Yes	2010
	Public Data	Yes	Yes	Yes	No
	Report	Yes	No	Yes	No
	Compendium	Yes	Yes	Yes	No
PISA 2012	Participation	Yes	Yes	Yes	Yes
	Public Data	Yes	Yes	Yes	Yes
	Report	Yes	Yes	Yes	Yes
	Compendium	Yes	Yes	Yes	Yes
PISA 2015	Participation	Yes	Yes	Yes	Yes
	Public Data	Yes	No	Yes	Yes
	Report	Yes	Yes	Yes	Yes
	Compendium	Yes	Yes	Yes	Yes

Demographic characteristics of PISA student samples from Southeast Asian countries

Technical reports (OECD, 2012[13]; OECD, 2014[41]; OECD, 2017[42]) present information about PISA sampling strategies and population coverage within country, and hence such information will not be repeated here. Instead, this section presents the demographic composition of the student samples (gender, language, Grade-level, school programme

type, father's and mother's education levels, and family structure) of Indonesia, Malaysia, Thailand, and Viet Nam in the PISA 2009, 2012, and 2015 cycles.

Gender

In PISA surveys, gender ratio is supposed to be approximately equal. That sampling framework appeared to have worked in Indonesia and Malaysia but less so in Thailand (Table 3). The percentage of Thai female students was higher than that of male students in all three assessment years. This is because many Thai male students attend religious schools such as the Buddhist or Islamic schools and these schools did not participate in PISA and thus were not included in the PISA sampling frame (Thien, Darmawan and Ong, 2015[43]). In Viet Nam's case, the gender ratio was balanced in 2015.

Table 3. Percentage of gender composition of student samples

Country	Gender	2009	2012	2015
Indonesia	Female	50	49	50
	Male	50	51	50
Malaysia	Female	51	52	n/a
	Male	49	48	n/a
Thailand	Female	57	56	57
	Male	43	44	43
Viet Nam	Female	n/a	54	51
	Male	n/a	46	49

Note: Variable: ST04Q01; n/a: data not available
Source: Adapted from OECD, PISA 2009, 2012, 2015 Databases (OECD, 2010[44]; OECD, 2013[45]; OECD, 2016[46]).

Language spoken at home

The information about whether students speak the same or different languages at home and in school (e.g. the PISA test language) is regularly collected in PISA student questionnaire. If home language differs from the language of instruction at school (and students are not completely bilingual), students may face learning challenges at school (Table 4). While virtually all students in Viet Nam spoke Vietnamese, as many as 64% of Indonesian, 42% of Malay, and 45% Thai students reported their languages being different between home and school.

Table 4. Percentage of PISA test language used at home

Country	PISA test language used at home	2009	2012	2015
Indonesia	Indonesian	36	41	36
	Another language	64	59	64
Malaysia	Malay/English	70	58	n/a
	Another language	30	42	n/a
Thailand	Thai	51	55	52
	Another language	49	45	48
Viet Nam	Vietnamese	n/a	98	94
	Another language	n/a	2	6

Note: Variable: ST19Q01in 2009; ST25Q01 in 2012; and ST022Q01TA in 2015; n/a: data not available; The 2015 Thai percentage from ST022Q01TA corrected by the information in the variable "LANGN". Both Malay (84% of the sample) and English (16%) were used as the test language in Malaysia.

Source: Adapted from OECD, PISA 2009, 2012, 2015 Databases (OECD, 2010[44]; OECD, 2013[45]; OECD, 2016[46]).

Grade-Level

The age-based sampling of PISA (i.e. 15-years-olds) often led to the student sample composition consisting of more than one grade-level. Apparently, there was a wide range of grade-level differences across the four Southeast Asian countries (Table 5). The majority (76%) of the Thai sample students, but even higher percentages of Malay (96%) and Viet Nam (89%) students, were in Grade 10 when they took the PISA tests (in the PISA 2012 data). On the other hand, only 48% of Indonesian students were in Grade 10 when they took the PISA assessment in 2012. Indonesian researchers (e.g. (Fenanlampir, Batlolona and Imelda, 2019[47])) have expressed the concern about their students having fewer years of schooling by the time that they sat for PISA testing.

It should also be mentioned that the PISA performance results of students in different Grade levels within country (e.g. comparing Grade 7 versus Grade 8 students in PISA 2009 or comparing Grade 7 in 2009 and Grade 8 in 2012) cannot be interpreted as evidence of student progress, because PISA is not a longitudinal assessment. Furthermore, the PISA tests are not designed to measure the learning outcomes that are designed to be mastered at a particular grade level (OECD, 2013, p. 196[48]). Nevertheless, countries are aware of potential consequences by having more or fewer students in the upper secondary level to sit for PISA tests.

Table 5. Percentage of grade-levels in student samples

Country	Grade	2009	2012	2015
Indonesia	Grade 7	2	2	2
	Grade 8	7	8	8
	Grade 9	46	38	42
	Grade 10	40	48	45
	Grade 11	5	4	2
	Grade 12	1	1	0
Malaysia	Grade 9	27	4	n/a
	Grade 10	72	96	n/a
	Grade 11	0	0	n/a
Thailand	Grade 7	0	0	0
	Grade 8	0	0	1
	Grade 9	23	21	24
	Grade 10	74	76	73
	Grade 11	3	3	2
Viet Nam	Grade 8	n/a	3	2
	Grade 9	n/a	8	8
	Grade 10	n/a	89	90
	Grade 11	n/a	0	0

Note: Variable: ST01Q01; n/a: data not available
Source: Adapted from OECD, PISA 2009, 2012, 2015 Databases (OECD, 2010[44]; OECD, 2013[45]; OECD, 2016[46]).

School type

Table 6 presents the percentages of students attending different school types within country: lower secondary versus upper secondary, and general, vocational, and religious schools.

In Indonesia and Thailand, the percentages of PISA student samples who were attending vocational schools were between 15% and 21%. The figure was smaller in Malaysia (12-13%). However, none of Vietnamese students were attending vocational institutions (in 2015; 1% in 2012). Given that Viet Nam has the national examination system for entrance to the upper secondary school, these percentages of Viet Nam make sense. Nevertheless, it can be noted the Viet Nam sample differed from the other three countries with respect to types of schools, which may have some implications for PISA performance results.

The national entrance examination to the upper secondary school level in Viet Nam is perceived as high-stakes and competitive with about 60% success rate in the country (Nguyen, 2019[49]). The PISA testing month is particularly relevant to Viet Nam because most 15-years-olds (PISA sample age) would be in the first year of upper secondary school if PISA is conducted between September and December. If PISA was conducted in the months between January and April, most 15-years-olds would be in the second semester of the last year of lower-secondary school level. Most of the Viet Nam's PISA sample students (more than 80%) were at Grade 10 in the upper secondary school level, and thus they can be considered as relatively more able students within the country.

As mentioned above, the percentages of students in the lower versus upper secondary schools appear to be an issue for Indonesia. For example, in the 2012 PISA testing, 48% of Indonesian students were attending the lower secondary levels while only 4% in Malaysia, 21% in Thailand, and 10% in Viet Nam students attended lower secondary schools.

Table 6. Percentage of school programme types in student samples

Country		2009	2012	2015
Indonesia	General Junior High School	41	37	39
	Islamic Junior High School	13	11	14
	General Senior High School	26	26	24
	Islamic Senior High School	5	6	8
	Vocational High School	15	20	16
Malaysia	Lower Secondary	28	4	n/a
	Science Upper Secondary	24	35	n/a
	Arts Upper Secondary	33	45	n/a
	Religious Secondary	3	3	n/a
	Technical/Vocational Secondary	12	13	n/a
Thailand	Lower Secondary Level	24	21	25
	Upper Secondary Level	55	59	58
	Vocational Certificate level	21	20	18
Viet Nam	Lower Secondary Level	n/a	10	9
	Upper Secondary Level	n/a	81	85
	Mixed schools	n/a	5	0
	Continuing education centers	n/a	3	5
	Vocational institutions	n/a	1	0

Note: Variable: PROGN; n/a: data not available

Source: Adapted from OECD, PISA 2009, 2012, 2015 Databases (OECD, 2010[44]; OECD, 2013[45]; OECD, 2016[46]).

Family structure

Table 7 presents family structure of the PISA student samples, which was classified into three categories: single parent, two-parents, and other arrangement. While the majority of students in Southeast Asian countries lived in homes with two parents, the Thai sample had the larger percentage of single-parent households and more than 30% of them did not live in two-parent homes.

The main reason for Thai children not being in school has been identified as poverty (Tharmmapornphilas, 2013[12]). To this, family structure, family size, youth's marital status, birth order (older sister taking care of younger sibling), and having labour substitution within family (i.e. having an elderly person in the house), adds the complexities of the issue of school attendance of Thai youth in ages 15-17 (Tharmmapornphilas, 2013[12]). Taken together with the relatively high adolescent birth rate in Thailand (see Table 2), the PISA sample (i.e. those who were attending school at the age of 15) can be regarded as a relatively privileged group in the nation.

Table 7. Percentage of family structure in student samples

Country	Family structure	2009	2012	2015
Indonesia	Single parent	8	7	n/a
	Two parents	71	76	n/a
	Other	22	16	n/a
Malaysia	Single parent	9	12	n/a
	Two parents	85	83	n/a
	Other	6	5	n/a
Thailand	Single parent	18	15	n/a
	Two parents	63	69	n/a
	Other	19	16	n/a
Viet Nam	Single parent	n/a	8	n/a
	Two parents	n/a	86	n/a
	Other	n/a	6	n/a

Note: Variables: FAMSTRUC; n/a: data not available
Source: Adapted from OECD, PISA 2009, 2012, 2015 Databases (OECD, 2010[44]; OECD, 2013[45]; OECD, 2016[46]).

Parental educational levels

- The information about father's and mother's education levels is gathered in the student questionnaires in PISA. Reporting of family's socio-economic status can differ by reporting sources or methods (Jerrim and Micklewright, 2014[50]) and thus the data below in
- Table 8 should be viewed with caution.
- It can be noted that about 9% to 12% in Indonesia and 11% to 17% of Viet Nam parents were reported to have no education at all.
- In Indonesia, primary education was the most common educational level of both fathers and mothers.

- In Malaysia, the most common level of educational attainment of fathers and mothers was some schooling after post-secondary (non-university).
- In Thailand, the primary education level was the most common for both fathers and mothers although the percentages decreased between 2009 and 2015.
- In Viet Nam, the most common education level was lower secondary education for both fathers and mothers.

Table 8. Percentage of father's and mother's education levels in student samples

Country	Education Level	Father			Mother		
		2009	2012	2015	2009	2012	2015
Indonesia	None	9	8	10	12	11	12
	ISCED 1 (primary education)	29	28	29	33	32	33
	ISCED 2 (lower secondary education)	18	19	19	19	19	20
	ISCED 3B, C (upper secondary education)	6	5	5	3	3	3
	ISCED 3A, ISCED 4 (post-secondary)	23	24	26	21	22	24
	ISCED 5B (*non-university* tertiary education)	5	4	1	5	3	1
	ISCED 5A, 6 (university level)	10	12	10	7	10	8
Malaysia	None	0	5	n/a	0	6	n/a
	ISCED 1 (primary education)	5	7	n/a	7	9	n/a
	ISCED 2 (lower secondary education)	8	13	n/a	9	13	n/a
	ISCED 3B, C (upper secondary education)	9	1	n/a	10	1	n/a
	ISCED 3A, ISCED 4 (post-secondary)	54	50	n/a	57	52	n/a
	ISCED 5B (*non-university* tertiary education)	11	10	n/a	8	9	n/a
	ISCED 5A, 6 (university level)	13	14	n/a	9	11	n/a
Thailand	None	6	5	4	8	6	5
	ISCED 1 (primary education)	44	37	31	49	43	30
	ISCED 2 (lower secondary education)	13	15	16	11	14	16
	ISCED 3B, C (upper secondary education)	4	3	4	3	2	4
	ISCED 3A, ISCED 4 (post-secondary)	19	25	29	17	22	29
	ISCED 5A, 6 (university level)	15	15	16	12	13	17
Viet Nam	None	n/a	11	14	n/a	14	17
	ISCED 1 (primary education)	n/a	18	22	n/a	21	23
	ISCED 2 (lower secondary education)	n/a	36	34	n/a	36	36
	ISCED 3B, C (upper secondary education)	n/a	2	1	n/a	1	1
	ISCED 3A, ISCED 4 (post-secondary)	n/a	25	25	n/a	21	19
	ISCED 5A, 6 (university level)	n/a	9	5	n/a	7	4

Note: Variables: FISCED for father' education level; MISCED for Mother's education level; n/a: data not available
Source: Adapted from OECD, PISA 2009, 2012, 2015 Databases (OECD, 2010[44]; OECD, 2013[45]; OECD, 2016[46]).

Comparison countries

A handful of countries from other world regions were selected for comparison purposes, based on the examination of relevant literature. Studies of Viet Nam often have Singapore and Korea as examples for educational excellence (e.g. (Dang and Glewwe, 2018[9]; World Bank, 2011[51])). A longitudinal project of childhood poverty surveys, called Young Lives (cohorts of children born in 1994/95 and 2001/2), involved Ethiopia, India, Peru, and Viet Nam (Sánchez and Singh, 2018[52]). Indonesia's performance has been examined together with those of Brazil, Columbia, and Peru (Fenanlampir, Batlolona and Imelda,

2019[47]). Thus, the following countries are included in this report, when highlighting the results of the four Southeast Asian countries:

- Singapore and Korea in Asia, for geographical proximity, economic development, and high student achievement;
- Brazil, Columbia, and Peru from South America, for being similar in terms of national wealth and student achievement;
- Australia and Finland, two Western nations, as they are often cited as having a balance of student development in both cognitive and non-cognitive areas (OECD, 2010[53]; 2013[48]; 2016[40]; 2019[2]).
- The OECD country averages or the averages of all PISA participant countries and economies are also presented for comparison with the findings of Southeast Asian data.

Concluding remarks

The PISA student samples in Indonesia, Malaysia, Thailand and Viet Nam are not perfectly comparable, in part, due to the variations in their demographic compositions (e.g. years of schooling or school type). However refined the sampling framework is, there will be country-specific educational policies and practices that are likely to influence the scope and nature of the PISA sampling population (e.g. school starting age, national examination). Furthermore, social norms, values and attitudes towards education are also likely to play a role in shaping the landscape of national educational contexts in which the samples are drawn for PISA testing. Thus, it is important to keep these limitations in mind when interpreting the findings presented in subsequent sections of this report. Nevertheless, it is hoped that some policy measures may be envisioned that can energise and incentivise individuals who wish to thrive within their own personal, family, and social environments.

2. Non-cognitive characteristics related to reading achievement

Non-cognitive characteristics related to reading and learning consist of the perceptions about learning environments, approaches to reading, and enjoyment from reading and learning (OECD, 2010[53]). These non-cognitive characteristics, collected from student questionnaire data in the PISA 2009 cycle, were the focus of this section. For the index-level analysis, the non-cognitive indices created by OECD were used (see Table 9 for the description of the indices). Based on the non-cognitive schema consisting of six broad domains (see Figure 1), these constructs were broadly categorised into:

- Affect/Personality: Enjoyment of reading (JOYREAD)
- Attitudes towards School: Attitude towards school (ATSCHL) and Disciplinary climate (DISCLIMA)
- Engagement: Diversity of reading materials (DIVREAD)
- Learning Strategy: Control strategies (CSTRAT), Memorisation (MEMOR), and Elaboration (ELAB)
- Self-Regulation: Metacognitive awareness about reading strategies: Summarising (METASUM), and Understanding and remembering (UNDREM)

Table 9. Nine non-cognitive indices examined in this section

Index label	Index description
ATSCHL	**Attitude towards school** The index of attitude towards school (ATSCHL) was derived from student responses to four items, asking to what extent do you agree or disagree with the following statements? (ST33): School has done little to prepare me for adult life when I leave school; School has been a waste of time; School helped give me confidence to make decisions; School has taught me things which could be useful in a job. All items which are negatively phrased (items ST33Q01, ST33Q02) were reverse scored for item response theory (IRT) scaling such that positive weighted maximum likelihood estimate (WLE) scores on this new index for PISA 2009 indicate a better attitude towards school.
CSTRAT	**Control strategies** Students' approach to learning is based on student responses in ST27 and measured through the following three indices: memorisation (MEMOR), elaboration (ELAB) and control strategies (CSTRAT). The index of control strategies (CSTRAT) was derived from students' reports on how often they did the following statements: i) when I study, I start by figuring out what exactly I need to learn; ii) when I study, I check if I understand what I have read; iii) when I study, I try to figure out which concepts I still haven't really understood; iv) when I study, I make sure that I remember the most important points in the text; and v) when I study and I don't understand something, I look for additional information to clarify this. Higher values on the index indicate higher importance attached to the given strategy.
DISCLIMA	**Disciplinary climate** The index of disciplinary climate (DISCLIMA) was derived from student responses of how often do these things happen in your <test language lessons> (ST36): Students don't listen to what the teacher says; There is noise and disorder; The teacher has to wait a long time for students to <quiet down>; Students cannot work well; Students don't start working for a long time after the lesson begins. Higher values on this index indicate a better disciplinary climate.
DIVREAD	**Diversity of reading materials** The index of diversity of reading materials (DIVREAD) was derived from the frequency with which students read the following materials because they want to (ST25): magazines, comic books, fiction, non-fiction books and newspapers. Higher values on this index indicate higher diversity in reading.
ELAB	**Elaboration** How students approach learning is based on student responses in ST27 and measured through the following three indices: memorisation (MEMOR), elaboration (ELAB) and control strategies (CSTRAT). The index of elaboration (ELAB) was derived from the frequency with which students did the following when they were studying: i) try to relate new information to prior knowledge acquired in other subjects; ii) figure out how the information might be useful

	outside school; iii) try to understand the material better by relating it to my own experiences; and iv) figure out how the text information fits in with what happens in real life.
JOYREAD	**Enjoyment of reading** The index of enjoyment of reading (JOYREAD) was derived from four response categories varying from "strongly disagree", "disagree", "agree" to "strongly agree". Eleven items (ST24) were used to measure enjoyment of reading in PISA 2009. All items which are negatively phrased (items a, d, f, h, i) were reverse scored for IRT scaling such that positive scores on this index for PISA 2009 indicate higher levels of enjoyment of reading: I read only if I have to; Reading is one of my favourite hobbies; I like talking about books with other people; I find it hard to finish books; I feel happy if I receive a book as a present; For me, reading is a waste of time; I enjoy going to a bookstore or a library; I read only to get information that I need; I cannot sit still and read for more than a few minutes; I like to express my opinions about books I have read; I like to exchange books with my friends.
MEMOR	**Memorisation** How students approach learning is based on student responses in ST27 and measured through the following three indices: memorisation (MEMOR), elaboration (ELAB) and control strategies (CSTRAT). The index of memorisation (MEMOR) was derived from the frequency with which students did the following when they were studying: i) try to memorise everything that is covered in the text; ii) try to memorise as many details as possible; iii) read the text so many times that they can recite it; and iv) read the text over and over again.
METASUM	**Summarising** The index of summarising (METASUM) was derived from students' reports on the usefulness of the following strategies for writing a summary of a long and rather difficult two-page text about fluctuations in the water levels of a lake in Africa (ST42): A) I write a summary. Then I check that each paragraph is covered in the summary, because the content of each paragraph should be included; B) I try to copy out accurately as many sentences as possible; C) before writing the summary, I read the text as many times as possible; D) I carefully check whether the most important facts in the text are represented in the summary; and E) I read through the text, underlining the most important sentences, then I write them in my own words as a summary. This index was scored using a rater-scoring system. The experts' agreed order of the five items consisting this index is DE>AC>B. Higher values on this index indicate greater students' perception of usefulness of this strategy.
UNDREM	**Understanding and remembering** The index of understanding and remembering (UNDREM) was derived from students' reports on the usefulness of the following strategies for understanding and memorising the text (ST41): A) I concentrate on the parts of the text that are easy to understand; B) I quickly read through the text twice; C) After reading the text, I discuss its content with other people; D) I underline important parts of the text; E) I summarise the text in my own words; and F) I read the text aloud to another person. These scores were standardised for the index to have a mean of 0 and a standard deviation of 1 across OECD member countries. Higher values on this index indicate greater students' perception of usefulness of this strategy.

Source: (OECD, 2010[53]), *PISA 2009 Results: Learning to Learn – Student Engagement, Strategies and Practices (Volume III),* http://dx.doi.org/10.1787/9789264083943-en; PISA 2009 Technical Report (OECD, 2012[13]), *PISA 2009 Technical Report*, http://dx.doi.org/10.1787/9789264167872-en.

Within-Country Non-cognitive prevalence patterns: Indonesia, Malaysia, and Thailand

The index mean scores for each of the nine non-cognitive variables in Indonesia, Malaysia, and Thailand are presented in Table 10 (the variables are listed in a descending order of the mean values. Those indices with the mean scores greater than 0.30 are in bold. Among them, variables that are common to all three countries are shaded in grey).

- Indonesia showed four non-cognitive variables of which the mean values were greater than the cut-off point of 0.30: DIVREAD (mean score of 0.60), ATSCHL (0.50), JOYREAD (0.43), and MEMOR (0.34).
- Among these four, DIVREAD (mean score of 0.80) and JOYREAD (0.37) were also found to be prevalent in Malaysia.
- These two variables, DIVREAD (mean score of 0.99) and JOYREAD (0.54), again, were among the top three prevalent non-cognitive characteristics in Thailand. DISCLIMA was an additional variable showing the mean score greater than 0.30. This index was also relatively high in Indonesia but not in Malaysia.

- Although ATSCHL was stronger in Indonesia (0.50), it was positive and ranked relatively high in the list of non-cognitive variables for Malaysia (0.20) and Thailand (0.20) as well.

Overall, students' non-cognitive profiles were similar in Indonesia, Malaysia, and Thailand. All three countries showed strong prevalence of reading a wide range of materials (DIVREAD) and enjoyment of reading (JOYREAD). On the other hand, students' endorsement of the statements related to whether they employed learning strategies and metacognitive awareness was relatively low, and lower than the OECD average, in all three countries.

Table 10. Mean index scores of nine non-cognitive variables

Indonesia			Malaysia			Thailand		
	Mean index	S.E.		Mean index	S.E.		Mean index	S.E.
DIVREAD	0.60	(0.03)	**DIVREAD**	0.80	(0.02)	**DIVREAD**	0.99	(0.02)
ATSCHL	0.50	(0.02)	**JOYREAD**	0.37	(0.01)	**JOYREAD**	0.54	(0.01)
JOYREAD	0.43	(0.01)	ATSCHL	0.20	(0.03)	**DISCLIMA**	0.33	(0.01)
MEMOR	0.34	(0.01)	ELAB	0.18	(0.01)	ELAB	0.27	(0.01)
DISCLIMA	0.26	(0.02)	MEMOR	0.05	(0.02)	ATSCHL	0.20	(0.02)
ELAB	0.25	(0.01)	DISCLIMA	0.05	(0.02)	MEMOR	0.06	(0.01)
CSTRAT	-0.19	(0.02)	UNDREM	-0.17	(0.02)	UNDREM	-0.30	(0.02)
UNDREM	-0.32	(0.03)	CSTRAT	-0.29	(0.02)	CSTRAT	-0.44	(0.01)
METASUM	-0.54	(0.03)	METASUM	-0.29	(0.02)	METASUM	-0.67	(0.02)

Note: N = 5 136 in Indonesia; N = 4 999 in Malaysia; N = 6 225 in Thailand. The mean scores greater than 0.30 are in bold. Among them, variables that were common in all three countries are shaded in grey. Viet Nam participated in PISA 2009, in 2010. Due to their late participation, the data was not included in the international data set. Hence, Viet Nam was not included in the PISA 2009 analysis.
Source: Adapted from OECD, PISA 2009 Database (OECD, 2010[44]).

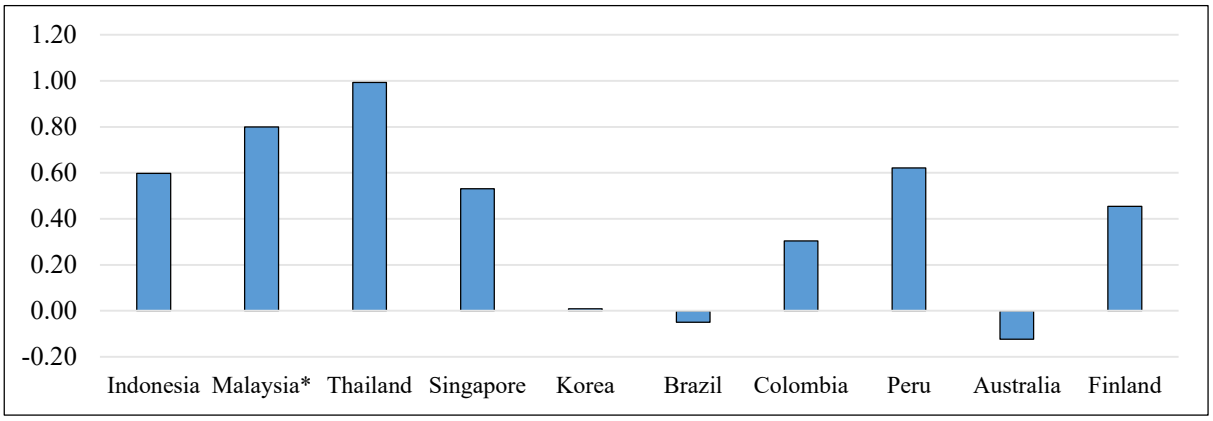
Two most prevalent non-cognitive characteristics: Diversity of reading and Enjoyment of reading in Indonesia, Malaysia, and Thailand

Two prevalent non-cognitive characteristics of Southeast Asia students turned out to be DIVREAD and JOYREAD. These two non-cognitive indices were further examined, for example, for comparisons with countries in other regions.

Diversity of reading materials (DIVREAD)

Indonesia, Malaysia, and Thailand, indeed, showed a strong prevalence of DIVREAD, compared to the other comparison countries (Figure 3). In fact, Thailand (mean score of 0.99), Malaysia (0.80), and Indonesia (0.60) had the second, third, and fifth highest mean scores on DIVREAD, respectively, across all countries and economies that participated in PISA 2009. The neighbouring country, Singapore also showed a strong endorsement of DIVREAD (mean score of 0.53).

Figure 3. Mean scores on the index of diversity of reading materials (DIVREAD) in ten countries

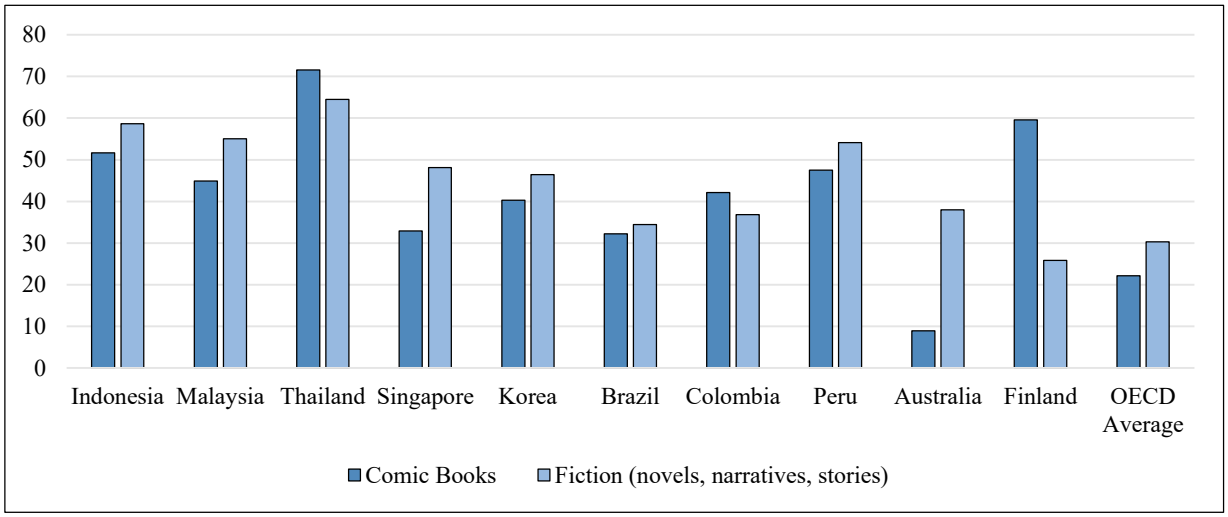


*Note**: Author's calculation of Malaysia.
Source: Table III.1.10, (OECD, 2010[53]), *PISA 2009 Results: Learning to Learn – Student Engagement, Strategies and Practices (Volume III)*, http://dx.doi.org/10.1787/9789264083943-en.

The index score of diversity of reading materials (DIVREAD) was derived from the frequency with which students read a range of reading materials: magazines, comic books, fiction, non-fiction books and newspapers. Thus, the item response pattern was examined if the students were engaged in reading any particular genre. It was found that Southeast Asian students' high scores on DIVREAD was largely driven by their higher endorsement of reading comic books and fiction and non-fiction books (Figure 4).

- The percentage of students who responded "several times a month" or "several times a week" (two highest response categories given to the item) reading comic books was 72% in Thailand, 52% in Indonesia, and 45% in Malaysia, as opposed to 22% of the OECD average.
- The percentage of students reading fiction was also higher: 65% in Thailand, 59% in Indonesia, and 55% in Malaysia, compared to 30% of the OECD average. Further, the percentages of students reading of non-fiction books was high: 50% in Thailand, 45% in Malaysia, and 35% in Indonesia, as opposed to a much lower percentage of 18% in the average across the OECD member countries.

Figure 4. Percentages of students who reported reading comic books or fiction "several times a month" or "several times a week"



Source: Adapted from OECD, PISA 2009 Database (OECD, 2010[44]).

Although both boys and girls in the four Southeast Asian countries included in Table 11 below obtained substantially higher scores on the DIVREAD index, compared to the OECD average, girls had significantly higher scores than boys on this index (Table 11). While the stronger tendency of girls reading a diverse range of materials was shown in all comparison group countries and the OECD average, it was more pronounced in Thailand with the difference of the index scores being as high as 0.47.

Table 11. Gender difference in the mean scores on the index of diversity of reading materials (DIVREAD)

Countries	Boys		Girls		Gender differences (boys - girls)	
	Mean index	S.E.	Mean index	S.E.	Diff.	S.E.
Indonesia	0.49	(0.04)	0.71	(0.04)	**-0.22**	(0.05)
Malaysia*	0.75	(0.03)	0.85	(0.02)	**-0.10**	(0.03)
Thailand	0.73	(0.03)	1.19	(0.02)	**-0.47**	(0.03)
Singapore	0.49	(0.02)	0.57	(0.02)	**-0.08**	(0.03)
Korea	-0.03	(0.03)	0.06	(0.03)	**-0.09**	(0.04)
Brazil	-0.24	(0.02)	0.12	(0.02)	**-0.36**	(0.03)
Colombia	0.14	(0.04)	0.45	(0.03)	**-0.31**	(0.04)
Peru	0.54	(0.03)	0.70	(0.02)	**-0.17**	(0.04)
Australia	-0.19	(0.02)	-0.06	(0.01)	**-0.13**	(0.02)
Finland	0.36	(0.02)	0.55	(0.02)	**-0.19**	(0.02)
OECD average	-0.09	(0.00)	0.09	(0.00)	**-0.18**	(0.01)

*Note**: Author's calculation of Malaysia.
Note: Statistically significant differences in bold.
Source: Table III.1.10, (OECD, 2010[53]), *PISA 2009 Results: Learning to Learn – Student Engagement, Strategies and Practices (Volume III)*, http://dx.doi.org/10.1787/888932343285.

Although reading a diverse range of genres can be seen as a positive aspect of student development, there were only moderate or weak, positive associations between DIVREAD

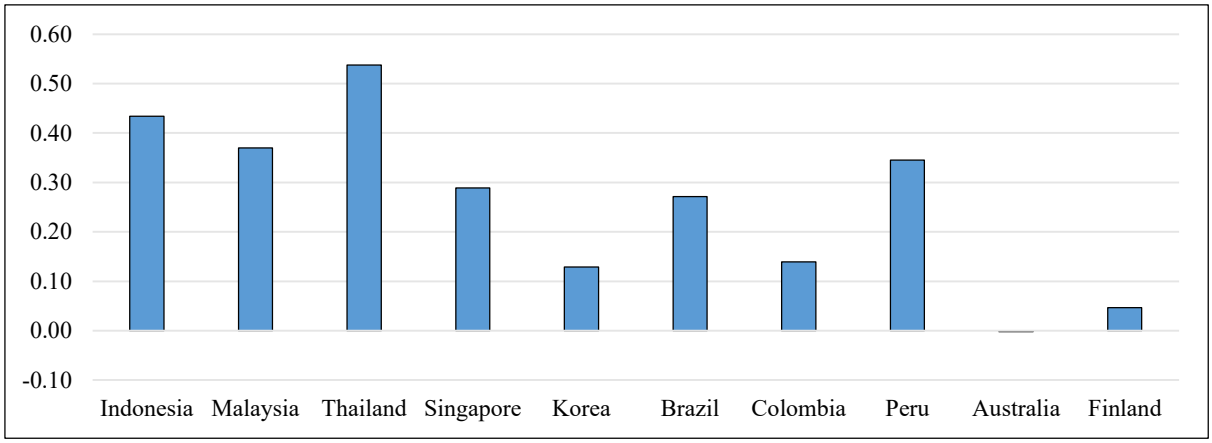
and reading achievement: r = .21 for Malaysia, r = .20 in Thailand, and r = .15 in Indonesia. Across all PISA 2009 participants, the strength of correlations was r = .18.

Among the comparison countries, Finland showed an interesting pattern of results. Students in Finland read comic books almost as often or even more often than students in Southeast Asian countries, and the association between DIVREAD and reading achievement was much stronger, r = .37. Thus, Finnish students who scored higher in reading achievement also tended to read a diverse range of materials, but this association was much weaker among Southeast Asian students.

Enjoyment of reading (JOYREAD)

Enjoyment of reading was another prevalent non-cognitive attribute of Southeast Asian students (Figure 5). The JOYREAD mean scores were substantially higher than the OECD average: Thailand (0.54) was more than a half of standard deviation higher than the OECD average, which was followed by Indonesia (0.43) and Malaysia (0.37). In fact, the mean scores of Thailand and Indonesia were the fifth and sixth highest scores across all PISA 2009 participant countries and economies.

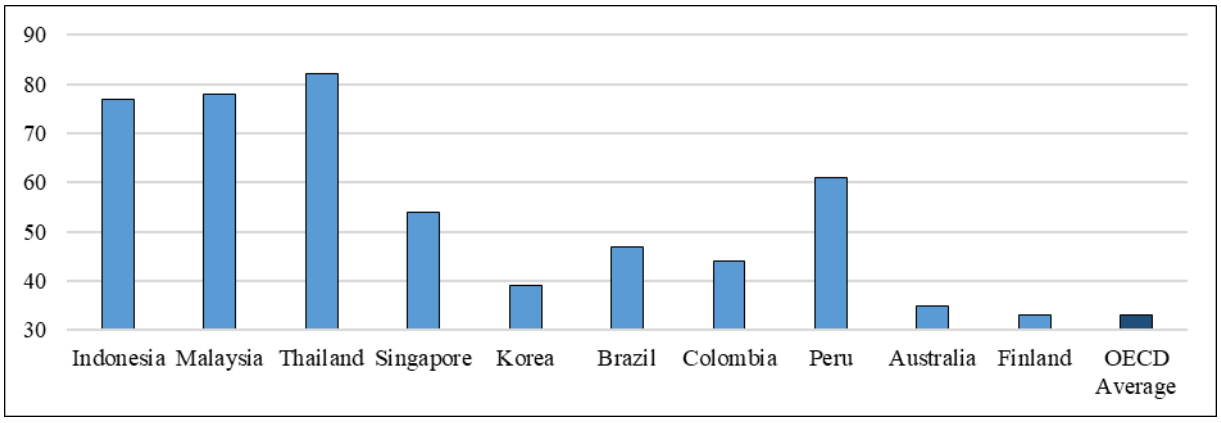
Figure 5. Mean scores on the index of enjoyment of reading (JOYREAD)



Note: Author's calculation of Malaysia
Source: Table III.1.1, (OECD, 2010[53]), *PISA 2009 Results: Learning to Learn – Student Engagement, Strategies and Practices (Volume III)*, http://dx.doi.org/10.1787/888932343285.

One item in the JOYREAD index, "reading is one of my favourite hobbies" stood out because as many as 82% of Thailand students, 78% of Malaysian students, and 77% of Indonesian students agreed or strongly agreed to this statement. The OECD average was only 33%, with Finland (33%) and Australia (35%) at around the OECD average (Figure 6).

Figure 6. Percentages of students who responded "strongly agree" or "agree" on "reading is one of my favourite hobbies" of the index of enjoyment of reading (JOYREAD)



Source: Adapted from OECD, PISA 2009 Database (OECD, 2010[44]).

Joy of reading (JOYREAD) was stronger among the girls than among the boys in Southeast Asian countries, as well as for the OECD average and across all comparison group countries (Table 12). However, the gender difference was much smaller among the Southeast Asian students. Whilst the OECD average showed as much as a 0.62 index score difference between boys and girls, the corresponding difference was only 0.22 in Indonesia, 0.34 in Malaysia, and 0.31 in Thailand.

Table 12. Gender difference in the mean scores on the index of enjoyment of reading (JOYREAD)

Countries	Boys		Girls		Gender differences (boys - girls)	
	Mean index	S.E.	Mean index	S.E.	Diff.	S.E.
Indonesia	0.32	(0.01)	0.55	(0.01)	**-0.22**	(0.02)
Malaysia*	0.19	(0.02)	0.53	(0.02)	**-0.34**	(0.02)
Thailand	0.36	(0.02)	0.67	(0.01)	**-0.31**	(0.02)
Singapore	0.00	(0.02)	0.58	(0.02)	**-0.58**	(0.02)
Korea	0.00	(0.02)	0.27	(0.02)	**-0.27**	(0.03)
Brazil	0.05	(0.01)	0.47	(0.01)	**-0.42**	(0.02)
Colombia	-0.02	(0.02)	0.28	(0.02)	**-0.29**	(0.03)
Peru	0.21	(0.02)	0.48	(0.02)	**-0.27**	(0.02)
Australia	-0.33	(0.02)	0.31	(0.02)	**-0.64**	(0.03)
Finland	-0.41	(0.02)	0.50	(0.02)	**-0.91**	(0.03)
OECD average	-0.31	(0.00)	0.31	(0.00)	**-0.62**	(0.01)

*Note**: Author's calculation of Malaysia
Note: Statistically significant differences in bold.
Source: Table III.1.1, (OECD, 2010[53]), *PISA 2009 Results: Learning to Learn – Student Engagement, Strategies and Practices (Volume III)*, http://dx.doi.org/10.1787/888932343285.

In PISA 2009, joy of reading (JOYREAD) was one of the stronger predictors of reading achievement scores, having the within-country average correlation of r = .35 across all participant countries and economies. Countries such as Finland and Australia had the strength of associations as high as r = .52 and r = .51 respectively.

In the Southeast Asian countries under review, the strength of associations between joy of reading (JOYREAD) and reading achievement was not as pronounced, but it was still one of the strongest among the associations between the non-cognitive variables and achievement in PISA 2009. The correlations were similar at r = .29 in Malaysia and r = .28 in Thailand. Indonesia had a lower association at r = .16, but this was one of the strongest non-cognitive associations with reading achievement within that country.

The percentage of the reading achievement scores explained by the joy of reading index (JOYREAD) were 18.1% for the OECD average, and 17.3% in Singapore, 17.6% in Korea, 26% in Australia, and 27% in Finland, which can be compared with smaller percentages of 2.5% in Indonesia, 7.7% in Thailand, and 8.6% in Malaysia.

Non-cognitive predictors of reading achievement: Indonesia, Malaysia, and Thailand

Table 13 presents the correlations between the nine non-cognitive indices and reading achievement of Indonesia, Malaysia, and Thailand. The average of all PISA participant countries and economies are also presented for comparison purposes. Correlations greater than .20 are marked in bold. Correlations that are found to be greater than .20 in Southeast Asian countries, as well as in the averages of all participant countries and economies, are shaded in grey.

Table 13. Correlations between nine non-cognitive variables and reading achievement

Indonesia		Malaysia		Thailand		All PISA 2009 Participant Countries and Economies	
METASUM	**0.33**	**METASUM**	**0.37**	**UNDREM**	**0.32**	**METASUM**	**0.42**
UNDREM	**0.32**	**MEMOR**	**0.30**	**JOYREAD**	**0.28**	**UNDREM**	**0.37**
ATSCHL	0.18	**CSTRAT**	**0.30**	**METASUM**	**0.27**	**JOYREAD**	**0.35**
CSTRAT	0.17	**JOYREAD**	**0.29**	**MEMOR**	**0.26**	**CSTRAT**	**0.25**
JOYREAD	0.16	**UNDREM**	**0.27**	**CSTRAT**	**0.24**	DIVREAD	0.18
DIVREAD	0.15	**ATSCHL**	**0.24**	**DIVREAD**	**0.20**	DISCLIMA	0.15
ELAB	0.13	**DIVREAD**	**0.21**	ATSCHL	0.19	ATSCHL	0.11
MEMOR	0.11	ELAB	0.19	ELAB	0.18	ELAB	0.07
DISCLIMA	0.04	DISCLIMA	0.15	DISCLIMA	0.14	MEMOR	0.00

Note: N = 5 136 in Indonesia; N = 4 999 in Malaysia; N = 6 225 in Thailand. Correlations greater than .20 are in bold. Correlations that were found to be greater than .20 in Southeast Asian countries, as well as in the averages of all participant countries and economies, are shaded in grey.
Source: Adapted from OECD, PISA 2009 Database (OECD, 2010[44]).

There were four non-cognitive variables that showed associations with reading achievement that were greater than r = .20 across all PISA 2009 participant countries and economies: the index of summarising (METASUM), the index of understanding and remembering (UNDREM), the index of enjoyment of reading (JOYREAD), and the index of control strategies (CSTRAT).

- Indonesia had only two non-cognitive variables (METASUM and UNDREM) that had greater than r = .20 with reading achievement.
- Malaysia had additional three variables (MEMOR, r = .30; ATSCHL, r = .24; and DIVREAD, r = .21) that had greater than r = .20 with reading achievement.
- Thailand had additional two variables that had greater than r = .20 with reading achievement, MEMOR, r = .26 and DIVREAD, r = .20.

Given these patterns of associations, the following conclusions can be made:

- On average, the best predictors of reading achievement among Southeast Asians did not differ much from those that were found in the averages across the other PISA participant countries and economies.
- However, MEMOR and ATSCHL appeared to be the regional-unique non-cognitive predictors of reading achievement in Southeast Asia; two variables were poor predictors of reading achievement on average across all countries and economies.

In the following sections, two non-cognitive variables, MEMOR and ATSCHL, are further examined, as they turned out to be unique predictors of Southeast Asian students' reading achievement.

Memorisation (MEMOR) and reading achievement in Malaysia and Thailand

Malaysia (r = .30) and Thailand (r = .26) showed a moderate strength of associations between memorisation and reading achievement; those who reported doing memorisation more often had better reading scores. However, they do not engage in memorisation substantially more than the OECD country average: the index mean scores were .05 in Malaysia and .06 in Thailand. This is in contrast to Indonesia where many more students reported using memorisation as a learning approach (the index mean of 0.34). However, this strategy hardly paid off for students' reading achievement (r = .11).

In Malaysia, memorisation alone explained as much as 9.3% of the variance in the reading scores, with a score-point difference of 31.0 associated with a one-unit difference of this index. In Thailand, memorisation alone explained as much as 6.7% of the variance in the reading achievement scores, with a score difference of 24.8 per unit of this index. Certainly, memorisation played a positive and important role in students' reading achievement in both Malaysia and Thailand.

Among the comparison groups from other regions, Korea also showed the positive effect of memorisation with 8.7% of the variance in the reading scores being explained by memorisation alone. The corresponding percentages were only 1.1% in the OECD average, Australia 1.0%, and 0.1% in Finland.

Attitude towards school (ATSCHL) and reading achievement in Indonesia, Malaysia, and Thailand

Unlike MEMOR, students' positive attitude towards school (ATSCHL) was a prevalent non-cognitive characteristic in all three countries. Their index mean scores were higher than the OECD average: Indonesia (.50), Malaysia (.20), and Thailand (.20).

As many as 93% in Indonesia, 88% in Malaysia, and 91% in Thailand either agreed or strongly agreed that "school helped give me confidence to make decisions". This can be compared to 73% of the OECD average (Table 14).

Similarly, as many as 95%, 92%, and 93% of students in Indonesia, Malaysia, and Thailand, respectively, either agreed or strongly agreed with the statement "school has taught me things which could be useful in a job".

Furthermore, only 2% of Indonesian students and only 5% of Malaysian students agreed or strongly agreed that "school has been a waste of time", while 8% of the OECD average and 10% of Finnish students and 11% of Korean students indicated that way.

Table 14. Percentages of students who agreed or strongly agreed with the four statements used in the index of attitude towards school (ATSCHL)

	School has done little to prepare me for adult life when I leave school	School has been a waste of time	School helped give me confidence to make decisions	School has taught me things which could be useful in a job
Indonesia	22	2	93	95
Malaysia	31	5	88	92
Thailand	35	8	91	93
Singapore	34	8	80	87
Korea	28	11	58	65
Brazil	15	3	83	91
Colombia	21	4	83	91
Peru	32	9	87	90
Australia	18	8	82	91
Finland	14	10	78	92
OECD Average	24	8	73	87

Source: Adapted from OECD, PISA 2009 Database (OECD, 2010[44]).

Like MEMOR, ATSCHL showed a relatively higher association with students' reading achievement in Malaysia (r = .24), in Thailand (r = .19) and in Indonesia (r = .18), compared to the average of all PISA 2009 participant countries and economies (r = .11).

ATSCHL alone explained 3% of variance in the reading scores in Indonesia, 6% in Malaysia, and 3% in Thailand. A favourable reading score difference of 13.1 in Indonesia, 19.5 in Malaysia, and 15.9 in Thailand were found per one unit increase on the ATSCHL index. Although these effect sizes were rather small, ATSCHL turned out to be one of the better predictors of reading achievement among the students in the Southeast Asian countries.

Relationships among non-cognitive attributes: Indonesia, Malaysia, and Thailand

Four non-cognitive student characteristics, ATSCHL, DIVREAD, JOYREAD, and MEMOR, were highlighted in this section, as either showing prevalence among students (i.e. reporting that they possess that characteristic) or having relevance as predictors of reading achievement. The relationships among these four variables are displayed in Table 15.

Table 15. Correlations among ATSCHL, DIVREAD, JOYREAD, and MEMOR

	Indonesia				Malaysia				Thailand			
	1.	2.	3.	4.	1.	2.	3.	4.	1.	2.	3.	4.
1. ATSCHL	1				1				1			
2. DIVREAD	.07	1			.18	1			.15	1		
3. JOYREAD	.26	.23	1		.29	.24	1		.33	.28	1	
4. MEMOR	.20	.20	.31	1	.26	.24	.35	1	.20	.25	.37	1

Note: N = 5 136 in Indonesia; N = 4 999 in Malaysia; N = 6 225 in Thailand.
Source: Adapted from OECD, PISA 2009 Database (OECD, 2010[44]).

- Three variables, ATSCHL, JOYREAD, and MEMOR, were moderately correlated with each other, in all three countries.
- The strongest relationship was found between JOYREAD, and MEMOR, which was the case in all three countries: Indonesia (r = .31), Malaysia (r = .35), and Thailand (r = .37).
- The weakest correlation was between ATSCHL and DIVREAD, also in all three countries.

Overall, the pattern of correlations among these four variables was similar in the three countries. The moderate level of correlations among these non-cognitive variables suggests that strategies for student non-cognitive development can be planned and created across these non-cognitive characteristics, simultaneously, for all three Southeast Asian countries.

Prediction of reading achievement from non-cognitive variables: Indonesia, Malaysia, and Thailand

The last set of analysis focused on creating a non-cognitive model for reading achievement of Southeast Asian countries. The model was built based on simultaneous multiple regression analyses, controlling for a set of students' demographic background information including grade-level, gender, pre-school attendance, whether their home language was the same as the PISA test language, and whether they attended a general or vocational school. Information about school-level clustering (in a multi-level sense) was not modelled in this set of analysis. Students' immigration status was considered but almost all students (99%) were native and thus this variable was excluded. For simplicity, each categorical variable was dichotomously recoded (see the table below for the items that were used and recoded for the analysis).

Table 16. PISA 2009 variables to explain reading achievement

Construct	Variable Name	Variable Label	Data Re-coded for the Analysis
Grade	ST01Q01	Raw international student grade (ranging from 7 to 12)	(7, 8, 9 = 0; 10, 11, 12 = 1)
Gender	ST04Q01	Sex (Female [1]; Male: [2])	(Male = 0; Female = 1)
Pre-school attendance	ST05Q01	Attend <ISCED 0> (No [1]; Yes, 1 year [2]; Yes, more than 1 year [3])	(No = 0; Yes = 1)
Language	ST19Q01	Language of test used at home (Language of test [1]; Another language [2])	(Another language = 0; Language of test at home = 1)
Programme type	ISCEDO	ISCED orientation (General school [1]; Vocational school [3])	(Vocational = 0; General = 1)
Family SES	ESCS	Index-level, continuous variable	No re-coding

Note: The ISCED orientation category options were General [1]; Pre-Vocational [2]; Vocational [3]; and Modular [4]. However, all sampled students in Indonesia, Malaysia, and Thailand reported attending either Vocational or General schools.
Source: OECD, PISA 2009 Database (OECD, 2010[44]).

Model 1 had only five variables of students' demographic background. Model 2 added the PISA index of economic, social and cultural status (ESCS) as a proxy for family SES. Model 3 added two non-cognitive variables that were found to be prevalent among the Southeast Asians. Finally, four additional, non-cognitive variables were added to Model 4:

ATSCHL and MEMOR as "unique" regional predictors and METASUM and UNDREM as "universal" predictors of reading achievement.

	Predictor variables in the model
Model 1	Grade level, Gender, Pre-school attendance, Language, Programme type
Model 2	Model 1 + Family SES (ESCS)
Model 3	Model 2 + DIVREAD, JOYREAD
Model 4	Model 3 + ATSCHL, MEMOR, METASUM, UNDREM

The overall model predictabilities, calculated as R-squared values in the regression analysis, are shown in Table 17.

- In Model 1, a set of students' demographic background variables alone explained 26%, 11%, and 19% of the variances in the reading achievement scores, in Indonesia, Malaysia, and Thailand, respectively. For Indonesia in particular, student demographic background turned out to be a strong predictor of reading achievement.
- In Model 2, where family SES was added, both Malaysia and Thailand showed 6% incremental predictability. For Indonesia, family SES hardly improved predictability in Model 2, compared to Model 1. This indicates that family SES was not a good predictor of reading achievement in Indonesia when other measures of student background were already included in the model.
- In Model 3, when DIVREAD and JOYREAD were added, the model predictability improved only slightly, as expected.
- In Model 4, the percentage of reading achievement scores explained were 37% in Indonesia, 34% in Malaysia, and 36% in Thailand. Thus, similar percentages were explained across the three countries, suggesting that the model can be used to predict students' reading achievement for all three countries of Southeast Asia.

Table 17. R-squared values of the regression models for reading achievement

	Model 1	Model 2	Model 3	Model 4
Indonesia	0.26	0.27	0.28	0.37
Malaysia	0.11	0.17	0.22	0.34
Thailand	0.19	0.27	0.31	0.36

Note: N = 5 136 in Indonesia; N = 4 999 in Malaysia; N = 6 225 in Thailand.
Source: Adapted from OECD, PISA 2009 Database (OECD, 2010[44]).

Table 18 presents regression coefficients for the first and final models in each of the three Southeast Asian countries. The standardised regression coefficients that were statistically significant at least at the .05 level are indicated in bold, for emphasis.

- Model 1 displays both similarities and differences of the effects of students' demographic variables on their reading achievement across the three countries.
  - The effect of being in the upper grades (Grade 10, 11, or 12) as opposed to the lower grades (Grade 7, 8, or 9) was particularly strong in Indonesia ($\beta = .38$). Indonesian students in the upper grades scored about 50 points higher, compared to those in the lower grades.

- Gender was the only demographic variable that showed similar effect sizes on reading achievement in all three countries, with about 30- to 32-point differences in favour of female students.
- On the other hand, the issue of language was particularly important in Malaysia where students who spoke the same language at home as the language of the PISA tests (either as Malaysian or English) scored nearly 30 points higher than students whose home language differed from the PISA test language. This was contrasted to only about a 1-point difference in Indonesia and about a 15-point difference in Thailand.
- The effect of programme type (whether students were attending a general or vocational school) differed in the three countries. A moderately strong effect was present in Thailand (an associated score difference of 42.71) while a smaller effect in Indonesia (23.45) and an almost negligible effect in Malaysia (8.75) were observed.

- The final model (Model 4) points to the relative importance of students' demographic background information, family SES, and non-cognitive variables in understanding reading achievement.
  - Among the student-demographic background variables, grade-level ($\beta = .29$) and gender ($\beta = .20$) had stronger effects in Indonesia.
  - On the other hand, family SES, at least in the way the PISA 2009 measured it, was weakly associated with students' reading achievement in Indonesia ($\beta = .09$). This effect was stronger in Malaysia ($\beta = .18$) and in Thailand ($\beta = .27$).
  - It is also noteworthy that the effect of METASUM was stronger than the effect of family SES in both Indonesia and Malaysia.
  - Overall, the final model suggests that students' non-cognitive characteristics cannot be ignored, even in the presence of other demographic information and family SES variables.

Table 18. Regression coefficients of Models 1 and 4 for predicting reading achievement

Country	Indonesia				Malaysia				Thailand			
Model 1	b	b.se	beta	beta.se	b	b.se	beta	beta.se	b	b.se	beta	beta.se
(CONSTANT)	329.33	(8.88)			324.75	(9.69)			298.76	(8.68)		
Grade: Upper secondary school	50.98	(6.04)	**0.38**	(0.04)	24.44	(3.42)	**0.14**	(0.02)	49.43	(3.95)	**0.29**	(0.02)
Female	30.18	(2.71)	**0.23**	(0.02)	31.12	(2.32)	**0.20**	(0.01)	32.47	(3.03)	**0.23**	(0.02)
Pre-school attendance	27.73	(3.95)	**0.21**	(0.03)	33.23	(4.20)	**0.13**	(0.02)	26.73	(6.24)	**0.05**	(0.01)
Language of test used at home	-1.20	(4.02)	-0.01	(0.03)	29.67	(5.52)	**0.17**	(0.03)	14.98	(3.73)	**0.10**	(0.03)
Programme type: General school	23.45	(7.83)	**0.13**	(0.04)	8.75	(8.12)	0.04	(0.03)	42.71	(5.79)	**0.24**	(0.03)
Model 4												
(CONSTANT)	357.61	(10.34)			360.16	(8.41)			365.21	(8.99)		
Grade: Upper secondary school	39.06	(5.35)	**0.29**	(0.04)	24.05	(2.76)	**0.14**	(0.01)	30.39	(3.27)	**0.18**	(0.02)
Female	25.90	(2.60)	**0.20**	(0.02)	17.82	(1.97)	**0.11**	(0.01)	24.04	(2.33)	**0.17**	(0.02)
Pre-school attendance	20.31	(3.09)	**0.15**	(0.02)	17.26	(3.76)	**0.07**	(0.02)	19.71	(6.35)	**0.04**	(0.01)
Language of test used at home	-2.81	(3.06)	-0.02	(0.02)	12.21	(4.14)	**0.07**	(0.02)	1.31	(3.11)	0.01	(0.02)
Programme type: General school	15.61	(7.53)	**0.08**	(0.04)	9.47	(6.17)	0.04	(0.03)	24.61	(5.23)	**0.14**	(0.03)
ESCS	5.31	(1.77)	**0.09**	(0.03)	15.95	(1.71)	**0.18**	(0.02)	16.23	(1.43)	**0.27**	(0.02)
DIVREAD	2.52	(0.89)	**0.05**	(0.02)	4.82	(1.27)	**0.06**	(0.02)	3.12	(0.86)	**0.05**	(0.01)
JOYREAD	5.03	(2.58)	**0.04**	(0.02)	16.84	(2.29)	**0.12**	(0.02)	10.79	(1.76)	**0.09**	(0.02)
ATSCHL	7.76	(1.44)	**0.10**	(0.02)	7.83	(1.63)	**0.09**	(0.02)	4.76	(1.40)	**0.06**	(0.02)
MEMOR	1.70	(1.63)	0.02	(0.02)	13.29	(1.58)	**0.13**	(0.02)	9.06	(1.35)	**0.09**	(0.01)
METASUM	11.70	(1.16)	**0.18**	(0.02)	19.75	(1.34)	**0.24**	(0.02)	7.91	(1.01)	**0.11**	(0.01)
UNDREM	9.74	(1.12)	**0.14**	(0.02)	9.10	(1.12)	**0.11**	(0.01)	10.04	(0.86)	**0.15**	(0.01)

Note: Coefficients statistically significant at least at the .05 level are presented in bold; All coefficients in Model 1 were statistically significant at the .05 significance level, except for language in Indonesia; and programme type in Malaysia. All coefficients in Model 4 were statistically significant at the .05 significance level, except for language and MEMOR in Indonesia; programme type in Malaysia; and language in Thailand. N = 5 136 in Indonesia; N = 4 999 in Malaysia; N = 6 225 in Thailand
Source: Adapted from OECD, PISA 2009 Database (OECD, 2010[44]).

Concluding remarks

This section reviewed the nine non-cognitive variables that were included in PISA 2009. Overall, the pattern of student responses on these variables was similar across Indonesia, Malaysia, and Thailand, in showing which non-cognitive variables were prevalent and which ones were more strongly related to students' reading achievement.

In the multiple regression modelling that included demographic, family SES, and non-cognitive variables, it was found that the strongest predictor of Indonesian students' achievement was whether the students were in the upper secondary school (as opposed to the lower secondary school). Thus, the effect of more years of schooling was strong in Indonesia. The strongest predictor of reading achievement in Malaysia was students' meta-cognitive ability in summarising the reading text. The other demographic variables and family SES appeared to have played weaker roles in student achievement in Malaysia.

In Thailand, the strongest predictor of reading achievement was family SES. While achieving educational equity is a paramount task in most countries, this issue appears to be more pronounced in Thailand than it is in Indonesia or Malaysia.

3. Non-cognitive characteristics related to mathematics achievement

The PISA 2012 data were reviewed and analysed to examine students' non-cognitive characteristics with respect to mathematics achievement in Indonesia, Malaysia, Thailand, and Viet Nam. Fifteen student-level non-cognitive variables were included in the analyses. The indices created by the OECD were used in the analysis presented in this section (see the index descriptions in Table 19). Based on the non-cognitive schema consisting of six broad domains (Figure 1), these constructs were categorised into:

- Attitude towards school and surroundings: ATSCHL, ATTLNACT, and SUBNORM
- Affect/Personality: BELONG, OPENPS, and PERSEV
- Engagement: MATBEH, MATINTFC, and MATWKETH
- Motivation: FAILMAT and INSTMOT
- Values/Interest: INTMAT
- Self-Beliefs: ANXMAT, MATHEFF, and SCMAT

Table 19. Fifteen non-cognitive indices examined in this section

Index label	Index description
ANXMAT	**Mathematics anxiety** The index of mathematics anxiety (ANXMAT) was constructed using student responses to question (ST42) over the extent they strongly agreed, agreed, disagreed or strongly disagreed with the following statements when asked to think about studying mathematics: I often worry that it will be difficult for me in mathematics classes; I get very tense when I have to do mathematics homework; I get very nervous doing mathematics problems; I feel helpless when doing a mathematics problem; I worry that I will get poor <grades> in mathematics.
ATSCHL	**Attitudes towards school (learning outcomes)** The index of attitudes towards school (learning outcomes) (ATSCHL) was constructed using student responses (ST88) over the extent they strongly agreed, agreed, disagreed or strongly disagreed to the following statements when asked about what they have learned in school: School has done little to prepare me for adult life when I leave school; school has been a waste of time; school has helped give me confidence to make decisions; school has taught me things which could be useful in a job.
ATTLNACT	**Attitudes towards school (learning activities)** The index of attitudes towards school (learning activities) (ATTLNACT) was constructed using student responses (ST89) over the extent they strongly agreed, agreed, disagreed or strongly disagreed to the following statements when asked to think about their school: Trying hard at school will help me get a good job; trying hard at school will help me get into a good <college>; I enjoy receiving good <grades>; trying hard at school is important.
BELONG	**Sense of belonging** The index of sense of belonging (BELONG) was constructed using student responses (ST87) over the extent they strongly agreed, agreed, disagreed or strongly disagreed to the following statements: I feel like an outsider (or left out of things) at school; I make friends easily at school; I feel like I belong at school; I feel awkward or out of place in my school; other students seem to like me; I feel lonely at school; I feel happy at school; things are ideal in my school; I am satisfied with my school.
FAILMAT	**Perceived self-responsibility for failing in mathematics** The index of perceived self-responsibility for failing in mathematics (FAILMAT) was constructed using student responses when examining the following scenario defined in (ST44): "suppose that you are a student in the following situation: each week, your mathematics teacher gives a short quiz. Recently you have done badly on these quizzes. Today you are trying to figure out why. Are you very likely, likely, slightly likely or not at all likely to have the following thoughts or feelings in this situation? I'm not very good at solving mathematics problems; my teacher did not explain the concepts well this week; this week I made bad guesses on the quiz; sometimes the course material is too hard; the teacher did not get students interested in the material; sometimes I am just unlucky.
INSTMOT	**Instrumental motivation to learn mathematics** The index of instrumental motivation to learn mathematics (INSTMOT) was constructed using student responses over the extent they strongly agreed, agreed, disagreed or strongly disagreed to a series of statements in question

	(ST29) when asked to think about their views on mathematics: Making an effort in mathematics is worth because it will help me in the work that I want to do later on; learning mathematics is worthwhile for me because it will improve my career <prospects, chances>; Mathematics is an important subject for me because I need it for what I want to study later on; I will learn many things in mathematics that will help me get a job.
INTMAT	**Intrinsic motivation to learn mathematics** The index of intrinsic motivation to learn mathematics (INTMAT) was constructed using student responses over the extent they strongly agreed, agreed, disagreed or strongly disagreed to the statements asked in question (ST29), when asked to think about their views on mathematics: I enjoy reading about mathematics; I look forward to my mathematics; I do mathematics because I enjoy it; I am interested in the things I learn in mathematics.
MATBEH	**Mathematics behaviours** The index of mathematics behaviours (MATBEH) was constructed using student responses (ST49) over how often (always or almost always, often, sometimes, never, rarely) they do the following things at school and outside of school: I talk about mathematics problems with my friends; I help my friends with mathematics; I do mathematics as an <extracurricular> activity; I take part in mathematics competitions; I do mathematics more than 2 hours a day outside of school; I play chess; I program computers; I participate in a mathematics club.
MATHEFF	**Mathematics self-efficacy** The index of mathematics self-efficacy (MATHEFF) was constructed using student responses over the extent they reported feeling very confident, confident, not very confident, not at confident about having to do a number of tasks. The question (ST37) asked about the following mathematics tasks: Using a <train timetable> to work out how long it would take to get from one place to another; calculating how much cheaper a TV would be after a 30% discount; calculating how many square metres of tiles you need to cover a floor; understanding graphs presented in newspapers; solving an equation like 3x+5='17;' finding the actual distance between two places on a map with a 1:10_000 scale; solving an equation like 2(x+3)='(x+3)(x-3);' calculating the petrol consumption rate of a car.
MATINTFC	**Mathematics intentions** The index of mathematics intentions (MATINTFC) was constructed asking students (ST48) to choose, for each pair of the following statements, the item that best described them: I intend to take additional mathematics courses after school finishes vs. I intend to take additional <test language> courses after school finishes; I plan on majoring in a subject in <college> that requires mathematics skills vs. I plan on majoring in a subject in <college> that requires science skills; I am willing to study harder in my mathematics classes than is required vs. I am willing to study harder in my <test language> classes than is required; I plan on <taking> as many mathematics classes as I can during my education vs. I plan on <taking> as many science classes as I can during my education; I am planning on pursuing a career that involves a lot of mathematics vs. I am planning on pursuing a career that involves a lot of science.
MATWKETH	**Mathematics work ethic** Nine items were used in the Main Survey of PISA 2012 to create a new scale labelled “Mathematics work ethic” (MATWKETH). The response categories ranged from “Strongly agree” to “Strongly disagree”. All items were reversed, so the higher difficulty corresponds to the higher level of work ethic. The items were: I finish my homework in time for mathematics class; I work hard on my mathematics homework; I am prepared for my mathematics exams; I study hard for mathematics quizzes; I keep studying until I understand mathematics material; I pay attention in mathematics class; I listen in mathematics class; I avoid distractions when I am studying mathematics; I keep my mathematics work well organised.
OPENPS	**Openness to problem solving** The index of openness to problem solving (OPENPS) was constructed using student responses (ST94) over whether they report that the following statements describe them very much, mostly, somewhat, not much, not at all: I can handle a lot of information; I am quick to understand things; I seek explanations of things; I can easily link facts together; I like to solve complex problems.
PERSEV	**Perseverance** The index of perseverance (PERSEV) was constructed using student responses (ST93) over whether they report that the following statements describe them very much, mostly, somewhat, not much, not at all: When confronted with a problem, I give up easily; I put off difficult problems; I remain interested in the tasks that I start; I continue working on tasks until everything is perfect; when confronted with a problem, I do more than what is expected of me.
SCMAT	**Mathematics self-concept** The index of mathematics self-concept (SCMAT) was constructed using student responses to question (ST42) over the extent they strongly agreed, agreed, disagreed or strongly disagreed with the following statements when asked to think about studying mathematics: I am just not good at mathematics; I get good <grades> in mathematics; I learn mathematics quickly; I have always believed that mathematics is one of my best subjects; in my mathematics class, I understand even the most difficult work.
SUBNORM	**Subjective norms in mathematics** The index of subjective norms in mathematics (SUBNORM) was constructed using student responses (ST35) over whether, thinking about how people important to them view mathematics, they strongly agreed, agreed, disagreed or strongly disagreed to the following statements: Most of my friends do well in mathematics; most of my friends work hard at mathematics; my friends enjoy taking mathematics tests; my parents believe it’s important for me to study mathematics; my parents believe that mathematics is important for my career; my parents like mathematics.

Source: (OECD, 2013[48]), *PISA 2012 Results: Ready to Learn: Students' Engagement, Drive and Self-Beliefs (Volume III),* http://dx.doi.org/10.1787/9789264201170-en; (OECD, 2014[41]), *PISA 2012 Technical Report*, https://www.oecd.org/pisa/pisaproducts/pisa2012technicalreport.htm [accessed on September 10, 2020]

Within-country non-cognitive prevalence patterns: Indonesia, Malaysia, Thailand, and Viet Nam

The index mean scores for each of the fifteen non-cognitive variables in Indonesia, Malaysia, Thailand, and Viet Nam are presented in Table 20 (where the variables are presented in descending order of the mean values within country). Given the index standardisation framework in PISA (0 as the mean and 1 as the standard deviation for the OECD student population), an index score of 0.30 (one-thirds of one unit of standard deviation) was taken as a reasonable cut-off point to conclude "prevalence" of a particular non-cognitive variable. The indices that were found to be prevalent were marked in bold, and among them, those that were found to be prevalent in at least three countries were shaded in grey.

- As can be seen in Table 20, the indices showing the top four highest mean scores in Malaysia, i.e. SUBNORM, MATBEH, INTMAT, and INSTMOT (ranging from the mean scores of 0.53 to 1.05), were also listed within the top five in Indonesia (ranging from 0.35 to 0.83) and Thailand (ranging from 0.39 to 0.97).
- While a slightly different pattern was obtained in Viet Nam, the strong prevalence of INTMAT, MATBEH, and INSTMOT was also demonstrated.
- At the bottom end of the non-cognitive variable list, ATTLNACT, BELONG, MATHEFF, and OPENPS were found as the least prevalent at least in three out of four Southeast Asian countries. Broadly speaking, the non-cognitive indices that emerged as being prevalent and not prevalent were similar in these four Southeast Asian countries.

Table 20. Mean index scores of fifteen non-cognitive variables

Indonesia			Malaysia			Thailand			Viet Nam		
	Mean index	S.E.		Mean index	S.E.		Mean index	S.E.		Mean index	S.E.
SUBNORM	0.83	(0.02)	**SUBNORM**	1.05	(0.01)	**MATBEH**	0.97	(0.01)	**INTMAT**	0.69	(0.02)
INTMAT	0.80	(0.02)	**MATBEH**	0.93	(0.02)	**SUBNORM**	0.83	(0.02)	**MATBEH**	0.68	(0.02)
MATBEH	0.68	(0.02)	**INTMAT**	0.91	(0.02)	**INTMAT**	0.77	(0.02)	**PERSEV**	0.45	(0.01)
MATWKETH	0.54	(0.03)	**INSTMOT**	0.53	(0.02)	**ANXMAT**	0.51	(0.02)	**INSTMOT**	0.37	(0.02)
INSTMOT	0.35	(0.03)	**ANXMAT**	0.43	(0.03)	**INSTMOT**	0.39	(0.02)	**MATINTFC**	0.32	(0.02)
ATSCHL	0.29	(0.03)	**MATWKETH**	0.34	(0.02)	MATWKETH	0.26	(0.02)	ANXMAT	0.22	(0.03)
ANXMAT	0.28	(0.02)	PERSEV	0.22	(0.02)	PERSEV	0.22	(0.01)	ATSCHL	0.13	(0.02)
PERSEV	0.26	(0.02)	MATINTFC	0.18	(0.02)	MATINTFC	0.14	(0.02)	FAILMAT	0.10	(0.02)
SCMAT	0.21	(0.02)	ATTLNACT	0.12	(0.02)	ATSCHL	0.00	(0.02)	MATWKETH	-0.01	(0.03)
FAILMAT	0.12	(0.02)	SCMAT	0.11	(0.02)	SCMAT	-0.07	(0.02)	SUBNORM	-0.08	(0.02)
OPENPS	0.06	(0.02)	ATSCHL	-0.01	(0.02)	BELONG	-0.08	(0.01)	SCMAT	-0.19	(0.03)
ATTLNACT	0.02	(0.02)	BELONG	-0.16	(0.02)	ATTLNACT	-0.09	(0.02)	BELONG	-0.26	(0.02)
BELONG	-0.01	(0.03)	FAILMAT	-0.16	(0.02)	FAILMAT	-0.21	(0.02)	MATHEFF	-0.26	(0.02)
MATINTFC	-0.02	(0.03)	OPENPS	-0.20	(0.03)	MATHEFF	-0.30	(0.02)	ATTLNACT	-0.53	(0.02)
MATHEFF	-0.26	(0.02)	MATHEFF	-0.25	(0.03)	OPENPS	-0.31	(0.02)	OPENPS	-0.60	(0.02)

Note: N = 5 622 in Indonesia; N = 5 197 in Malaysia; N = 6 606 in Thailand; N = 4 959 in Viet Nam. The mean scores greater than 0.30 are in bold. Among them, variables that were common in at least three countries are shaded in grey.
Source: Adapted from OECD, PISA 2012 Database (OECD, 2013[45]).

Four most prevalent non-cognitive characteristics: Indonesia, Malaysia, Thailand, and Viet Nam

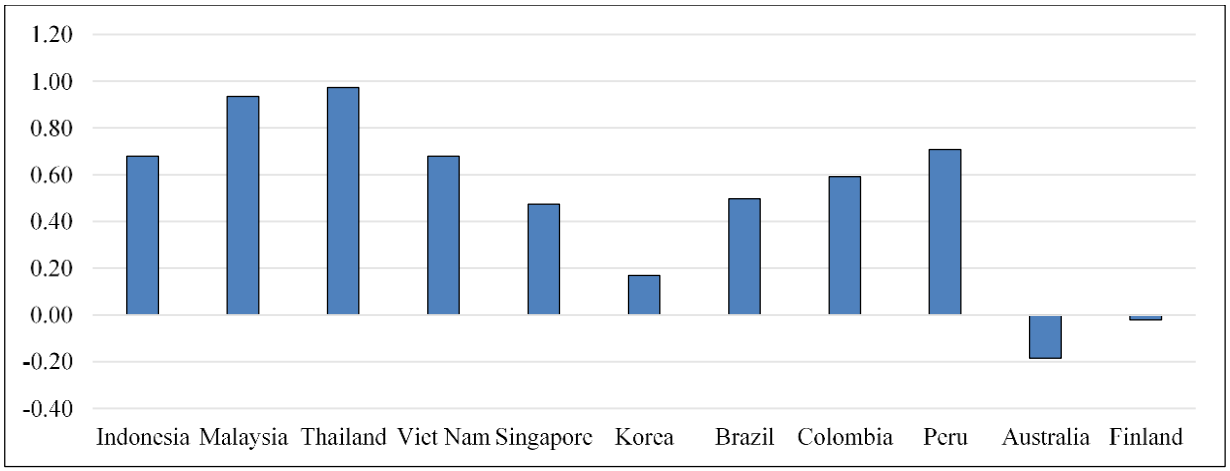
The four prevalent non-cognitive characteristics in Southeast Asian countries, MATBEH, SUBNORM, INTMAT, and INSTMOT were further examined.

Mathematics behaviours (MATBEH)

MATBEH was ranked within the top two in three out of four countries, while it was the third most prevalent non-cognitive characteristics in Indonesia.

Compared to the countries in the other regions, Southeast Asian countries' MATBEH scores were higher, while South American countries, especially Peru, also showed a high score on MATBEH (Figure 7).

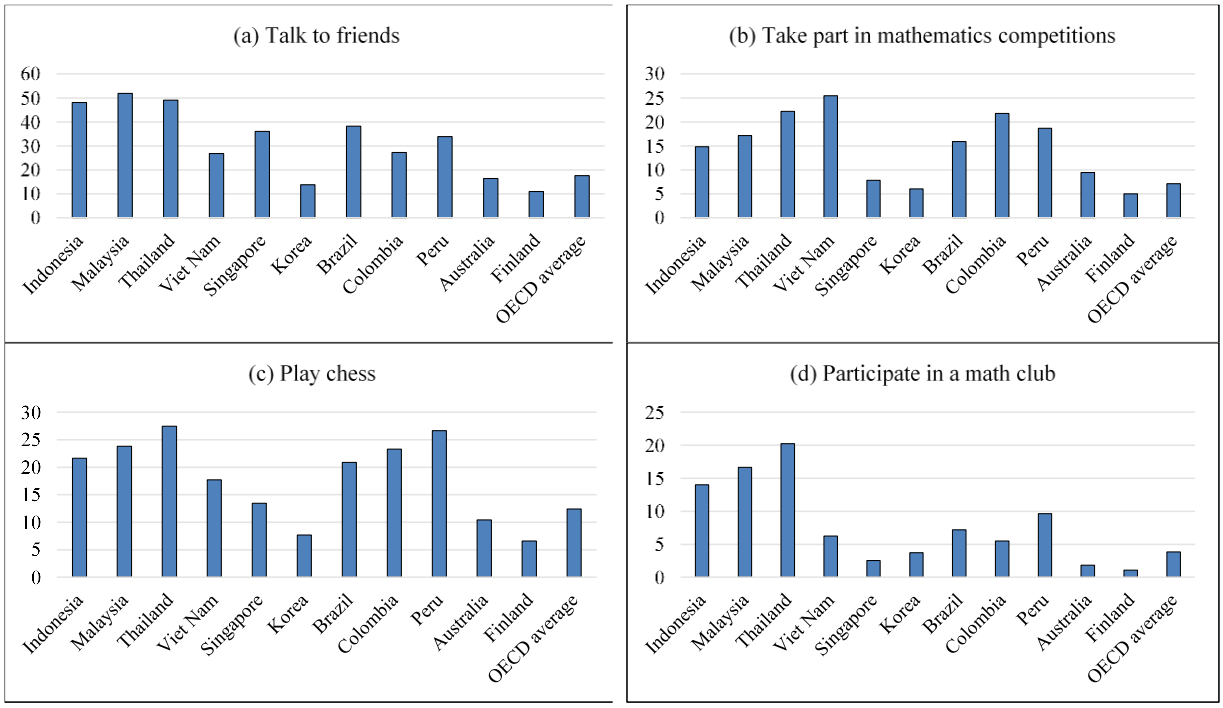
Figure 7. Mean scores on the index of mathematics behaviours (MATBEH)



Source: Adapted from OECD, PISA 2012 Database (OECD, 2013[45]).

A close look at the item-level data of the MATBEH index showed that four (out of eighth) items within the index – (a) I talk about mathematics problems with my friends; (b) I take part in mathematics competitions; (c) I play chess; and (d) I participate in a mathematics club – were the main drivers of the index mean levels being high in Indonesia, Malaysia, and Thailand (Figure 8). South American countries followed closely, especially on the item of "I play chess".

Figure 8. Percentages of students who responded "always" or "almost always" to four items in the index of mathematics behaviours (MATBEH)



Note: The four items were: (a) I talk about mathematics problems with my friends; (b) I take part in mathematics competitions; (c) play chess; and (d) I participate in a mathematics club.
Source: Table III. 4.4a, (OECD, 2013[48]), *PISA 2012 Results: Ready to Learn: Students' Engagement, Drive and Self-Beliefs (Volume III)*, http://dx.doi.org/10.1787/9789264201170-en.

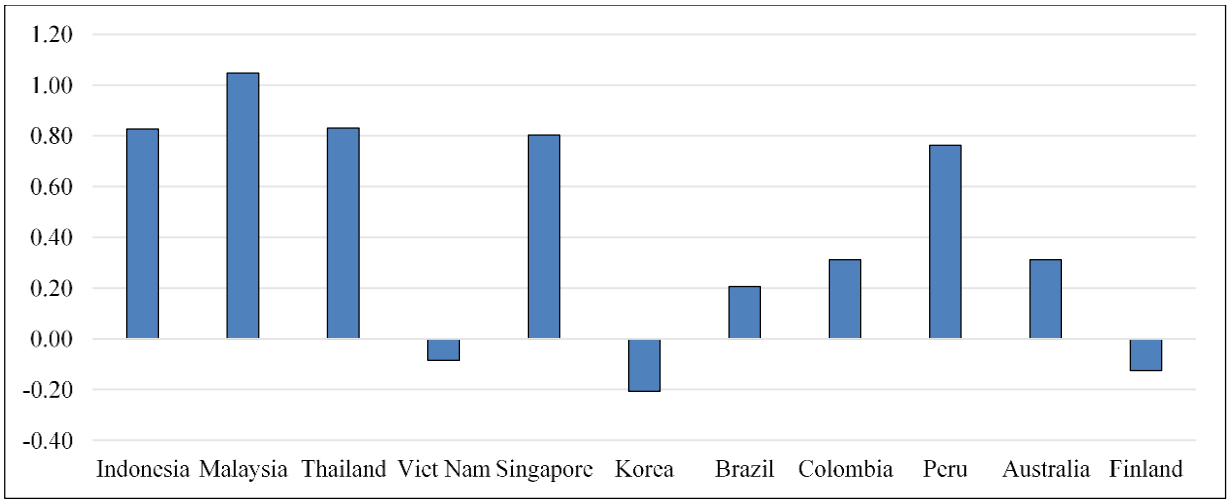
Gender difference on MATBEH was statistically significant in favour of boys showing a higher mean score in all four countries.

Ironically, there was virtually zero difference in mathematics scores explained by MATBEH in Malaysia and Thailand, although Viet Nam showed a positive relationship, as expected, with a score difference of 21.2 points in mathematics achievement per a one-unit difference. The effect was even negative in Indonesia with a 9.4 lower point in mathematics achievement for students scoring higher on MATBEH. This relationship can be summarised in the correlations between MATBEH and mathematics: r = -0.11 in Indonesia, virtually zero in Malaysia and Thailand, and r = 0.16 in Viet Nam.

Subjective norms in mathematics (SUBNORM)

In Indonesia (an average score of 0.83), Malaysia (1.05), and Thailand (0.83), students had strong perceptions of subjective norms about how mathematics was valued by peers and parents (SUBNORM). This variable was the most prevalent non-cognitive characteristic in both Indonesia and Malaysia, and it was the second most prevalent non-cognitive characteristic in Thailand. This tendency was also shown in a neighbouring country of Singapore and a South American country of Peru (Figure 9).

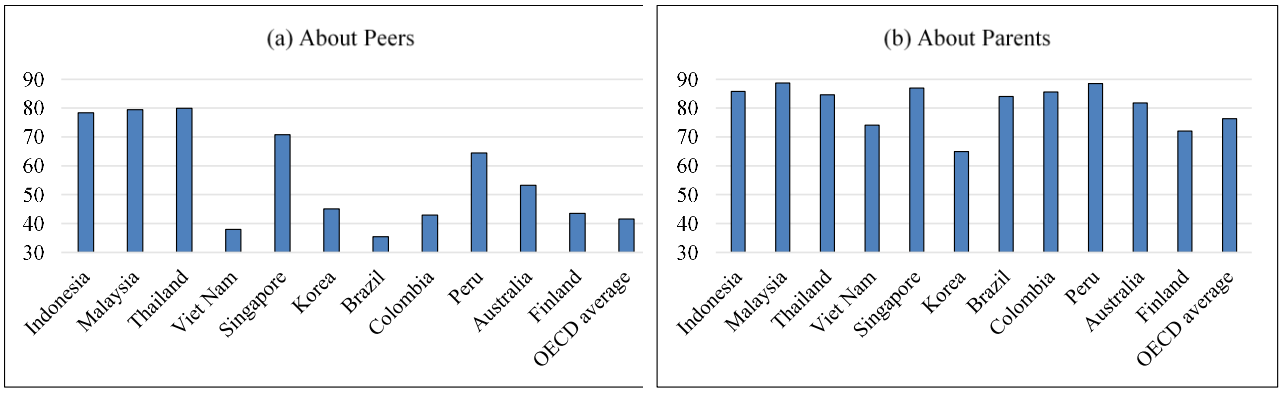
Figure 9. Mean scores on the index of subjective norms (SUBNORM)



Source: Adapted from OECD, PISA 2012 Database (OECD, 2013[45]).

The SUBNORM index had three items about peers and three items about parents (see the item descriptions in Table 19). The main cause of the relative high scores of Indonesia, Malaysia, and Thailand in this index (Figure 10) was due to the students' positive views about their peers (doing well, working hard, and enjoying mathematics) rather than about parents (e.g. believing in the importance of mathematics).

Figure 10. Percentages of students who responded "strongly agrees" or "agree" on three items about peers (a) and three items about parents (b) in the index of subjective norms (SUBNORM)



Source: Adapted from OECD, PISA 2012 Database (OECD, 2013[45]).

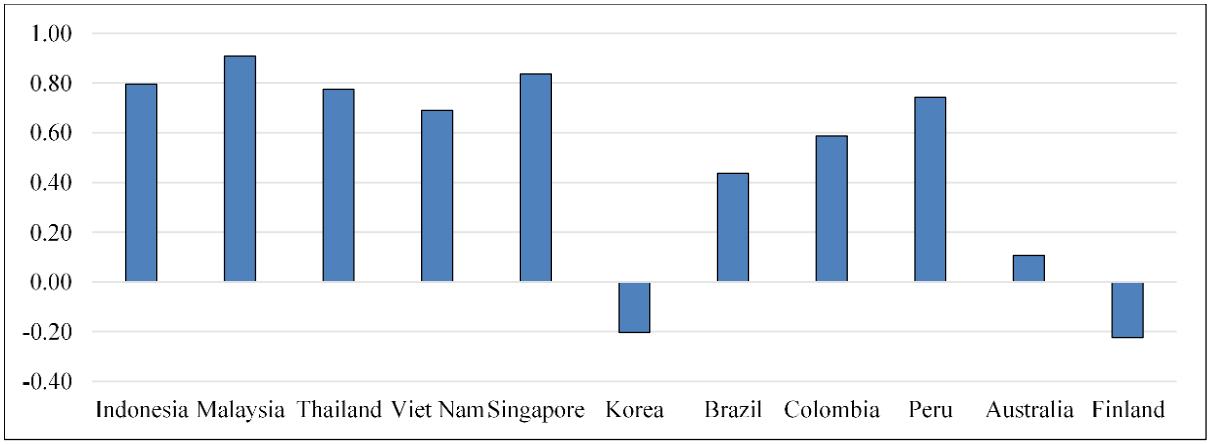
- No significant gender difference was found on SUBNORM in Indonesia, Thailand, and Viet Nam, while a stronger prevalence of SUBNORM was found among girls in Malaysia (a statistically significant difference in the gender gap of -0.15). In the OECD average, boys showed a stronger SUBNORM with the gender gap of 0.12.
- Family socioeconomic background was not strongly associated with SUBNORM: the correlations between SUBNORM and ESCS were virtually zero in Indonesia and Thailand, and only r = .11 in Malaysia and r = .14 in Viet Nam.

- The SUBNORM index was not associated with students' mathematics achievement either. The correlations were near zero in Malaysia, Thailand, and Viet Nam, whilst a negative correlation (r = -.19) was found in Indonesia (i.e. students who felt strongly about subjective norms had a lower score in mathematics).

Intrinsic motivation to learn mathematics (INTMAT)

Students' intrinsic motivation to learn mathematics (INTMAT) was one of the most prevalent non-cognitive characteristics in all four Southeast Asian countries. Such tendency was shown within country, compared to their own scores on the other non-cognitive indices (Table 20), as well as compared to other countries (Figure 11). As was the case in the SUBNORM index, Singapore and Peru also had high scores on INTMAT.

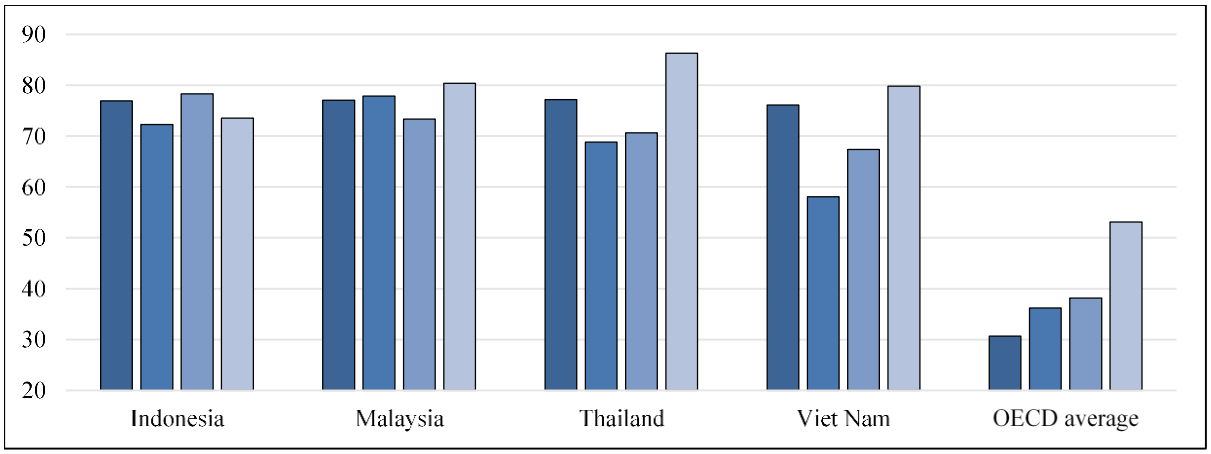
Figure 11. Mean scores on the index of *intrinsic motivation to learn mathematics* (INTMAT)



Source: Adapted from OECD, PISA 2012 Database (OECD, 2013[45]).

Southeast Asian students strongly agreed or agreed to all four items of the INTMAT index (Figure 12). It is noteworthy that as many as 86% in Thailand and 80% in Viet Nam reported being "interested in the things that they learn in mathematics", which can be contrasted to only 53% in the OECD average.

Figure 12. Percentages of students who reported "strongly agree" or "agree" on four items of the index of intrinsic motivation to learn mathematics (INTMAT)



Note: The percentages are shown from left to right for the following items of: (a) I enjoy reading about mathematics; (b) I look forward to my mathematics; (c) I do mathematics because I enjoy it; and (d) I am interested in the things I learn in mathematics.
Source: Adapted from OECD, PISA 2012 Database (OECD, 2013[45]).

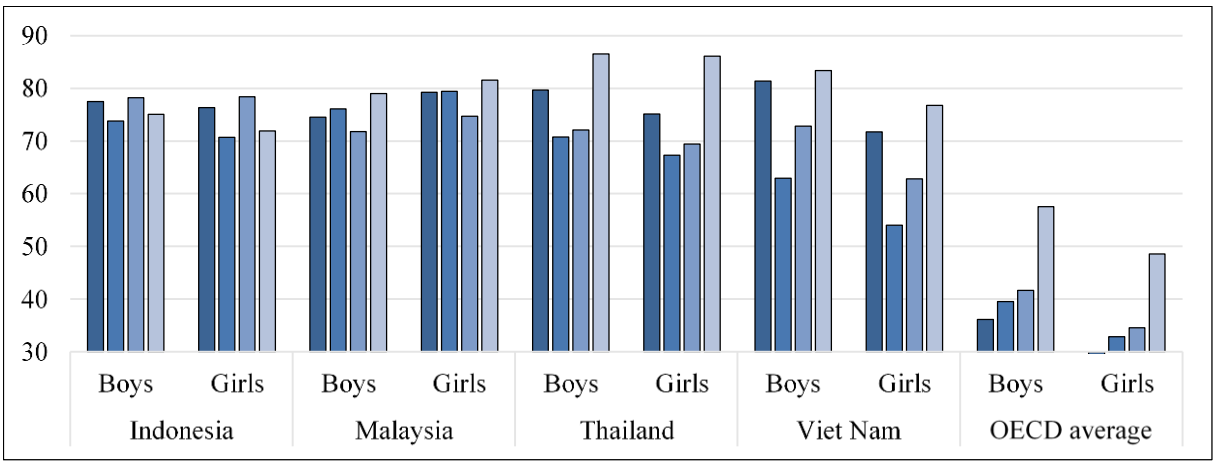
Gender difference in INTMAT, with boys having a higher level than girls, was observed globally in as many as 52 countries and economies in PISA 2012. However, this was not the case in Indonesia, Malaysia, and Thailand. In general, both boys and girls showed relatively high levels of intrinsic motivation to learn mathematics. Gender difference on this index was nearly zero in Indonesia. It was statistically significant but smaller than the OECD average in the other three countries (Table 21 and Figure 13).

Table 21. Gender difference in the mean scores on the index of intrinsic motivation to learn mathematics (INTMAT)

Countries	Boys		Girls		Gender differences (boys - girls)	
	Mean index	S.E.	Mean index	S.E.	Diff.	S.E.
Indonesia	0.81	(0.02)	0.78	(0.03)	0.03	(0.03)
Malaysia	0.86	(0.02)	0.95	(0.02)	**-0.10**	(0.03)
Thailand	0.82	(0.02)	0.74	(0.02)	**0.07**	(0.02)
Viet Nam	0.77	(0.02)	0.62	(0.02)	**0.15**	(0.02)
Singapore	0.88	(0.03)	0.79	(0.02)	**0.08**	(0.03)
Korea	-0.12	(0.04)	-0.30	(0.03)	**0.18**	(0.04)
Brazil	0.52	(0.02)	0.34	(0.02)	**0.18**	(0.02)
Colombia	0.64	(0.03)	0.54	(0.03)	**0.10**	(0.03)
Peru	0.81	(0.02)	0.68	(0.03)	**0.13**	(0.03)
Australia	0.26	(0.02)	-0.06	(0.02)	**0.32**	(0.03)
Finland	-0.12	(0.02)	-0.33	(0.02)	**0.20**	(0.03)
OECD average	0.10	(0.00)	-0.11	(0.00)	**0.21**	(0.01)

Note: Statistically significant differences in bold.
Source: Table III.3.4d, (OECD, 2013[48]), *PISA 2012 Results: Ready to Learn: Students' Engagement, Drive and Self-Beliefs (Volume III)*, http://dx.doi.org/10.1787/9789264201170-en.

Figure 13. Gender difference in the percentages of students who reported "strongly agree" or "agree" on four items of the index of intrinsic motivation to learn mathematics (INTMAT)



Note: The percentages are shown from left to right for the following items:
(a) I enjoy reading about mathematics; (b) I look forward to my mathematics; (c) I do mathematics because I enjoy it; and (d) I am interested in the things I learn in mathematics. Author's reconstruction of the figure.
Source: Table III.3.4b, (OECD, 2013[48]), *PISA 2012 Results: Ready to Learn: Students' Engagement, Drive and Self-Beliefs (Volume III)*, http://dx.doi.org/10.1787/9789264201170-en.

The correlations between ESCS and INTMAT were virtually zero in all four countries, suggesting that intrinsic motivation was not higher among those from more advantaged family backgrounds.

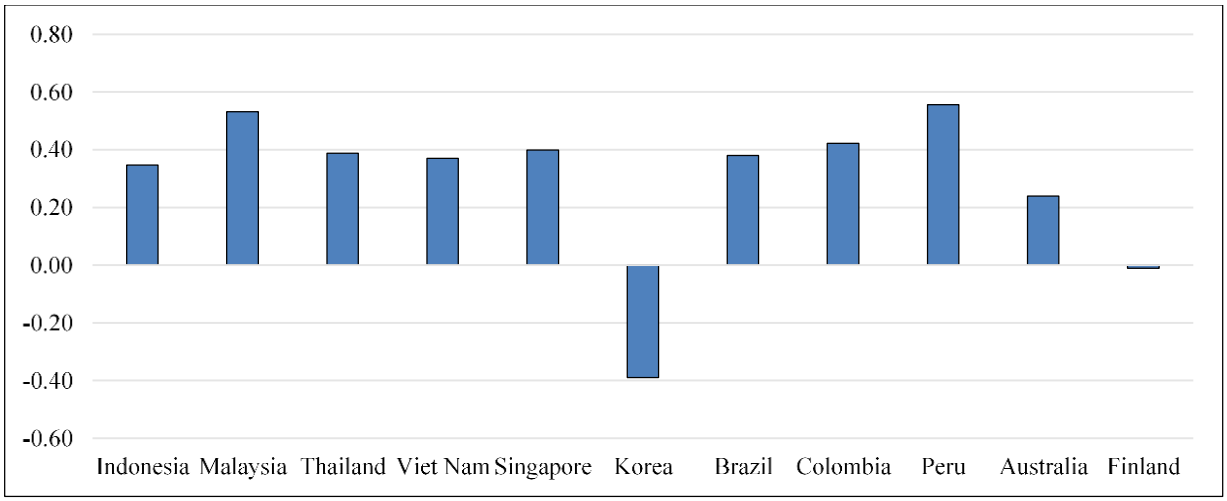
Ironically, INTMAT was hardly associated with mathematics performance in three out of the four Southeast countries. The percentages in the variance explained in mathematics performance by INTMAT were negligible in Indonesia (0.5%), Thailand (0.2%), and Viet Nam (2.3%). The corresponding percentage was higher in Malaysia (3.9%). This translated into correlations of r = -.07 in Indonesia, r = .20 in Malaysia, r = .04 in Thailand, and r = .15 in Viet Nam. Thus, intrinsic motivation was a modest predictor of students' mathematics achievement in Malaysia only.

Instrumental motivation to learn mathematics (INSTMOT)

Students' instrumental motivation to learn mathematics (INSTMOT) was not as high as intrinsic motivation to learning mathematics (INTMAT), but it was one of the most prevalent non-cognitive characteristics in all four Southeast Asian countries (Table 20).

It appeared that motivation was not an issue among the students in this region given that their index mean scores in INSTMOT were high and higher than the OECD average. A neighbouring country of Singapore and three South American countries Brazil, Columbia, and Peru showed comparable scores in this index (Figure 14).

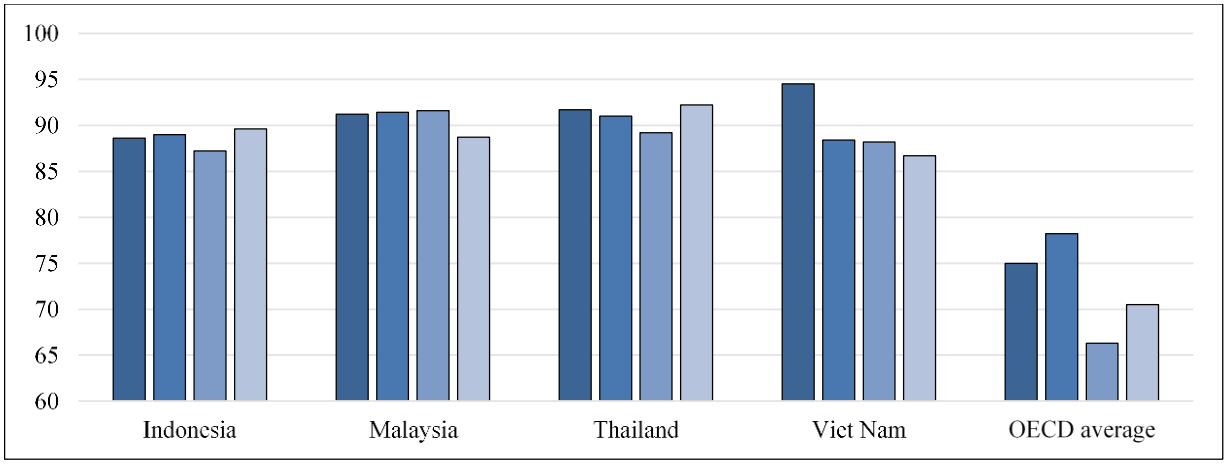
Figure 14. Mean scores on the index of instrumental motivation to learn mathematics (INSTMOT)



Source: Adapted from OECD, PISA 2012 Database (OECD, 2013[45]).

Four items were used to measure INSTMOT (see the item descriptions in Table 19). Nearly as many as 90% of students strongly agreed or agreed to all four items of INSTMOT, indicating a strong sense of instrumental motivation to learning mathematics, students in the four Southeast Asian countries, for their future work, career prospects, study, or employment chances (Figure 15).

Figure 15. Percentages of students who reported "strongly agree" or "agree" on four items of the index of instrumental motivation to learn mathematics (INSTMOT)



Notes: The percentages are shown from left to right for the following items of: (a) Making an effort in mathematics is worth because it will help me in the work that I want to do later on; (b) Learning mathematics is worthwhile for me because it will improve my career <prospects, chances>; (c) Mathematics is an important subject for me because I need it for what I want to study later on; and (d) I will learn many things in mathematics that will help me get a job.
Source: Adapted from OECD, PISA 2012 Database (OECD, 2013[45]).

Further, gender difference in INSTMOT was minor in all four countries: it was virtually zero in Indonesia (-0.05) and Viet Nam (0.00). Small gender difference was statistically significant in Malaysia (-0.13) and Thailand (-0.09), with girls having higher levels of instrumental motivation compared to boys within the country (Table 22). This gender difference pattern was the opposite in the OECD country average where boys had higher instrumental motivation than girls (0.19).

Table 22. Gender difference in the mean scores on the index of instrumental motivation to learn mathematics (INSTMOT)

Countries	Boys		Girls		Gender differences (boys - girls)	
	Mean index	S.E.	Mean index	S.E.	Diff.	S.E.
Indonesia	0.32	(0.02)	0.37	(0.03)	-0.05	(0.03)
Malaysia	0.46	(0.03)	0.60	(0.02)	**-0.13**	(0.03)
Thailand	0.34	(0.02)	0.43	(0.02)	**-0.09**	(0.03)
Viet Nam	0.37	(0.02)	0.37	(0.02)	0.00	(0.03)
Singapore	0.46	(0.02)	0.33	(0.02)	**0.13**	(0.03)
Korea	-0.31	(0.04)	-0.48	(0.03)	**0.17**	(0.05)
Brazil	0.42	(0.02)	0.34	(0.02)	**0.08**	(0.02)
Colombia	0.45	(0.02)	0.40	(0.02)	0.06	(0.03)
Peru	0.55	(0.02)	0.56	(0.02)	-0.01	(0.04)
Australia	0.39	(0.02)	0.08	(0.01)	**0.30**	(0.02)
Finland	0.02	(0.02)	-0.04	(0.02)	**0.06**	(0.03)
OECD average	0.09	(0.00)	-0.10	(0.00)	**0.19**	(0.01)

Note: Statistically significant differences in bold.
Source: Table III.3.5d, (OECD, 2013[48]), *PISA 2012 Results: Ready to Learn: Students' Engagement, Drive and Self-Beliefs (Volume III),* http://dx.doi.org/10.1787/9789264201170-en.

INSTMOT had virtually zero correlation with the family SES index of ESCS: r = .01 in Indonesia and r = -.03 in Thailand. The relationship was slightly stronger but still minor in Malaysia (r = .07) and Viet Nam (r = .12).

Students in Malaysia, Thailand, and Viet Nam who expressed a greater level of instrumental motivation did score higher in mathematics achievement, but the strength of this relationship was rather weak: r = .19 in Malaysia, r = .12 in Thailand, and r = .15 in Viet Nam. The corresponding association was nearly zero (r = .02) in Indonesia.

Non-cognitive predictors of mathematics achievement: Indonesia, Malaysia, Thailand, and Viet Nam

The non-cognitive variables were also reviewed for their relevance as predictors of mathematics achievement. Table 23 presents the associations between the fifteen non-cognitive student characteristics and mathematics achievement in the four Southeast Asian countries and in the average across all PISA 2012 participants. Correlations greater than .20 are indicated in bold. The variables showing the correlations of greater than .20 in Southeast Asian countries and in the all participant averages are shaded in grey.

Table 23. Correlations between fifteen non-cognitive variables and mathematics achievement

Indonesia		Malaysia		Thailand		Viet Nam		All PISA 2012 participant countries and economies	
MATHEFF	0.17	**MATHEFF**	**0.38**	**MATHEFF**	**0.24**	**MATHEFF**	**0.50**	**MATHEFF**	**0.46**
ATSCHL	0.15	**ANXMAT**	**-0.22**	**PERSEV**	**0.21**	**SCMAT**	**0.32**	**SCMAT**	**0.34**
ANXMAT	-0.14	**INTMAT**	**0.20**	**ANXMAT**	**-0.21**	**ANXMAT**	**-0.32**	**ANXMAT**	**-0.34**
MATINTFC	0.12	**SCMAT**	**0.20**	ATSCHL	0.19	**OPENPS**	**0.26**	**OPENPS**	**0.27**
BELONG	0.11	INSTMOT	0.19	BELONG	0.18	**MATINTFC**	**0.21**	PERSEV	0.19
PERSEV	0.11	PERSEV	0.15	MATINTFC	0.17	MATBEH	0.16	INTMAT	0.15
OPENPS	0.09	OPENPS	0.13	INSTMOT	0.12	INSTMOT	0.15	INSTMOT	0.13
INSTMOT	0.02	MATWKETH	0.12	OPENPS	0.09	INTMAT	0.15	MATINTFC	0.12
ATTLNACT	0.02	ATSCHL	0.08	SCMAT	0.08	PERSEV	0.08	MATWKETH	0.11
FAILMAT	0.01	ATTLNACT	0.08	MATWKETH	0.05	SUBNORM	0.08	ATSCHL	0.10
MATWKETH	-0.06	MATINTFC	0.08	INTMAT	0.04	MATWKETH	0.05	BELONG	0.07
INTMAT	-0.07	BELONG	0.05	ATTLNACT	0.04	FAILMAT	0.04	ATTLNACT	0.07
SCMAT	-0.08	SUBNORM	0.05	MATBEH	-0.01	ATTLNACT	0.03	MATBEH	0.07
MATBEH	-0.11	MATBEH	0.00	SUBNORM	-0.03	BELONG	0.00	SUBNORM	-0.03
SUBNORM	-0.19	FAILMAT	-0.12	FAILMAT	-0.26	ATSCHL	-0.05	FAILMAT	-0.15

Note: N = 5 622 in Indonesia; N = 5 197 in Malaysia; N = 6 606 in Thailand; N = 4 959 in Viet Nam. Correlations greater than .20 are in bold. Correlations that were found to be greater than .20 in Southeast Asian countries, as well as in the averages of all participant countries and economies, are shaded in grey.
Source: Adapted from OECD, PISA 2012 Database (OECD, 2013[45]).

There were four non-cognitive variables showing the associations with mathematics achievement greater than r = .20 across all PISA 2012 participant countries and economies: mathematics self-efficacy (MATHEFF), mathematics self-concept (SCMAT), mathematics anxiety (ANXMAT), and openness to problem solving (OPENPS).

- In Indonesia, none of the non-cognitive variables had a correlation greater than r = .20 with mathematics achievement.
- In Malaysia, MATHEFF showed the strongest association while INTMAT, ANXMAT, and SCMAT had a similar size of correlation of around r = .20.
- In Thailand, perseverance (PERSEV) showed a correlation of greater than r = .20, in addition to MATHEFF and ANXMAT.
- In Viet Nam, the index of mathematics intentions (MATINTFC) showed a correlation greater than .20 (r = .21) in addition to MATHEFF, SCMAT, ANXMAT, and OPENPS.

The following conclusions can be made given the patterns of the correlation results:

- MATHEFF was the best predictor of mathematics achievement across all PISA participants on average, which also turned out to be the best predictor of mathematics achievement in all four Southeast Asian countries.
- However, SCMAT and OPENPS were found to be hardly relevant predictors of mathematics achievement in Indonesia and Thailand.
- The country-unique predictors of mathematics achievement were identified as: intrinsic motivation to learn mathematics (INTMAT) in Malaysia; perseverance (PERSEV) in Thailand; and mathematics intentions (MATINTFC) in Viet Nam.

- While Indonesia did not have any non-cognitive variable showing at least a moderate level of association with mathematics, non-cognitive predictors of mathematics achievement did not differ much between the Southeast Asian countries and the rest of the PISA participant countries and economies.

Three non-cognitive variables, INTMAT, PERSEV, and MATINTFC turned out to be unique predictors of Southeast Asian students' mathematics achievement. The index of INTMAT was reviewed in the previous section, and thus, PERSEV and MATINTFC, were further examined and discussed in the following sections.

Perseverance (PERSEV) and mathematics achievement in Thailand

- Perseverance was a unique predictor of mathematics achievement in Thailand (r = .21), while that was not the case in the other three Southeast Asian countries: r = .11 in Indonesia, r = .15 in Malaysia, and r = .08 in Viet Nam.
- However, perseverance was one of the prevalent dispositions in all four Southeast Asian countries: its mean index scores were 0.26 in Indonesia, 0.22 in Malaysia, and 0.22 in Thailand, and 0.45 in Viet Nam.
- While boys showed a higher level of perseverance in doing mathematics in the OECD average, it was girls who reported having a higher level of perseverance than boys in Thailand (Table 24). No statistically significant difference was found in Indonesia, Malaysia, and Viet Nam.

Table 24. Gender difference in the mean scores on the index of perseverance (PERSEV)

Countries	Boys		Girls		Gender differences (boys - girls)	
	Mean index	S.E.	Mean index	S.E.	Diff.	S.E.
Indonesia	0.27	(0.03)	0.25	(0.03)	0.02	(0.03)
Malaysia	0.21	(0.03)	0.23	(0.02)	-0.03	(0.03)
Thailand	0.14	(0.02)	0.28	(0.02)	**-0.14**	(0.03)
Viet Nam	0.47	(0.03)	0.43	(0.03)	0.03	(0.04)
OECD average	0.05	(0.00)	-0.05	(0.00)	**0.10**	(0.01)

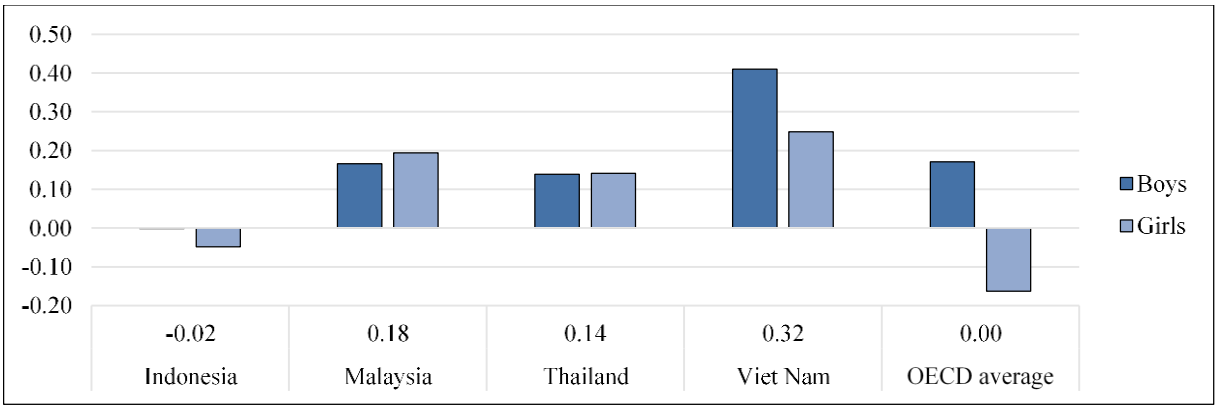
Source: Table III.3.1d, (OECD, 2013[48]), *PISA 2012 Results: Ready to Learn: Students' Engagement, Drive and Self-Beliefs (Volume III)*, http://dx.doi.org/10.1787/9789264201170-en.

Mathematics intentions (MATINTFC) and mathematics achievement in Viet Nam

Students' mathematics intentions (MATINTFC) was "prevalent" (the index mean greater than 0.30) and "relevant as predictor of mathematics" (association greater than r = .20) in Viet Nam.

Although gender difference was statistically significant in favour of boys, both gender groups showed high and positive scores in Viet Nam (Figure 16). Further, the strength of association between MATINTFC and mathematics achievement was similar among boys (r = .18) and girls (r = .22) in Viet Nam. As can be seen in Figure 16, more substantial gender gap existed in the OECD average, with boys showing a positive score and girls showing a negative score on MATINTFC.

Figure 16. Mean scores on the index of mathematics intentions (MATINTFC) by gender



Source: Table III.4.5b, (OECD, 2013[48]), *PISA 2012 Results: Ready to Learn: Students' Engagement, Drive and Self-Beliefs (Volume III)*, http://dx.doi.org/10.1787/9789264201170-en.

Relationships among the non-cognitive attributes: Indonesia, Malaysia, Thailand, and Viet Nam

Thus far in this section, four variables, mathematics behaviour (MATBEH), subjective norms (SUBNORM), intrinsic motivation (INTMAT), and instrumental motivation (INSTMOT) were highlighted as they were prevalent non-cognitive characteristics of Southeast Asian students. Additional two variables, perseverance (PERSEV) and mathematics intentions (MATINTFC), were presented as unique predictors of mathematics achievement in Thailand and Viet Nam, respectively. Four variables, MATHEFF, SCMAT, ANXMAT, and OPENPS were the best predictors of students' mathematics achievement on average across all PISA 2012 participant countries and economies, including Southeast Asian countries. Thus, how these ten variables were related to each other was further explored (Table 25).

Overall, the pattern of correlations among the non-cognitive variables was more similar than dissimilar in the four countries, especially in Indonesia and Malaysia. The strongest pairs of variables (i.e. correlations greater than .50) were found in the pairs of variables:

- between INSTMOT and INTMAT; between INSTMOT and SUBNORM; and between INTMAT and SCMAT in Indonesia and Malaysia;
- between INSTMOT and INTMAT; and between INTMAT and SCMAT in Thailand; and
- between SCMAT and ANXMAT; and between SCMAT and INTMAT in Viet Nam.

Table 25. Correlations among ten non-cognitive variables in PISA 2012

	ANXMAT	INSTMOT	INTMAT	MATHEFF	MATINTFC	MATBEH	OPENPS	PERSEV	SCMAT	SUBNORM
Indonesia (lower diagonal) and Malaysia (upper diagonal)										
ANXMAT	1	-0.03	-0.22	-0.08	-0.14	-0.05	0.04	-0.18	-0.45	0.00
INSTMOT	-0.11	1	0.61	0.40	0.24	0.25	0.23	0.21	0.40	0.54
INTMAT	-0.22	0.59	1	0.45	0.36	0.40	0.27	0.20	0.64	0.46
MATHEFF	-0.09	0.40	0.43	1	0.13	0.36	0.43	0.27	0.43	0.37
MATINTFC	-0.19	0.24	0.38	0.22	1	0.20	0.05	0.04	0.27	0.12
MATBEH	0.00	0.23	0.39	0.34	0.23	1	0.46	0.19	0.41	0.31
OPENPS	-0.04	0.29	0.29	0.37	0.08	0.38	1	0.34	0.31	0.28
PERSEV	-0.20	0.28	0.26	0.30	0.10	0.13	0.39	1	0.26	0.22
SCMAT	-0.33	0.42	0.57	0.37	0.29	0.40	0.27	0.23	1	0.43
SUBNORM	0.00	0.54	0.46	0.37	0.12	0.31	0.28	0.22	0.43	1
Thailand (lower diagonal) and Viet Nam (upper diagonal)										
ANXMAT	1	-0.09	-0.31	-0.31	-0.24	-0.28	-0.20	-0.22	-0.50	-0.03
INSTMOT	-0.08	1	0.48	0.35	0.26	0.30	0.24	0.24	0.23	0.43
INTMAT	-0.17	0.63	1	0.41	0.40	0.47	0.28	0.24	0.50	0.38
MATHEFF	-0.03	0.38	0.42	1	0.23	0.38	0.42	0.28	0.44	0.32
MATINTFC	-0.20	0.28	0.35	0.18	1	0.31	0.14	0.07	0.36	0.16
MATBEH	0.05	0.23	0.40	0.35	0.19	1	0.41	0.24	0.45	0.30
OPENPS	0.01	0.22	0.29	0.39	0.07	0.43	1	0.42	0.39	0.26
PERSEV	-0.13	0.21	0.13	0.22	0.08	0.07	0.27	1	0.21	0.16
SCMAT	-0.27	0.38	0.62	0.40	0.33	0.47	0.37	0.12	1	0.29
SUBNORM	0.09	0.48	0.44	0.35	0.13	0.27	0.24	0.12	0.28	1

Note: N = 5 622 in Indonesia; N = 5 197 in Malaysia; N = 6 606 in Thailand; N = 4 959 in Viet Nam.
Source: Adapted from OECD, PISA 2012 Database (OECD, 2013[45]).

Prediction of mathematics achievement from non-cognitive variables: Indonesia, Malaysia, Thailand, and Viet Nam

Non-cognitive models for predicting mathematics achievement of Southeast Asian countries were developed, based on simultaneous multiple regression analyses, controlling for a set of students' demographic background information including grade-level, gender, pre-school attendance, whether their home language was the same as the PISA test language, and whether they attended a general or vocational school. For simplicity, each categorical variable was dichotomously recoded (see the table below for the items that were used and recoded for the analysis).

Table 26. PISA 2012 variables to explain mathematics achievement

Construct	Variable Name	Variable Label	Data Re-coded for the Analysis
Grade	ST01Q01	Raw international student grade (ranging from 7 to 12)	(7, 8, 9 = 0; 10, 11, 12 = 1)
Gender	ST04Q01	Sex (Female [1]; Male: [2])	(Male = 0; Female = 1)
Pre-school attendance	ST05Q01	Attend <ISCED 0> (No [1]; Yes, 1 year [2]; Yes, more than 1 year [3])	(No = 0; Yes = 1)
Language	ST25Q01	Language of test used at home (Language of test [1]; Another language [2])	(Another language = 0; Language of test at home = 1)
Programme type	ISCEDO	ISCED orientation (General school [1]; Vocational school [3])	(Vocational = 0; General = 1)
Family SES	ESCS	Index-level, continuous variable	No re-coding

Note: Students' immigration status was also considered but almost all students (98%) were native in the PISA 2012 data and thus this variable was excluded. The ISCED orientation category options were General [1]; Pre-Vocational [2]; Vocational [3]; and Modular [4]. However, all sampled students in Indonesia, Malaysia, and Thailand reported attending either Vocational or General schools. There were fewer than 1% indicating "Modular" and the rest indicating "General" in Viet Nam.
Source: OECD, PISA 2012 Database (OECD, 2013[45]).

Model 1 had five variables of students' demographic background to predict mathematics achievement. Model 2 added the PISA index of economic, social and cultural status (ESCS) as a proxy for family SES. Model 3 added four non-cognitive variables that were prevalent: MATBEH, SUBNORM, INTMAT, and INSTMOT. Finally, Model 4 included "regional-unique" predictors of mathematics achievement (MATINTFC and PERSEV) as well as "universal" predictors of mathematics achievement (ANXMAT, MATHEFF, SCMAT, and OPENPS).

	Predictor variables in the model
Model 1	Grade level, Gender, Pre-school attendance, Language, Programme type
Model 2	Model 1 + Family SES (ESCS)
Model 3	Model 2 + prevalent non-cognitive variables
Model 4	Model 3 + unique and universal non-cognitive variables

The overall model predictability, calculated as R-squared values in the regression analysis, is shown in Table 27.

- In Model 1, a set of students' demographic background variables alone explained 16%, 11%, 10%, and 23% of the variances in the mathematics achievement scores, in Indonesia, Malaysia, Thailand, and Viet Nam, respectively. The effect of students' demographic background on mathematics achievement was stronger in Viet Nam than in the other three Southeast Asian countries.
- In Model 2, the incremental predictability from the addition of ESCS was 4% in Indonesia, 10% in Malaysia, and 7% in both Thailand and Viet Nam. Thus, family SES holds less importance in the prediction of mathematics achievement in Indonesia.
- In Model 3, the predictability improved only slightly, as expected.
- In Model 4, when the non-cognitive predictors with the moderately strong associations with mathematics achievement were added, the predictability jumped by 8% in Indonesia, 10% in Malaysia, 8% in Thailand, and 16% in Viet Nam, compared to Model 3.

- The final model's predictability was better for Viet Nam, and less effective for Indonesia, Malaysia, and Thailand. There was much room to improve in learning about other non-cognitive variables that were more culturally relevant for Indonesia, Malaysia, and Thailand.

Table 27. R-squared values of the regression models for mathematics achievement

	Model 1	Model 2	Model 3	Model 4
Indonesia	0.16	0.20	0.24	0.32
Malaysia	0.11	0.21	0.26	0.36
Thailand	0.10	0.17	0.20	0.28
Viet Nam	0.23	0.30	0.32	0.48

Note: N = 5 622 in Indonesia; N = 5 197 in Malaysia; N = 6 606 in Thailand; N = 4 959 in Viet Nam.
Source: Adapted from OECD, PISA 2012 Database (OECD, 2013[45]).

Table 28 presents regression coefficients of the first and final models. The statistically significant, standardised regression coefficients at the .05 level were indicated in bold.

- Model 1 showed the effects of the student demographic variables on mathematics achievement.
  - The effect of being in the upper grades (Grade 10, 11, or 12) as opposed to the lower grades (Grade 7, 8, or 9) was shown to be as large as one standard deviation in the mathematics scores in Malaysia (101.43) and Viet Nam (118.27). The grade effect was still substantial about 41 points in Indonesia, and but much smaller at 26 points in Thailand.
  - The gender effect varied in the four countries. Viet Nam showed the largest gender effect with boys having a higher mathematics score than girls.
  - The language effect was substantial in Malaysia and Viet Nam. Malay students who spoke the same language at home and in school (i.e. PISA test language) scored nearly 35 points lower in mathematics than students whose languages differed between home and school. In Viet Nam, students who spoke the same language at home and in school scored about 31 points higher in mathematics than those whose used different languages in the two settings.
  - There was a moderately strong effect of programme type (whether students were attending a general or vocational school) in Thailand (an associated score difference of 63.65).
- The final model (Model 4) showed the relative strength of both demographic background and non-cognitive variables as predictors of students' mathematics achievement. The variables with the standardised coefficients greater than .15 were found in:
  - grade-level, pre-school experience, ESCS, MATHEFF, and SUBNORM in Indonesia;
  - grade-level, language, ESCS, ANXMAT, MATBEH, and MATHEFF In Malaysia;
  - programme-level, ESCS, ANXMAT, and MATHEFF in Thailand; and
  - grade-level, ESCS, and MATHEFF in Viet Nam.

- As can be seen, two variables, ESCS and MATHEFF, stood out as they were found to be among the strongest predictors of mathematics achievement in all four Southeast Asian countries.

Table 28. Regression coefficients of Models 1 and 4 predicting mathematics achievement

Country	Indonesia				Malaysia			
Model 1	b	b.se	beta	beta.se	b	b.se	beta	beta.se
(CONSTANT)	327.52	13.45	N/A	N/A	310.38	11.18	N/A	N/A
Grade: Upper secondary school	41.00	7.97	**0.29**	0.05	101.43	6.54	**0.24**	0.02
Female	-8.76	2.49	**-0.06**	0.02	3.03	3.26	0.02	0.02
Pre-school attendance	40.38	5.40	**0.28**	0.03	23.64	3.56	**0.12**	0.02
Language of test used at home	-4.12	4.73	-0.03	0.03	-34.39	4.62	**-0.21**	0.03
Programme type: General school	13.56	11.15	0.08	0.06	15.75	9.77	0.07	0.04
Country	Thailand				Viet Nam			
Model 1	b	b.se	beta	beta.se	b	b.se	beta	beta.se
(CONSTANT)	301.42	13.98	N/A	N/A	373.40	16.91	N/A	N/A
Grade: Upper secondary school	26.27	7.37	**0.13**	0.04	118.27	8.23	**0.44**	0.04
Female	2.29	3.12	0.01	0.02	-19.70	2.23	**-0.12**	0.01
Pre-school attendance	47.22	11.12	**0.07**	0.02	18.33	4.91	**0.06**	0.02
Language of test used at home	11.29	5.23	**0.07**	0.03	31.42	13.90	**0.05**	0.02
Programme type: General school	63.65	5.72	**0.31**	0.02	N/A	N/A	N/A	N/A
Country	Indonesia				Malaysia			
Model 4	b	b.se	beta	beta.se	b	b.se	beta	beta.se
(CONSTANT)	404.52	11.68	N/A	N/A	397.81	12.68	N/A	N/A
Grade: Upper secondary school	29.07	6.17	**0.20**	0.04	71.07	7.79	**0.17**	0.02
Female	-7.54	2.66	**-0.05**	0.02	1.81	2.71	**0.01**	0.02
Pre-school attendance	26.03	4.14	**0.18**	0.02	12.45	3.21	**0.07**	0.02
Language of test used at home	-9.46	3.54	**-0.07**	0.03	-29.10	3.75	**-0.18**	0.02
Programme type: General school	5.36	8.73	0.03	0.05	9.24	7.78	0.04	0.03
ESCS	12.01	2.08	**0.18**	0.03	21.47	1.68	**0.26**	0.02
ANXMAT	-12.18	2.56	**-0.12**	0.02	-18.22	2.77	**-0.17**	0.03
INSTMOT	9.38	2.28	**0.10**	0.02	10.96	2.48	**0.11**	0.02
INTMAT	-9.19	4.92	**-0.09**	0.05	5.05	3.74	0.05	0.04
MATBEH	-10.51	2.43	**-0.12**	0.03	-16.70	2.71	**-0.17**	0.03
MATHEFF	20.87	2.66	**0.21**	0.02	32.79	2.45	**0.32**	0.02
MATINTFC	9.72	1.58	**0.14**	0.02	2.21	1.88	0.03	0.02
OPENPS	3.98	1.52	**0.05**	0.02	3.32	1.88	0.04	0.02
PERSEV	1.72	1.79	0.02	0.02	1.39	1.68	0.01	0.02
SCMAT	-4.32	4.66	-0.04	0.04	-5.21	4.14	-0.05	0.04
SUBNORM	-15.48	1.60	**-0.23**	0.02	-8.90	1.69	**-0.12**	0.02
Country	Thailand				Viet Nam			
Model4	b	b.se	beta	beta.se	b	b.se	beta	beta.se
(CONSTANT)	403.23	14.29	N/A	N/A	492.46	19.52	N/A	N/A
Grade: Upper secondary school	13.64	6.72	**0.07**	0.03	88.52	7.11	**0.33**	0.04
Female	5.08	2.66	**0.03**	0.02	-6.61	2.36	**-0.04**	0.01
Pre-school attendance	37.01	11.60	**0.06**	0.02	10.49	4.35	**0.04**	0.02
Language of test used at home	-4.24	4.20	-0.03	0.03	-2.94	14.64	-0.01	0.02
Programme type: General school	45.32	4.51	**0.22**	0.02	N/A	N/A	N/A	N/A
ESCS	17.73	1.88	**0.25**	0.03	12.91	2.42	**0.17**	0.03
ANXMAT	-20.35	2.86	**-0.16**	0.02	-19.24	3.17	**-0.14**	0.02
INSTMOT	12.65	2.50	**0.11**	0.02	2.06	2.43	0.02	0.02
INTMAT	-12.36	3.56	**-0.11**	0.03	-11.42	2.95	**-0.09**	0.02

MATBEH	-8.20	2.75	**-0.07**	0.02	-7.98	2.80	**-0.06**	0.02
MATHEFF	23.99	3.08	**0.20**	0.03	46.40	3.25	**0.35**	0.02
MATINTFC	8.62	1.47	**0.10**	0.02	7.06	1.42	**0.09**	0.02
OPENPS	2.62	2.29	0.02	0.02	9.20	1.94	**0.09**	0.02
PERSEV	9.02	2.18	**0.08**	0.02	-6.45	1.52	**-0.07**	0.02
SCMAT	2.60	3.99	0.02	0.03	10.40	4.86	**0.07**	0.03
SUBNORM	-9.85	1.53	**-0.13**	0.02	-5.09	2.13	**-0.05**	0.02

Note: Coefficients statistically significant at least at the .05 level are presented in bold; All coefficients in Model 1 were statistically significant at the .05 level, except for language and programme type in Indonesia; gender and programme type in Malaysia; and gender in Thailand. All coefficients in Model 4 were statistically significant at the .05 significance level, except for programme type, PERSEV and SCMAT in Indonesia; programme type, INTMAT, MATINTFC, OPENPS, PERSEV, and SCMAT in Malaysia; language, OPENPS, and SCMAT in Thailand; and language and INSTMOT in Viet Nam; There was less than 1% of students attending a non-general programme type in Viet Nam and thus, the variable "programme type" was excluded in the analysis of Viet Nam. N = 5 622 in Indonesia; N = 5 197 in Malaysia; N = 6 606 in Thailand; N = 4 959 in Viet Nam

Source: Adapted from OECD, PISA 2012 Database (OECD, 2013[45]).

Concluding remarks

Fifteen non-cognitive variables related to mathematics achievement were reviewed in this section. Four variables – mathematics behaviour (MATBEH), subjective norms (SUBNORM), intrinsic motivation (INTMAT), and instrumental motivation (INSTMOT) – were prevalent in Southeast Asian countries. Two variables – perseverance (PERSEV) and mathematics intentions (MATINTFC) – were unique predictors of mathematics achievement in this region.

The final model predicted students' mathematics achievement quite well in Viet Nam, but the model was relatively less effective in Indonesia, Malaysia, and Thailand. Mathematics self-efficacy (MATHEFF) was the strongest predictor of mathematics achievement in Indonesia, Malaysia, and Viet Nam. However, the strongest predictor was family SES in Thailand, as was seen for reading achievement in PISA 2009 data (presented in section 2). Overall, region-specific non-cognitive variables may need to be further explored to arrive at a better understanding of student achievement outcomes, especially in Indonesia, Malaysia, and Thailand.

4. Non-cognitive characteristics related to science achievement

This section presents an overview of non-cognitive disposition of in Indonesia, Thailand, and Viet Nam with respect to science achievement, based on the PISA 2015 data. The same approach taken for the PISA 2009 and PISA 2012 data analyses was adopted. The following six non-cognitive variables (see index descriptions in Table 29) are the focus of this section. Based on the non-cognitive schema consisting of six broad domains (Figure 1), they were broadly categorised into:

- Affect/Personality: Sense of belonging (BELONG) and Enjoyment of science (JOYSCIE)
- Motivation: Instrumental motivation (INSTSCIE)
- Values/Interest: Awareness of environmental matters (ENVAWARE) and Epistemological beliefs about science (EPIST)
- Self-Beliefs: Science self-efficacy (SCIEEFF)

Table 29. Six non-cognitive indices examined in this section.

Index label	Index description
BELONG	**Sense of belonging** The index of sense of belonging (BELONG) was constructed using students' responses to a trend question about their sense of belonging to school. Students reported, on a four-point Likert scale with the answering categories "strongly agree", "agree", "disagree", and "strongly disagree", their agreement with the following statements (ST034): I feel like an outsider (or left out of things) at school; I make friends easily at school; I feel like I belong at school; I feel awkward and out of place in my school; Other students seem to like me; I feel lonely at school. The answers to three items were reversed-coded so that higher values in the index indicate a greater sense of belonging.
ENVAWARE	**Awareness of environmental matters** The index of awareness of environmental matters (ENVAWARE) was constructed using students' responses to seven items with the question of how informed are you about the following environmental issues (ST092): the increase of greenhouse gases in the atmosphere; the use of genetically modified organisms; nuclear waste; the consequences of clearing forests for other land use; air pollution; extinction of plants and animals, and water shortage.
EPIST	**Epistemological beliefs about science** The index of epistemological beliefs about science were measured with a new question about students' views on scientific approaches (ST131). Students answered on a four-point Likert scale with the answering categories "strongly agree", "agree", "disagree", and "strongly disagree". The items of this index were: A good way to know if something is true is to do an experiment. Ideas in <broad science> sometimes change; Good answers are based on evidence from many different experiments; It is good to try experiments more than once to make sure of your findings; and Sometimes <broad science> scientists change their minds about what is true in science.
INSTSCIE	**Instrumental motivation** The index of instrumental motivation was constructed based on student responses to four items (ST113). They responded on a four-point Likert scale with the categories "strongly agree", "agree", "disagree", and "strongly disagree". Higher values correspond to higher levels of instrumental motivation. The items used under this index were: making an effort in my <school science> subject(s) is worth it because this will help me in the work I want to do later on; What I learn in my <school science> subject(s) is important for me because I need this for what I want to do later on; Studying my <school science> subject(s) is worthwhile for me because what I learn will improve my career prospects; Many things I learn in my <school science> subject(s) will help me to get a job.
JOYSCIE	**Enjoyment of science** The index of enjoyment of science (JOYSCIE) was constructed based on a trend question (ST094) from PISA 2006 (ID in 2006: ST16), asking students on a four-point Likert scale with the categories "strongly agree", "agree", "disagree", and "strongly disagree" about their agreement with the following statements: I generally have fun when I am learning <broad science> topics; I like reading about <broad science>; I am happy working on <broad science> topics; I enjoy acquiring new knowledge in <broad science>; and I am interested in learning about <broad science>.

SCIEEFF	**Science self-efficacy** The index of science self-efficacy (SCIEEFF) was constructed based on a trend question (ST129) that was taken from PISA 2006 (ID in 2006: ST17). Students were asked, using a four-point answering scale with the categories: "I could do this easily"; "I could do this with a bit of effort"; "I would struggle to do this on my own"; and "I couldn't do this", to rate how they would perform in the following science tasks of: recognise the science question that underlies a newspaper report on a health issue; explain why earthquakes occur more frequently in some areas than in others; describe the role of antibiotics in the treatment of disease; identify the science question associated with the disposal of garbage; predict how changes to an environment will affect the survival of certain species; interpret the scientific information provided on the labelling of food items; discuss how new evidence can lead you to change your understanding about the possibility of life on Mars; and identify the better of two explanations for the formation of acid rain. Responses were reverse-coded so that higher values of the index correspond to higher levels of science self-efficacy.

Note: The PISA 2015 non-cognitive assessment included enjoyment of co-operation (COOPERATE), valuing co-operation (CPSVALUE), environmental optimism (ENVOPT), and interest in broad science topics (INTBRSCI), but the data on these variables was not available for Indonesia, Thailand, and Viet Nam.
Source: (OECD, 2017[54]), *PISA 2015 Results (Volume III): Students' Well-Being*, http://dx.doi.org/10.1787/9789264273856-en; (OECD, 2017[42]), *PISA 2015 Technical Report*, https://www.oecd.org/pisa/data/2015-technical-report/.

Within-country non-cognitive prevalence patterns: Indonesia, Thailand, and Viet Nam

The index mean scores for the six non-cognitive indices are presented in Table 30. An index score of 0.30 (one-thirds of one unit of standard deviation) is taken as a reasonable cut-off point to conclude "prevalence" of a particular non-cognitive variable given the standardisation with 0 as the mean and 1 as the standard deviation. The variables are presented in descending order of the mean values within country. The indices with mean scores greater than 0.30 are marked in bold. Among them, those that are common in all three countries are shaded in grey.

- The non-cognitive variables emerged as the most prevalent in the three Southeast Asian countries turned out to be the same one: instrumental motivation (INSTSCIE) and enjoyment of science (JOYSCIE).
- The least prevalent indices, however, differed between the three countries: awareness of environmental matters (ENVAWARE) in Indonesia; sense of belonging (BELONG) in Thailand; and science self-efficacy (SCIEEFF) in Viet Nam.

Table 30. Mean index scores of six non-cognitive variables

Indonesia			Thailand			Viet Nam		
	Mean index	S.E.		Mean index	S.E.		Mean index	S.E.
INSTSCIE	0.81	0.02	**INSTSCIE**	0.48	0.01	**JOYSCIE**	0.65	0.02
JOYSCIE	0.65	0.01	**JOYSCIE**	0.42	0.01	**INSTSCIE**	0.48	0.01
BELONG	0.10	0.01	SCIEEFF	0.17	0.02	ENVAWARE	0.05	0.02
EPIST	-0.30	0.01	EPIST	-0.07	0.02	BELONG	-0.06	0.01
SCIEEFF	-0.51	0.02	ENVAWARE	-0.08	0.02	EPIST	-0.15	0.02
ENVAWARE	-0.54	0.02	BELONG	-0.35	0.01	SCIEEFF	-0.28	0.03

Note: N = 6 513 in Indonesia; N = 8 249 in Thailand; N = 5 826 in Viet Nam. The mean scores greater than 0.30 are in bold. Among them, variables that were common in all three countries are shaded in grey.
Source: Adapted from OECD, PISA 2015 Database (OECD, 2016[46]).

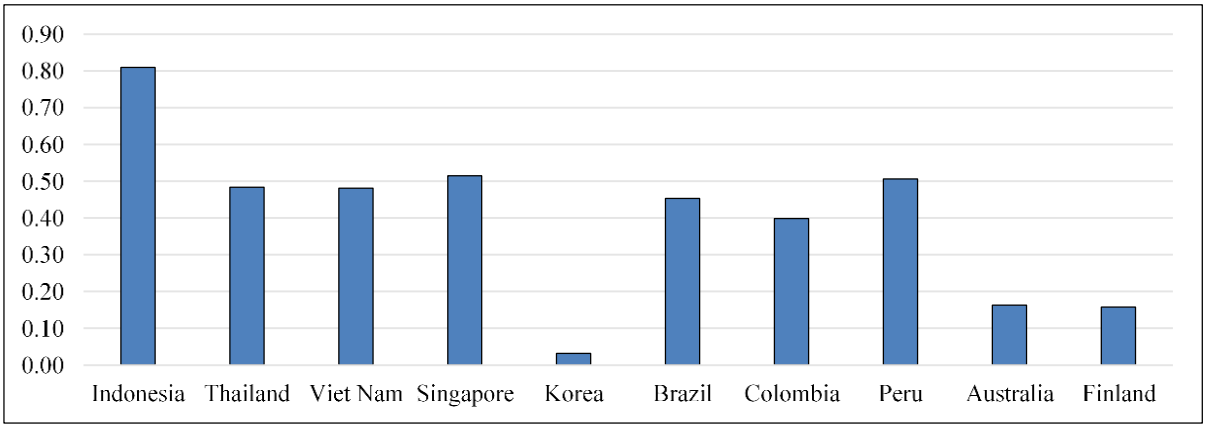
Two most prevalent non-cognitive characteristics: Instrumental motivation in science and enjoyment of science in Indonesia, Thailand, and Viet Nam

The two most prevalent non-cognitive characteristics – instrumental motivation in science (INSTSCIE) and enjoyment of science (JOYSCIE) – were further examined for comparison to the comparison countries of other regions and to discern if there was any pattern of unusual item responses behind their high mean scores.

Instrumental motivation in science (INSTSCIE)

The high mean index scores on INSTSCIE in Indonesia, Thailand, and Viet Nam were even more pronounced when they were juxtaposed against the comparison countries (Figure 17). Indonesia (with a mean score of 0.81) was in sharp contrast to Korea (0.03), while Singapore and three South American countries of Brazil, Columbia, and Peru showed a similar, positive disposition on INSTSCIE (Figure 17).

Figure 17. Mean scores on the index of instrumental motivation in science (INSTSCIE) in ten countries

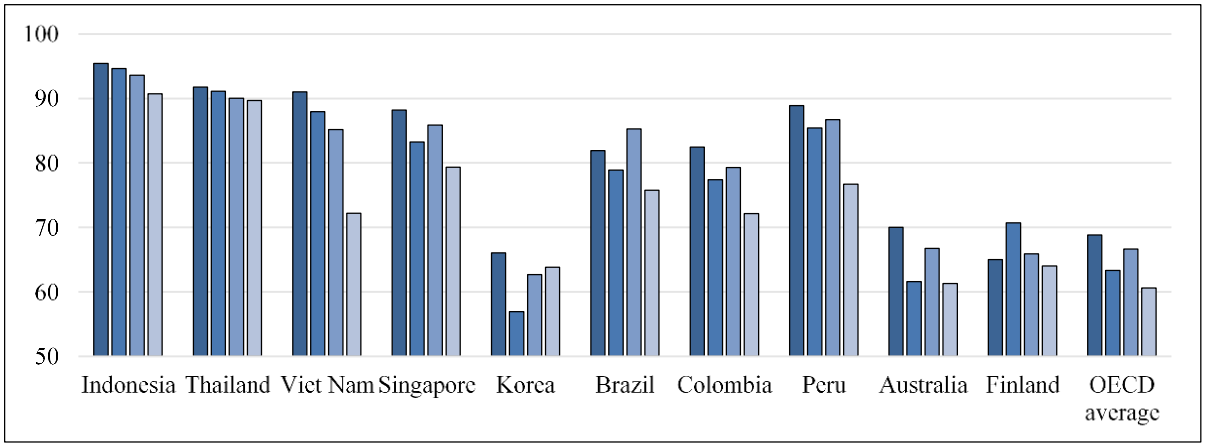


Source: Table I.3.3a, (OECD, 2016[40]), *PISA 2015 Results (Volume I): Excellence and Equity in* Education, http://dx.doi.org/10.1787/9789264266490-en.

The item-level analysis on the INSTSCIE index revealed that more than 90% of Indonesian students and more than or nearly 90% of Thai students strongly agreed or agreed to all four items of this index.

Overall, Indonesia, Thailand, and Viet Nam, along with Singapore, Brazil, Columbia, and Peru, were contrasted to Korea, Australia, Finland, and the OECE average (Figure 18).

Figure 18. Percentages of students who reported "strongly agreed" or "agreed" to four items used in the index of instrumental motivation in science (INSTSCIE)



Note: The percentages are shown from left to right for the following items: (a) Making an effort in my <school science> subject(s) is worth it because this will help me in the work I want to do later on; (b) What I learn in my <school science> subject(s) is important for me because I need this for what I want to do later on; (c) Studying my <school science> subject(s) is worthwhile for me because what I learn will improve my career prospects; and (d) Many things I learn in my <school science> subject(s) will help me to get a job.
Source: Table I.3.3a, (OECD, 2016[40]), *PISA 2015 Results (Volume I): Excellence and Equity in* Education, http://dx.doi.org/10.1787/9789264266490-en.

Gender differences in instrumental motivation in science (INSTSCIE) were rather minor in Southeast Asian countries although the small differences turned out to be statistically significant (Table 31). Among the comparison group the gender difference in INSTSCIE was the largest in Korea, showing boys having higher INSTSCIE than girls with the index difference score of greater than 0.20.

Table 31. Gender difference in the mean scores on the index of *instrumental motivation in science* (INSTSCIE)

Countries	Boys		Girls		Gender differences (boys - girls)	
	Mean index	S.E.	Mean index	S.E.	Diff.	S.E.
Indonesia	0.78	(0.02)	0.84	(0.02)	**-0.06**	(0.02)
Thailand	0.43	(0.01)	0.52	(0.01)	**-0.09**	(0.02)
Viet Nam	0.49	(0.02)	0.47	(0.02)	0.02	(0.03)
Singapore	0.53	(0.02)	0.50	(0.02)	0.03	(0.02)
Korea	0.14	(0.02)	-0.08	(0.03)	**0.22**	(0.03)
Brazil	0.41	(0.01)	0.49	(0.01)	**-0.08**	(0.02)
Colombia	0.36	(0.02)	0.43	(0.02)	**-0.07**	(0.02)
Peru	0.47	(0.02)	0.55	(0.02)	**-0.08**	(0.02)
Australia	0.19	(0.02)	0.14	(0.02)	**0.05**	(0.02)
Finland	0.14	(0.02)	0.18	(0.02)	-0.04	(0.03)
OECD average	0.16	(0.00)	0.12	(0.00)	**0.04**	(0.01)

Note: Statistically significant differences by gender are in bold.
Source: Table I.3.3c, (OECD, 2016[40]), *PISA 2015 Results (Volume I): Excellence and Equity in* Education, http://dx.doi.org/10.1787/9789264266490-en.

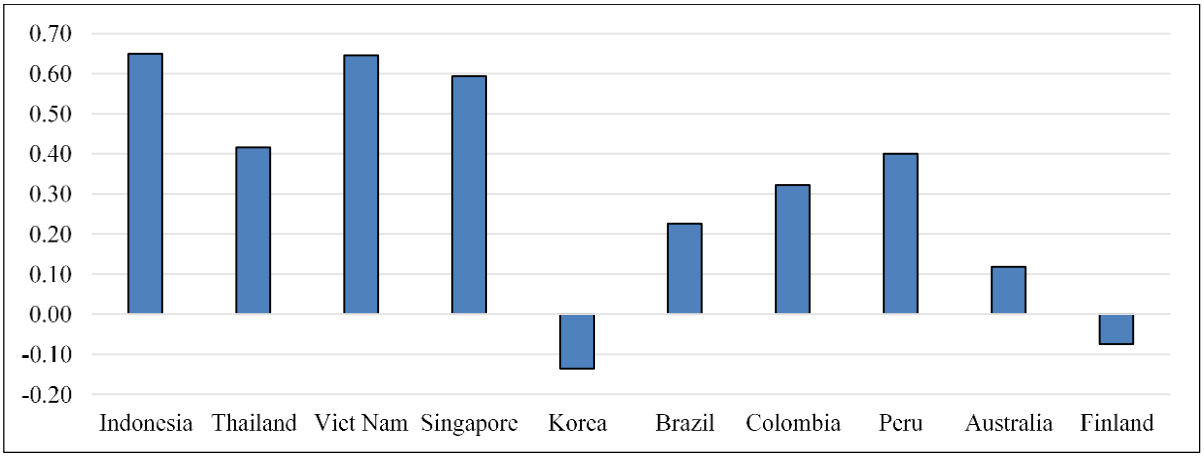
It would be reasonable to expect a positive association between INSTSCIE and science achievement scores, but this relationship did not hold. Indonesia (r = .05) and in Viet Nam (r = .01) showed the correlations nearly zero. Thailand had a statistically significant, positive correlation but rather weak, r = .17. Across all PISA participant countries and economies, on average, the correlation was r = .07.

Enjoyment of science (JOYSCIE)

Enjoyment of science (JOYSCIE) was also prevalent in Southeast Asia. It was the most prevalent characteristic for Viet Nam, compared to the other non-cognitive variables.

Compared to the comparison countries from other regions, a neighbouring country of Singapore, and Peru to some extent, shared this positive attitude toward science (Figure 19).

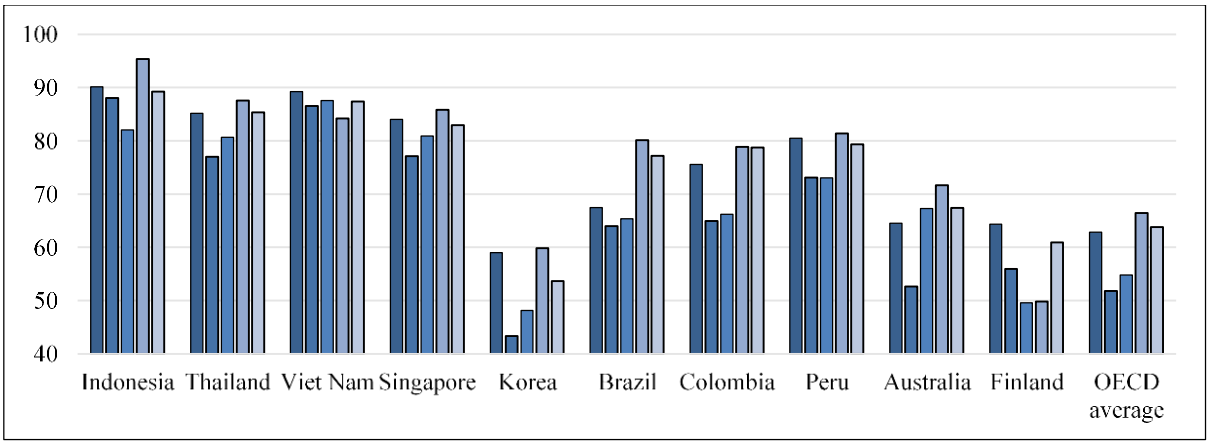
Figure 19. Mean scores on the index of enjoyment of science (JOYSCIE)



Source: Table I.3.1a, (OECD, 2016[40]), *PISA 2015 Results (Volume I): Excellence and Equity in* Education, http://dx.doi.org/10.1787/9789264266490-en.

The item responses showed that as many as 95% of Indonesian students, 88% of Thai students, and 84% of Vietnamese students either strongly agreed or agreed that they "enjoy acquiring new knowledge in science". Overall, the Southeast Asian students showed high endorsement in all five items (Figure 20).

Figure 20. Percentages of students who reported "strongly agreed" or "agreed" to five items used in the index of enjoyment of science (JOYSCIE)



Note: The percentages are shown from left to right for the following items: (a) I generally have fun when I am learning <broad science> topics; (b) I like reading about <broad science>; (c) I am happy working on <broad science> topics; (d) I enjoy acquiring new knowledge in <broad science>; and (e) I am interested in learning about <broad science>
Source: Table I.3.1a, (OECD, 2016[40]), *PISA 2015 Results (Volume I): Excellence and Equity in* Education, http://dx.doi.org/10.1787/9789264266490-en.

As was the case with instrumental motivation to learn science (INSTSCIE), gender difference in enjoyment of science (JOYSCIE) does not appear to be of particularly great concern for all three of Southeast Asian countries (Table 32).

Table 32. Gender difference in the mean scores on the index of enjoyment of science (JOYSCIE)

Countries	Boys		Girls		Gender differences (boys - girls)	
	Mean index	S.E.	Mean index	S.E.	Diff.	S.E.
Indonesia	0.62	(0.02)	0.68	(0.02)	**-0.06**	(0.02)
Thailand	0.39	(0.02)	0.44	(0.01)	-0.05	(0.02)
Viet Nam	0.67	(0.02)	0.62	(0.02)	**0.06**	(0.02)
Singapore	0.67	(0.02)	0.51	(0.02)	**0.17**	(0.03)
Korea	0.02	(0.03)	-0.30	(0.03)	**0.32**	(0.04)
Brazil	0.21	(0.02)	0.24	(0.01)	**-0.04**	(0.02)
Colombia	0.31	(0.02)	0.33	(0.02)	-0.02	(0.03)
Peru	0.41	(0.02)	0.39	(0.02)	0.01	(0.02)
Australia	0.20	(0.02)	0.04	(0.02)	**0.16**	(0.03)
Finland	-0.05	(0.02)	-0.10	(0.03)	0.04	(0.03)
OECD average	0.08	(0.00)	-0.05	(0.00)	**0.13**	(0.01)

Note: Statistically significant differences by gender are in bold.
Source: Table I.3.1c, (OECD, 2016[40]), *PISA 2015 Results (Volume I): Excellence and Equity in* Education, http://dx.doi.org/10.1787/9789264266490-en.

Unlike instrumental motivation to learn science (INSTSCIE), enjoyment of science (JOYSCIE) did moderately correlate with science assessment (r = .26), on average, across

all participant countries and economies. However, the associations were weaker in Southeast Asia: r = .17 in Thailand and r = .15 in Viet Nam.

Ironically, Indonesia had the highest score on enjoyment of science (JOYSCIE) among the ten countries, where there was virtually zero correlation (r = .06) with science achievement.

Non-cognitive predictors of science achievement: Indonesia, Thailand, and Viet Nam

The relevance of the six non-cognitive variables assessed in PISA 2015, as predictors of science achievement in Southeast Asian countries, was explored. Correlations greater than .20 are indicated in bold (Table 33). Correlations that are found to be greater than .20 in Southeast Asian countries as well as in the averages of all participant countries and economies are shaded in grey.

Table 33. Correlations between six non-cognitive variables and science achievement

Indonesia		Thailand		Viet Nam		All PISA 2015 Participant Countries and Economies	
ENVAWARE	**0.36**	**EPIST**	**0.34**	**EPIST**	**0.29**	**EPIST**	**0.33**
EPIST	0.16	**ENVAWARE**	**0.21**	**ENVAWARE**	**0.25**	**ENVAWARE**	**0.33**
JOYSCIE	0.06	BELONG	0.18	**SCIEEFF**	**0.25**	**JOYSCIE**	**0.26**
INSTSCIE	0.05	JOYSCIE	0.17	JOYSCIE	0.15	SCIEEFF	0.19
SCIEEFF	0.05	INSTSCIE	0.17	BELONG	0.02	BELONG	0.10
BELONG	0.04	SCIEEFF	0.01	INSTSCIE	0.01	INSTSCIE	0.07

Note: N = 6 513 in Indonesia; N = 8 249 in Thailand; N = 5 826 in Viet Nam. Correlations greater than .20 are in bold. Correlations that were found to be greater than .20 in Southeast Asian countries, as well as in the averages of all participant countries and economies, are shaded in grey.
Source: Adapted from OECD, PISA 2015 Database (OECD, 2016[46]).

Three non-cognitive indices showed moderately strong associations (greater than *r* = .20) with science achievement, on average, across all participant countries and economies (Table 33): *awareness of environmental matters* (ENVAWARE), *epistemological beliefs about science* (EPIST), and *enjoyment of science* (JOYSCIE).

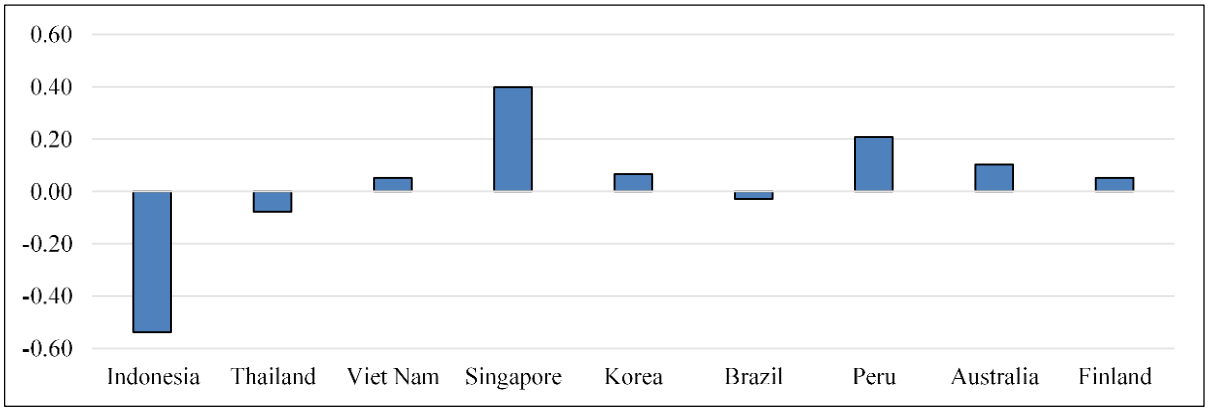
- Overall, the best predictors of science achievement among Southeast Asian students did not differ much from those that were identified on average across all PISA participant countries and economies. Indonesia had ENVAWARE, Thailand had EPIST and ENVAWARE, and Viet Nam had EPIST, ENVAWARE, and SCIEEFF with moderately strong associations with science achievement.
- *Enjoyment of science* (JOYSCIE) was not associated with science achievement scores in Southeast Asian countries as strongly as it was in all participant countries and economies on average. In particular, the association was virtually non-existent in Indonesia (*r* = .06).
- *Science self-efficacy* (SCIEEFF) had almost zero correlations with science achievement in Indonesia (*r* = .05) and Thailand (*r* = .01), which can be contrasted to Viet Nam (*r* = .25) and the average of all countries and economies (*r* = .19).

In the following sections, EPIST and ENVAWARE were further examined, as they turned out to be the best predictors of science achievement in Southeast Asian countries.

Environmental awareness (ENVAWARE) and Science achievement in Indonesia, Thailand, and Viet Nam

In spite of ENVAWARE being one of the better predictors of science achievement in Indonesia, Thailand, and Viet Nam, ENVAWARE was not a prevalent non-cognitive disposition. Indonesia had the lowest score on ENVAWARE among the three Southeast Asian countries (Figure 21).

Figure 21. Mean scores on the index of awareness of environmental matters (ENVAWARE)

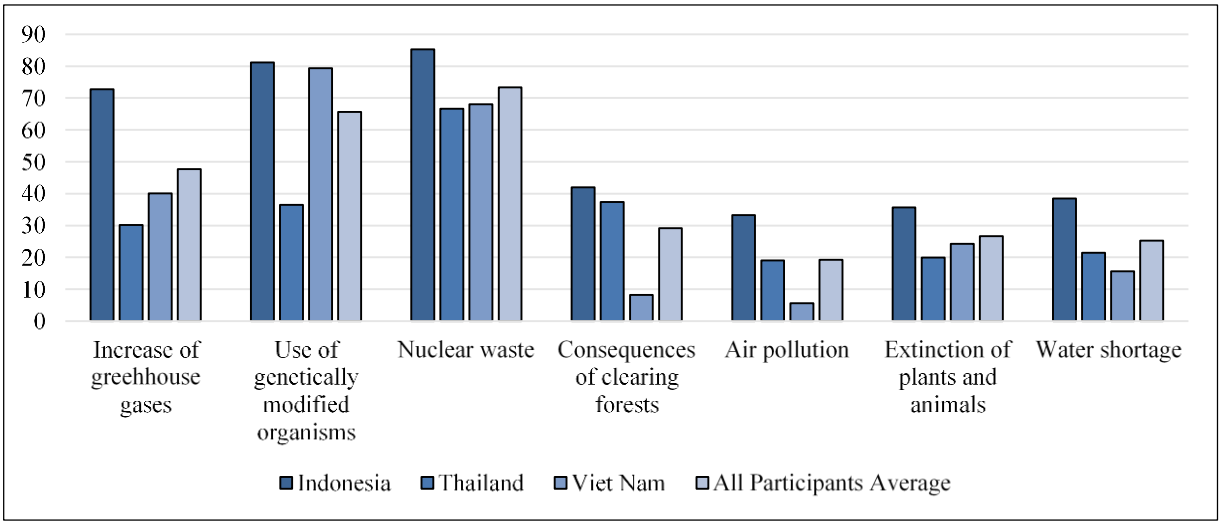


Note. The index score of Colombia is not available due to its response missing on one item (ST092Q06: How informed are you about this environmental issue? Air pollution).
Source: Adapted from OECD, PISA 2015 Database (OECD, 2016[46]).

Figure 22 presents student responses to each of the four items of the index of awareness of environmental matters (ENVAWARE) in Indonesia, Viet Nam, Thailand, and the average of all PISA 2015 participant countries and economies.

- As many as 85% of Indonesian students "never hear of" or "heard about it but would not be able to explain" nuclear waste and as many as 81% of them responded in the same way about the "use of genetically modified organisms".
- As many as 33% and 36% of Indonesian students "never hear of" or "heard about it but would not be able to explain" air pollution and extinction of plants and animals, respectively. This is in contrast to 6% and 24% of Vietnamese students on these two items.

Figure 22. Percentages "never heard of this" or "heard about this but I would not be able to explain" to seven items used in the index of awareness of environmental matters (ENVAWARE)



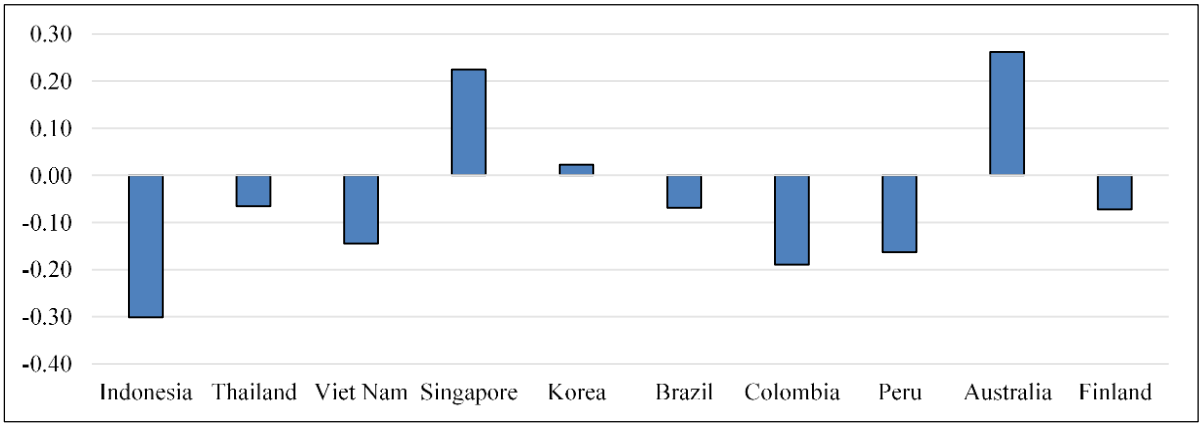
Source: Adapted from OECD, PISA 2015 Database (OECD, 2016[46]).

Epistemological beliefs about science (EPIST) and Science achievement in Indonesia, Thailand and Viet Nam

The index of epistemological beliefs about science (EPIST) showed the strongest associations with science achievement in Thailand (r = .34) and Viet Nam (r = .29), among the non-cognitive variables from the PISA 2015 data. EPIST showed the strongest association, on average, across all participant countries and economies (r = .33) as well. On the other hand, the correlation (r = .16) was much smaller in Indonesia.

However, EPIST was not a prevalent characteristic of Southeast Asian countries (see Figure 23). Their index mean values were lower than the OECD average, in Indonesia (-.30), Viet Nam (-0.15), and Thailand (-0.07).

Figure 23. Mean scores on the index of epistemological beliefs about science (EPIST)



Source: Adapted from OECD, PISA 2015 Database (OECD, 2016[46]).

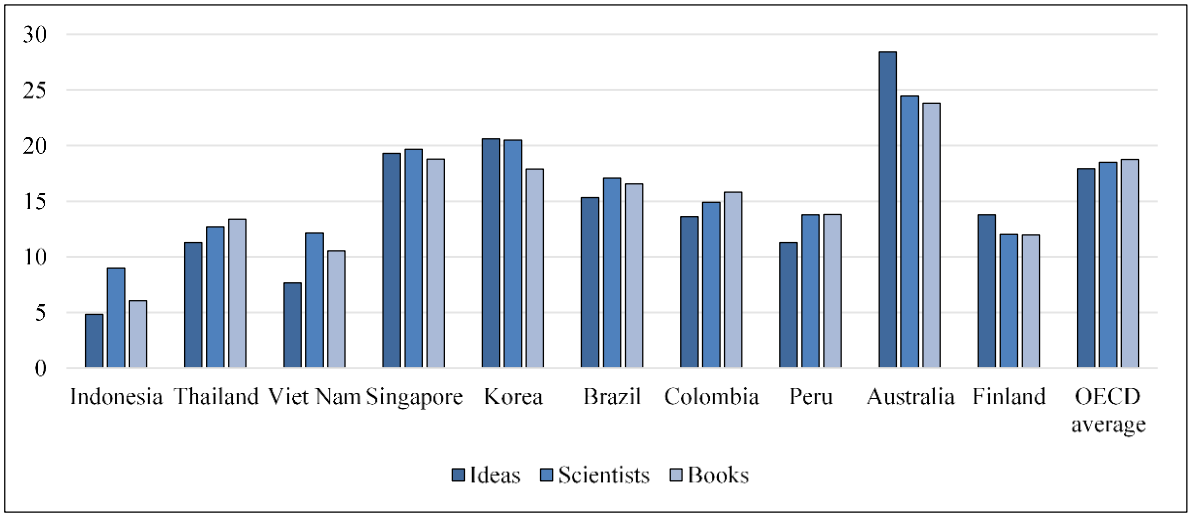
The index of epistemological beliefs about science (EPIST) consisted of six items, asking about whether doing an experiment, evidence-based inquiry, and multiple trials of experiments is a good way to know if something is true. It also asked about changes, i.e. whether ideas, scientists, and even the ideas in science books sometimes change.

Figure 24 presents the percentage of students who answered in the top category ("strongly agree") to: (a) Ideas in <broad science> sometimes change; (b) Sometimes <broad science> scientists change their minds about what is true in science; (c) The ideas in <broad science> science books sometimes change.

Southeast Asian students, in general, did not believe that such changes often occur. For instance, only about 5% of Indonesian students, 11% of Thai students, and 8% of Vietnamese students strongly believed that ideas in science books sometimes could change, which was contrasted to as many as 28% of Australian students and 21% of Korean students.

Although there was a smaller number of students who held strong views on epistemological beliefs about science (EPIST) in Southeast Asian countries, those who believed so had higher science assessment scores within the country.

Figure 24. Percentages of students who reported "strongly agree" to the three items used in the index *of epistemological beliefs about science* (EPIST)



Note: The percentages were presented from the order of: (a) Ideas in <broad science> sometimes change; (b) Sometimes <broad science> scientists change their minds about what is true in science; (c) The ideas in <broad science> science books sometimes change.
Source: Adapted from OECD, PISA 2015 Database (OECD, 2016[46]).

Relationships among non-cognitive attributes: Indonesia, Thailand, and Viet Nam

Four non-cognitive student characteristics, ENVAWARE, EPIST, JOYSCIE, and INSTSCIE, were highlighted in this section, as either showing prevalence or having relevance as predictors of students' science achievement scores. Patterns of associations about them were explored (Table 34).

Table 34. Correlations among ENVAWARE, EPIST, JOYSCIE, and INSTSCIE

	Indonesia				Thailand				Viet Nam			
	1.	2.	3.	4.	1.	2.	3.	4.	1.	2.	3.	4.
1. ENVAWARE	1				1				1			
2. EPIST	.17	1			.27	1			.23	1		
3. JOYSCIE	.20	.21	1		.33	.39	1		.28	.27	1	
4. INSTSCIE	.09	.14	.30	1	.18	.30	.34	1	.11	.07	.11	1

Note: N = 6 513 in Indonesia; N = 8 249 in Thailand; N = 5 826 in Viet Nam.
Source: Adapted from OECD, PISA 2015 Database (OECD, 2016[46]).

Enjoyment of science (JOYSCIE) appeared to be related to the other variables more strongly than the other variables did, suggesting that enjoyment may be a foundation of non-cognitive characteristic of students in this region.

The correlations between JOYSCIE and ENVAWARE; between JOYSCIE and EPIST; and between JOYSCIE and INSTSCIE were moderately strong in Indonesia and Thailand.

The correlations greater than .20 were found between JOYSCIE and ENVAWARE; between JOYSCIE and EPIST; and between ENVAWARE and EPIST, in Viet Nam.

Prediction of science achievement from non-cognitive variables: Indonesia, Thailand, and Viet Nam

Non-cognitive models predicting students' science achievement were explored for the three countries of Southeast Asian countries. The models were created based on simultaneous multiple regression analyses, controlling for a set of students' demographic background information including grade-level, gender, whether their home language was the same as the PISA test language, and whether they attended a general or vocational school. For simplicity, each categorical variable was dichotomously recoded (see the Table 35 below for the items that were used and recoded for the analysis).

Table 35. PISA 2015 variables to explain science achievement

Construct	Variable Name	Variable Label	Data Re-coded for the Analysis
Grade	ST001D01T	Raw international student grade (ranging from 7 to 12)	(7, 8, 9 = 0; 10, 11, 12 = 1)
Gender	ST004D01T	Sex (Female [1]; Male: [2])	(Male = 0; Female = 1)
Language	ST022Q01TA	Language of test used at home (Language of test [1]; Another language [2])	(Another language = 0; Language of test at home = 1)
Programme type	ISCEDO	ISCED orientation (General school [1]; Vocational school [3])	(Vocational = 0; General = 1)
Family SES	ESCS	Index-level, continuous variable	No re-coding

Note: Pre-school attendance was not included in the analysis because Thailand has no data on this variable. Students' immigration status was also considered but almost all students (97%) were native in the PISA 2015 and thus this variable was excluded. The ISCED orientation category options were General [1]; Pre-Vocational [2]; Vocational [3]; and Modular [4]. However, all sampled students in Indonesia and Thailand reported attending either Vocational or General schools. There were fewer than 5% indicating "Modular" and the rest indicating "General" in Viet Nam.
Source: OECD, PISA 2015 Database (OECD, 2016[46]).

Model 1 had four variables of students' demographic background. Model 2 added the PISA index of economic, social and cultural status (ESCS) as a proxy for family SES. Model 3 added two non-cognitive variables that were found to be prevalent among the Southeast Asians. Finally, Model 4 included three additional, non-cognitive variables that were found to have moderately strong correlations with science achievement of students in Southeast Asian.

	Predictor variables in the model
Model 1	Grade level, Gender, Language, Programme type
Model 2	Model 1 + Family SES (ESCS)
Model 3	Model 2 + INSTSCIE, JOYSCIE (prevalent non-cognitive variables)
Model 4	Model 3 + ENVAWARE, EPIST, SCIEFF (predictive non-cognitive variables)

The overall predictabilities of the models, as calculated as R-squared values, can be compared (Table 36).

- Model 1 showing 8%, 11%, and 10% of the variances in the science achievement in Indonesia, Thailand, and Viet Nam, respectively indicated that the demographic background variables explained only about 10% of science assessment.
- In Model 2, there were 10% incremental predictability in Indonesia, 5% in Thailand, and 7% in Viet Nam. Thus, family SES did not improve the model predictability much.
- In Model 3, when INSTSCIE and JOYSCIE were added, the model's predictability hardly improved, which was expected because they were included due to their prevalence not due to their relevance as predictors.
- Model 4, when ENVAWARE, EPIST, and SCIEFF were included in the model, the predictability was improved by 6% or 7%. The overall percentage of science achievement scores explained by Model 4 was the same, 25% in all three Southeast Asian countries.

Table 36. R-squared values of the regression models for science achievement

	Model 1	Model 2	Model 3	Model 4
Indonesia	0.08	0.18	0.18	0.25
Thailand	0.11	0.16	0.19	0.25
Viet Nam	0.10	0.17	0.18	0.25

Note: N = 6 513 in Indonesia; N = 8 249 in Thailand; N = 5 826 in Viet Nam.
Source: Adapted from OECD, PISA 2015 Database (OECD, 2016[46]).

Table 37 presents the coefficients of the regression models. The standardised regression coefficients that were statistically significant at least at the .05 level are indicated in bold, for emphasis.

- Model 1 indicates both similarities and differences of the effects of student demographic variables on science achievement across the three countries.
  - The effect of being in the upper grades (Grade 10, 11, or 12) as opposed to the lower grades (Grade 7, 8, or 9) was strong in all three countries and in Viet Nam in particular.
  - The effect of gender (in the standardised coefficients) was almost zero in Indonesia, Thailand, and Viet Nam.
  - Students who spoke the same language scored 36.83 points higher in Thailand and 33.89 points higher in Viet Nam, compared to those within the respective country who spoke different languages at home and in school.
  - The effect of programme type (whether students were attending a general or vocational school) was somewhat strong in Thailand (an associated score difference of 62.64), while its effect was smaller in Indonesia (21.15).
- The final model (Model 4) relative effects of demographic background, family SES, and non-cognitive variables as predictors of science achievement.
  - The regression analysis findings did not differ from the findings from the bivariate correlational analysis. ENVAWARE was a good predictor in Indonesia while EPIST was for Thailand and Viet Nam.
- These non-cognitive predictors had similar effect sizes to those of ESCS in all three Southeast Asian countries. The standardised beta regression coefficients were:
  - Indonesia: $\beta = .28$ for ESCS versus $\beta = .26$ for ENVAWARE
  - Thailand: $\beta = .20$ for ESCS versus $\beta = .24$ for EPIST
  - Viet Nam: $\beta = .21$ for ESCS versus $\beta = .19$ for EPIST
- Overall, non-cognitive variables of ENVAWARE and EPIST, along with the effects of family socioeconomic status (ESCS), were found to be the best predictors of science achievement in Southeast Asian students.

Table 37. Regression coefficients of Models 1 and 4 predicting science achievement

Country	Indonesia				Thailand				Viet Nam			
Model 1	b	b.se	beta	beta.se	b	b.se	beta	beta.se	b	b.se	beta	beta.se
(CONSTANT)	367.13	(8.93)			304.27	(13.22)			429.10	(9.78)		
Grade: Upper secondary school	43.99	(6.64)	**0.32**	(0.04)	38.00	(4.26)	**0.21**	(0.02)	76.51	(7.24)	**0.30**	(0.04)
Female	0.22	(2.95)	0.00	(0.02)	2.49	(2.79)	0.02	(0.02)	-4.92	(2.45)	-0.03	(0.02)
Language of test used at home	-6.07	(4.37)	-0.04	(0.03)	36.83	(12.19)	**0.07**	(0.03)	33.89	(8.38)	**0.10**	(0.02)
Programme type: General school	21.15	(7.89)	**0.11**	(0.04)	62.64	(4.75)	**0.30**	(0.02)	N/A	N/A	N/A	N/A
Model 4												
(CONSTANT)	430.55	(8.68)			359.68	(13.85)			493.12	(10.15)		
Grade: Upper secondary school	25.35	(5.31)	**0.18**	(0.04)	26.51	(3.45)	**0.15**	(0.02)	58.19	(6.23)	**0.22**	(0.03)
Female	1.11	(2.51)	0.01	(0.02)	1.38	(2.33)	0.01	(0.01)	-4.93	(2.36)	**-0.03**	(0.02)
Language of test used at home	-17.24	(3.38)	**-0.12**	(0.02)	19.79	(12.11)	0.04	(0.02)	15.29	(6.60)	**0.05**	(0.02)
Programme type: General school	10.93	(5.87)	0.06	(0.03)	46.30	(3.94)	**0.22**	(0.02)	N/A	N/A	N/A	N/A
ESCS	16.92	(1.70)	**0.28**	(0.03)	14.47	(1.91)	**0.20**	(0.03)	14.44	(2.42)	**0.21**	(0.03)
ENVAWARE	19.67	(1.53)	**0.26**	(0.02)	5.85	(0.99)	**0.08**	(0.01)	9.43	(2.31)	**0.09**	(0.02)
EPIST	7.80	(1.77)	**0.08**	(0.02)	24.81	(1.86)	**0.24**	(0.02)	20.23	(2.12)	**0.19**	(0.02)
INSTSCIE	0.58	(1.77)	0.01	(0.02)	7.98	(1.92)	**0.06**	(0.01)	-2.26	(1.91)	-0.02	(0.02)
JOYSCIE	0.26	(1.39)	0.00	(0.01)	1.95	(1.75)	0.02	(0.02)	3.47	(1.62)	**0.04**	(0.02)
SCIEEFF	-3.14	(1.20)	**-0.05**	(0.02)	-4.69	(1.16)	**-0.06**	(0.02)	9.21	(1.91)	**0.11**	(0.02)

Note: Coefficients statistically significant at least at the .05 level are presented in bold. All coefficients in Model 1 were statistically significant at the .05 significance level, except for gender and language in Indonesia; and gender in Thailand and Viet Nam. All coefficients in Model 4 were statistically significant at the .05 significance level, except for gender, programme type, INSTSCIE, and JOYSCIE in Indonesia; gender, language, and JOYSCIE in Thailand; and INSTSCIE in Viet Nam; There was less than 5% of students attending a non-general programme type in Viet Nam and thus the variables, "programme type", was excluded in the analysis of Viet Nam. N = 6 513 in Indonesia; N = 8 249 in Thailand; N = 5 826 in Viet Nam.
Source: Adapted from OECD, PISA 2015 Database (OECD, 2016[46]).

Concluding remarks

Although the focus of this review was on non-cognitive characteristics, student demographic background and family SES were also critical in the explanation of science achievement. The regression model appeared to have worked in Indonesia, Thailand, and Viet Nam, in the sense that the same percentage of science achievement scores (25%) were explained in all three countries, but there remains room for improvement in the prediction.

Awareness of scientific/environmental matters was the best non-cognitive predictor of science achievement in Indonesia while it had little meaning as a predictor in Thailand and Viet Nam. On the other hand, epistemological beliefs about science (whether things and science can change) was the best predictor in Thailand and Viet Nam, but it had little role as a predictor in Indonesia.

The PISA 2015 data also demonstrated the comparable effect sizes for science achievement obtained by family SES and the best non-cognitive variables. Given that non-cognitive

interventions (as opposed to family SES) may be feasible and malleable to change, the findings of this section may be useful in considering the intervention strategies and approaches targeted for student development in academic and non-cognitive areas.

5. Summary and policy implications

While OECD has shown its commitment to engage low- and middle-income countries in PISA surveys in recent years, the understanding of culturally relevant factors of student learning in these countries remains to be a challenge (Bloem, 2013[8]; Lockheed, Prokic-Bruer and Shadrova, 2015[55]). Demographic characteristics tend to be fixed and difficult to change. Raising socio-economic status of targeted families, although not impossible, would be hard to implement in a school-based intervention programme. System-level information itself (such as school type) are not effective in explaining student outcome variations, especially at the lower- or upper-ends of the performance distribution (Lockheed, Prokic-Bruer and Shadrova, 2015[55]). On the other hand, researchers have long argued that intervention programmes targeted at non-cognitive characteristics may hold promise (Duckworth and Yeager, 2015[17]; Lee and Shute, 2010[3]). Some helpful policy measures may be aimed at strengthening self-beliefs in learning, setting reasonable but ambitious goals for educational attainment, and gaining deeper understanding of values of learning. Certainly, recommendations for non-cognitive interventions that may be derived from PISA findings will also need to be appropriate for the specific local contexts.

Key findings and non-cognitive schema

The non-cognitive schema with six domains, introduced in section 1 (Figure 1), may be a useful way to organise and highlight the learner profiles of Southeast Asian students. All the non-cognitive indices reviewed in this report are presented in Table 38, along with the information about their prevalence (i.e. the index mean scores greater than 0.30) and relevance as predictors of academic achievement (i.e. bivariate correlations greater than .20). In the fourth and fifth column of the table, the variables were marked if they were prevalent or relevant in at least three of the Southeast Asian countries.

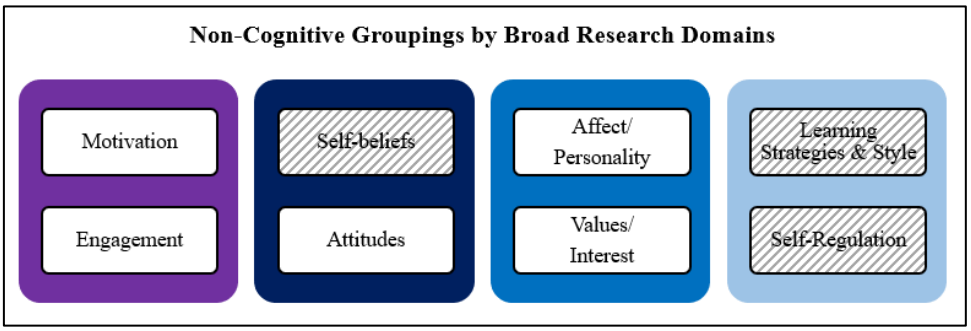
Table 38. Prevalence and relevance of non-cognitive characteristics of Southeast Asian countries

Academic Domain	Index label	Non-Cognitive Domain	Prevalence	Relevance
	ATSCHL	Attitude		
	CSTRAT	Learning Strategy		
	DISCLIMA	Attitude		
	DIVREAD	Engagement	v	
Reading Achievement	ELAB	Learning Strategy		
	JOYREAD	Affect/Personality	v	
	MEMOR	Learning Strategy		
	METASUM	Self-Regulation		v
	UNDREM	Self-Regulation		v
Mathematics Achievement	ANXMAT	Self-Beliefs		v
	ATSCHL	Attitude		
	ATTLNACT	Attitude		
	BELONG	Affect/Personality		
	FAILMAT	Motivation		
	INSTMOT	Motivation	v	
	INTMAT	Values/Interest	v	
	MATBEH	Engagement	v	

	MATHEFF	Self-Beliefs		v
	MATINTFC	Engagement		
	MATWKETH	Engagement		
	OPENPS	Affect/Personality		
	PERSEV	Affect/Personality		
	SCMAT	Self-Beliefs		
	SUBNORM	Attitude	v	
Science Achievement	BELONG	Affect/Personality		
	ENVAWARE	Values/Interest		v
	EPIST	Values/Interest		
	INSTSCIE	Motivation	v	
	JOYSCIE	Affect/Personality	v	
	SCIEEFF	Self-Beliefs		

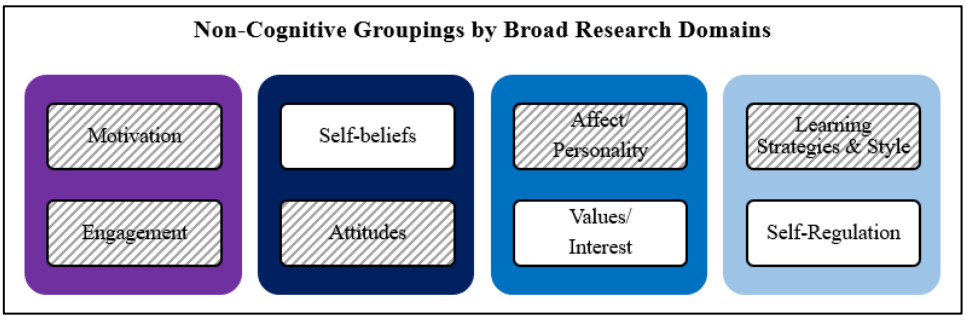
The information in Table 38 above was further summarised in the figures below. The "white" boxes contain the non-cognitive domains that were found to be prevalent (Figure 25) or relevant for student achievement (Figure 26) in at least three Southeast Asian countries. Two noteworthy observations emerged: (a) in spite of high levels on motivation, engagement, attitudes, and affect/personality, they were not good predictors of student achievement. In contrast, (b) self-beliefs and self-regulation were good predictors of student achievement and yet they were not prevalent among Southeast Asian students.

Figure 25. Prevalent non-cognitive characteristics of Southeast Asian countries



Note: The non-cognitive characteristics that are prevalent in at least three Southeast Asian countries are in the white boxes.

Figure 26. Relevance of non-cognitive characteristics as predictors of achievement in Southeast Asian countries



Note: The non-cognitive characteristics that are predictive of student achievement in at least three Southeast Asian countries are in the white boxes.

The key findings of the final regression models are summarised in Table 39; the variables showing a standardised regression coefficient greater than +.20 are presented and non-cognitive variables are shaded in grey for emphasis. MATHEFF was the strongest predictor of mathematics achievement in all countries. Such dominant non-cognitive influence did not appear in relation to reading or science achievement, although METASUM, ENVAWARE, and EPIST were also strong predictors in one of the countries. The role of family SES was important for student achievement as expected. However, it can be noted that the family SES effect sizes were comparable to those obtained by the best non-cognitive measures.

Table 39. Variables with standardised regression coefficients greater than +.20

	Indonesia	Malaysia	Thailand	Viet Nam
PISA 2009 reading assessment	Grade-level	METASUM	Family SES	N/A
	Gender			
PISA 2012 mathematics assessment	Grade-level	Family SES	Programme type	Grade-level
	MATHEFF	MATHEFF	Family SES	MATHEFF
			MATHEFF	
PISA 2015 science assessment	Family SES	N/A	Programme type	Grade-level
	ENVAWARE		Family SES	Family SES
			EPIST	

Note: Metacognitive ability related to summarising (METASUM); Mathematics self-efficacy (MATHEFF); Epistemological beliefs about science (EPIST); Awareness of environmental matters (ENVAWARE).

It is also worthwhile to point out that the prevalent non-cognitive characteristics, enjoyment in learning of science (JOYSCIE) and instrumental motivation in learning science (INSTSCIE), of students in all three Southeast Asian countries, Indonesia, Thailand, and Viet Nam were not even moderately associated with student achievement. Several possible explanations can be conjectured. Students really enjoy learning but are not effective learners (there were low levels of the use of learning strategies in PISA 2009). The results may also be related to social desirability or response bias (e.g. acquiescence) or the content of the PISA items may have been less than optimal to capture the common learning/classroom environments. Alternatively, the results may be related to a relative lack of other more enticing activities for teenagers such as computer games, extra curriculum activities, or social networks. Students could have responded in a way to reflect normative beliefs rather than expressing their own personal views. It is also possible that some unforeseen mistakes could have occurred in translation or adaptation process. In-depth analysis to find the causes of the misalignment between liking/motivation and achievement may be a worthwhile endeavour to understand students' attitudes and behaviours towards learning in this region.

Policy implications

Several challenges were identified for low- or middle-income countries to meaningfully participate in international assessments such as PISA. Lockheed et al. (2015[55]) identified them to be: financial challenges (especially for financing the assessment), technical challenges (delivery of PISA specific tasks, i.e. translation, sampling, survey administration such as data collection and data entry, and coding of constructed-response items), and contextual challenges (political and cultural environments related to the assessment implementation). It was concluded that "a review of the experience of middle-

and low-income countries participating in PISA 2000 to 2015 shows that the PISA questionnaires do not always capture the most relevant contextual factors for these countries. For example, questions about school infrastructure and teaching and learning materials are related to student performance in high-income countries but are often unrelated to differences in performance in middle-income countries" (p.100), calling for "developing contextual questionnaires and data collection instruments that better capture diverse situations in emerging and developing countries" (Lockheed, Prokic-Bruer and Shadrova, 2015, p. 18[55]).

Presented below are some recommendations for future PISA development as well as some implications for educational policy approaches in the Southeast Asian region.

Collaboration can be strengthened with countries showing similar non-cognitive profiles

Students' non-cognitive characteristics were more similar than dissimilar in the four countries of Southeast Asian region. Thus, similar types of educational initiatives or programmes may be developed collaboratively in the region.

- Singapore, in spite of the obvious differences in economy and population characteristics, shares a lot in common with the Southeast Asian countries in terms of non-cognitive profiles. Coupled with its high performance and geographical proximity, Singapore may be a convenient candidate to build stronger collaboration with other Southeast Asian countries.
- Korea, on the other hand, had very little in common with the Southeast Asian countries. Thus, educational policy learning from Korea may not be useful for Southeast Asian countries.
- South American countries (Brazil, Columbia, and Peru) appeared to share some similarity with Southeast Asian countries. Given similar economic development status, common educational policy measures may be developed in these two world regions.
- As was expected, not much in common was found between the two Western countries of Australia and Finland and the four Southeast Asian countries.

Simultaneous interventions for multiple non-cognitive characteristics may be developed

Non-cognitive characteristics tend to be correlated with one another. This suggests that regional collaboration to design non-cognitive intervention programmes may be pursued over a range of non-cognitive variables collectively. Pairings of non-cognitive characteristics that may prove to be useful for Southeast Asian countries are:

- Enjoyment of reading (JOYREAD), attitude towards school (ATSCHL), and diversity in reading (DIVREAD), for reading achievement;
- Intrinsic motivation in learning mathematics (INTMAT), instrumental motivation in learning mathematics (INSTMOT), mathematics self-concept (SCMAT), mathematics anxiety (ANXMAT), and subjective norms in mathematics (SUBNORM), for mathematics achievement; and

- Enjoyment in learning of science (JOYSCIE), instrumental motivation in learning science (INSTSCIE), awareness of environmental matters (ENVAWARE) and epistemological beliefs about science (EPIST), for science achievement.

Information about non-cognitive characteristics may be more effectively disseminated within each country

Information about students' non-cognitive characteristics, which PISA data can reveal, may need to be disseminated more effectively within each country. For instance, students' tendency to read comic books and fiction (novels, narratives, stories) was particularly high in Indonesia, Malaysia, and Thailand. This information can be made use of in designing reading materials and textbooks. Southeast Asian students also showed liking for learning with peers and higher desire to know about peers and teachers. This information may inspire teachers to use more group projects in their classroom activities. In general, PISA impact in forming national policy agendas has not been as visible or strong in low- and middle-income countries as it has been in OECD member countries (Lockheed, Prokic-Bruer and Shadrova, 2015[55]). A more widespread recognition and knowledge about learner characteristics within the country may be a useful direction in assisting students' academic and non-cognitive development.

Equitable improvement starts from the tail

A country may try to increase efforts to improve academic performance of students at the lower end of the proficiency distributions. In most countries, socio-economically vulnerable groups are often found at the tail of the performance distribution (Crouch and Rolleston, 2017[56]). Many of them live in rural, remote, mountainous, severely isolated, or poor areas where basic infrastructure and physical resources are not sufficiently available for student development. Insufficient physical resources combined with less desirable non-cognitive qualities can make a substantial impact on student learning outcomes. Strategies to provide necessary assistance to vulnerable groups may include support for student development of non-cognitive attributes such as resilience, self-beliefs, and enjoyment of learning.

In-depth analysis may be required to evaluate cultural relevance of the PISA questionnaire items for Southeast Asian countries

The existing PISA non-cognitive indices did not work well for Indonesia. Out of hundreds of questionnaire items administered in three cycles of PISA, only three indices (METASU, UNDREM, and ENVAWARE) had sufficiently good predictive validities for student achievement in Indonesia. On a brighter side, the predictability of PISA's non-cognitive indices worked well in Viet Nam. More in-depth analyses exploring system-level educational or cultural factors may be required to understand the observed differences across the Southeast Asian countries.

Development of regional questionnaires may be a useful direction for PISA

There is a remaining question of whether other well-known regional and culture-specific non-cognitive characteristics have been left out in the previous PISA cycles. With the growing number of participants in PISA from middle- and low-income countries, it may be necessary to envision a way to include regional questionnaires in PISA.

Concluding remarks

Wealth of a nation provides the means to establish infrastructure and resources for education of its own citizen. Evidently, wealthier countries perform better in PISA than less wealthy countries. However, a country can perform above the expected level based on national wealth, as shown in the case of Viet Nam. Further, within-country variation in student performance is evident to support the argument that national wealth alone cannot determine student learning outcomes.

While student background questionnaires can be further adjusted and improved for the Southeast Asian countries, the non-cognitive information drawn from the three available sets of PISA 2009, 2012, and 2015 data proved to be useful in predicting student achievement, suggesting some future revision for PISA questionnaires, and drawing some policy implications for the region. For more in-depth understanding, PISA contextual background questionnaire may include regional questionnaires in future. Strong collaboration with local experts and organisations may be necessary to identify culturally relevant non-cognitive characteristics of students in each of the world regions.

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