

## Analysis of the factors that influence mathematics achievement in the ASEAN countries

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### Abstract

Mathematical achievements affect students in determining their future careers and the economy of a country. However, mathematical achievement in Association of Southeast Asian Nations (ASEAN) countries has not reached the target, except in Singapore. However, no systematic studies have examined this problem yet. Thus, this study was conducted to identify the factors that influence mathematical achievement in ASEAN countries. Using the guidance of the Preferred Reporting Items for Systematic Review and Meta-Analyses statement's review methodology, systematic reviews using the Scopus and Web of Science databases identified 40 studies related to mathematics achievement in ASEAN countries. The results show that the factors of students, families, teachers, schools and policymakers influence mathematical achievements in ASEAN countries. Thus, mathematical achievement in ASEAN countries is not influenced by students alone. Suggestions in the future should pay serious attention to all factors in order to improve mathematical achievement in ASEAN countries.

Keywords: Mathematics achievement, factors, ASEAN countries, systematic review;

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## 1. Introduction

Mathematics assumes a part in building up understudies' information and abilities to empower them to take care of day-by-day issues, to seek after advanced education and to fill in as a powerful labour force. Students need good mathematics achievement to further their studies and for their future. For a country, good mathematical achievement is needed to produce a workforce that can contribute to science and technology. However, mathematical achievement at present is less encouraging. This is evidenced through the International Large-Scale Assessment (ILSA) as the Programme for International Student Assessment (PISA) 2018. From the results, only 27 out of 78 countries are significantly above the Organisation for Economic Co-operation and Development (OECD) average, 5 out of 78 countries are not statistically significantly different from the OECD average and 46 out of 78 are significantly below the OECD average. This problem has also been mentioned by Thien (2016), Mundia and Metussin (2018). In addition, the largest gap achievement between the maximum and minimum performing OECD countries was in mathematics. Many studies have been handled to bridge the gap in mathematics achievement (Akiba, Letendre & Scribner, 2007; Al-Agili, Bin, Abdullah & Maad, 2012; Caponera & Losito, 2016; Effandi, Normalizam, Ahmad & Erlina, 2012; Mohammadpour & Compus, 2014).

There are many factors related to student mathematics achievement. For example, Thien (2016) found that gender and financial status were critical elements in Malaysian understudies' exhibition in mathematics proficiency in the PISA. Ayieko, Kanyongo and Nelson, (2018) found that the teacher quality factor was linked to sixth-grade students' mathematics skills all over Kenya and Zimbabwe. Rabab'h and Veloo, (2014) suggested that teachers can improve mathematics achievement by focusing on mathematics attitude, mathematics motivation and math anxiety in classes to improve mathematics achievement. Researchers should identify the factors that influence mathematics achievement to make improvements.

This is especially important for developing countries such as those belonging to the Association of Southeast Asian Nations (ASEAN). Mathematics is truly the core of science, technology and engineering that advances a nation. ASEAN is a coalition of ten countries consisting of Indonesia, Malaysia, the Philippines, Singapore, Thailand, Brunei, Laos, Myanmar, Cambodia and Vietnam. Six ASEAN countries – Singapore, Malaysia, Brunei, Thailand, Indonesia and the Philippines – participated in the OECD's PISA 2018. Table 1 shows the mathematical mean scores of ASEAN countries participating in PISA 2018.

Table 1. Mathematical mean scores of ASEAN countries participating in PISA 2018

Country	Mathematics mean score
Singapore	569
OECD average	489
Malaysia	440
Brunei	430
Thailand	419
Indonesia	379
Philippines	353

Table 1 shows that only Singapore surpassed the OECD average in PISA 2018 while the other ASEAN countries are still trying to exceed it. Therefore, numerous examinations have been directed by researchers to distinguish factors that impact mathematical accomplishment (Mundia & Metussin, 2018; Ng, Lay, Areepattamannil, Treagust & Chandrasegaranet, 2019; Shin, Lee & Kim, 2009). However, many are still unaware of the factors that are causing the problem of underachievement and how these factors can improve math achievement in ASEAN countries. To address this problem, a systematic review was conducted to identify factors influencing mathematical achievement and how

these factors helped improve mathematics achievement in ASEAN countries. This systematic review was conducted to answer the following questions:

1. What are the factors that influence mathematics achievement in ASEAN countries?
2. What representatives of each factor influence mathematics achievement in ASEAN countries?

## 2. Method

This systematic review was handled in conformity with the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) statement. The PRISMA report comprises a 27-item listing and 4-phase stream chart (Moher, Liberati, Tetzlaff & Altman, 2009; Moher et al., 2009). This study began with the process of finding articles related to mathematics achievement in ASEAN countries using the Scopus and Web of Science (WOS) databases. This process went through the identification phase, screening phase, eligibility phase and inclusion phase.

### 2.1. Identification phase

This systematic review study used two major sources: Scopus and WOS. Scopus is Elsevier's hypothetical and reference information base which was dispatched in 2004. Scopus include around 36,377 titles from about 11,678 distributors, of which 34,346 are peer-assessed journals in high rank course fields: life sciences, humanistic systems, actual sciences and prosperity sciences. WOS is a site that gives participation-based admittance to different data sets that offer comprehensive reference data on a wide scope of academic subjects. It was at first made by the Institute for Scientific Information and is at present kept up by Clarivate Analytics. Table 2 shows the keywords used when looking for articles related to the mathematical achievement of ASEAN countries. Additional information such as literature type, language, time line and country/territory were entered according to the researcher's criteria, as shown in Table 3.

Table 2. Keywords used for the process of finding relevant literature

Databases	Keywords used
Scopus	TITLE-ABS-KEY (impact OR effect OR influence) AND ('mathematics achievement' OR 'mathematics performances' OR 'students' achievement' OR 'students' performance') AND (Indonesia OR Malaysia OR Philippines OR Singapore OR Thailand OR Brunei OR Laos OR Myanmar OR Cambodia OR Vietnam)
WOS	TS= (impact OR effect OR influence) AND ('mathematics achievement' OR 'mathematics performances' OR 'students' achievement' OR 'students' performance') AND (Indonesia OR Malaysia OR Philippines OR Singapore OR Thailand OR Brunei OR Laos OR Myanmar OR Cambodia OR Vietnam)

Table 3. The eligibility and exclusion criteria

Criterion	Eligibility	Exclusion
Literature type	Journal (research articles)	Book, book series, chapter in book, systematic review articles, conference proceeding
Language	English	Non-English
Time line	Between 2010 and 2020	<2010
Country/territory	ASEAN countries	Non-ASEAN countries

## 2.2. Screening phase

The researchers carefully identified duplicate articles in Scopus and WOS. The remaining articles were examined in detail to meet the criteria that the researchers set.

## 2.3. Eligibility phase

The articles that were eligible for use in the study had to meet the conditions set by the researchers, such as literature type, language, time line and country. Specifically, research articles were obtained from SCOPUS and WOS indexed journals. The selection of SCOPUS and WOS indexed journals is as described in section 2.1. Next, the study data should be collected from the student respondents of ASEAN countries and the writing should be in English to avoid translation problems. Last qualification, the study should be conducted after 2010 to ensure that the study used is relevant today. These are shown in Table 3.

## 2.4. Exclusion phase

After going through three phases, only the number of articles that really met the requirements was included. They include qualitative research and mixed methods. The important points for exclusion were book, book series, chapter in book, systematic review articles, conference proceeding, non-English articles published before 2010 and science citation indexed expanded from non-ASEAN countries. This was taken into account because there are ASEAN researchers who use data from non-ASEAN countries. All of these things were considered in order to obtain quality data.

Visually, the process carried out is shown as Figure 1.

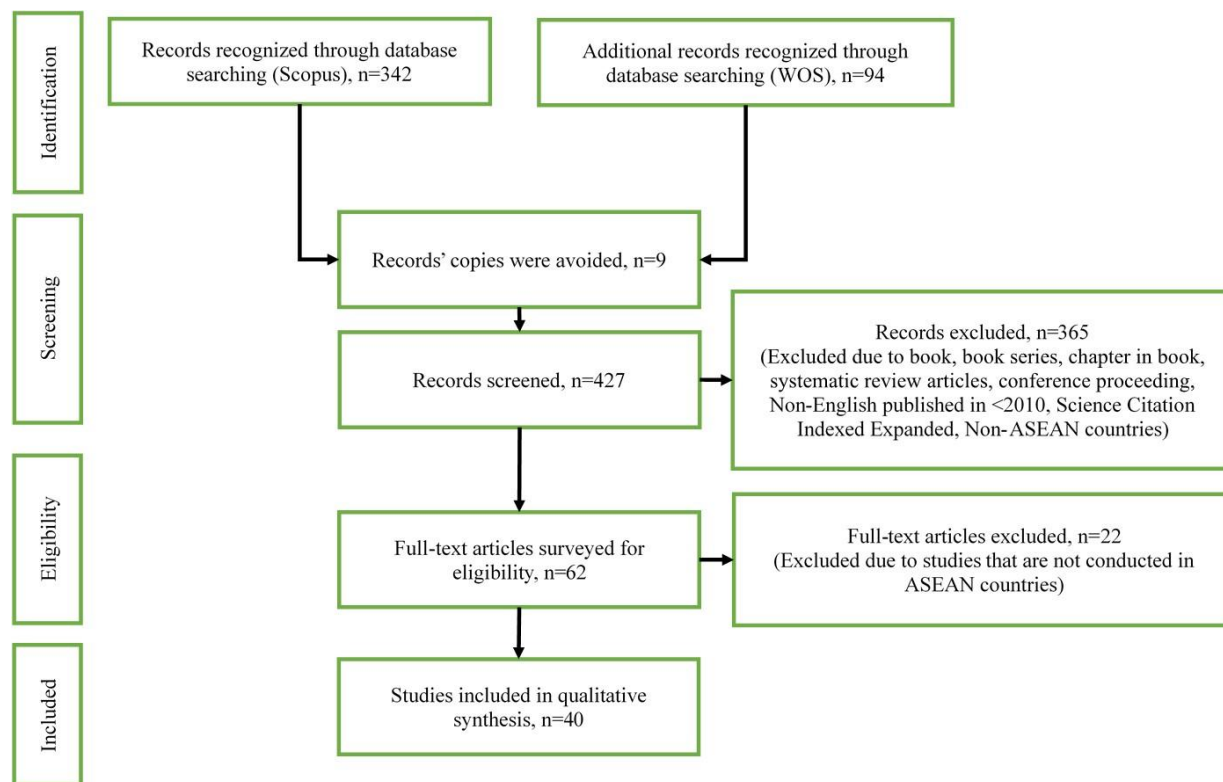


Figure 1. The stream chart of the examination

### 3. Results and discussion

Finally, after going through four phases to determine which articles were eligible for review, there were 40 articles identified with factors impacting mathematics accomplishment in ASEAN nations. The number of studies by country is shown in Figure 2. In light of the writing survey, specialists found that there are five factors that impact math accomplishment in ASEAN nations. These factors are student factors (Abdullah, Abd Rahman & Hamzah, 2017; Awang & Fah, 2013; Bakar, Ayub, Gopal & Salim, 2019; Hassan & Rahman, 2017; Ismail & Awang, 2012; Kelanang & Zakaria, 2012; Kien-Kheng, Azlan, Ahmad, Leong & Mohamed, 2016; La Ndia, Solihatin & Syahril, 2019; Lay, Ng & Chong, 2012; Lounkaew, 2013; Mundia & Metussin, 2018; Mohd & Mahmood, 2011; Mokhtar, Yusof & Misiran, 2012; Ng, Lay, Areepattamannil, Treagust & Chandrasegaran, 2012; Nguyen, 2016; Prafitriyani, Magfirah, Amir, Irmawati & Umanailo, 2019; Sriphai, Damrongpanit & Sakulku, 2011; Tee, Leong & Rahim, 2018; Tee Leong & Rahim, 2019; Thien, Darmawan & Ong, 2015); family factors (Ismail & Awang, 2012; Ng et al., 2012); teacher factors (As'ari et al., 2019; Bringula, Fosgate Jr., Garcia & Josf Yorobe, 2017; Cabrera, 2017; Damrongpanit, 2019; Hogan et al., 2013; Hoon, Chong & Binti Ngah, 2010; Jing, Tarmizi, Bakar & Aralas, 2017; Lim & Chapman, 2015; Mokhtar et al., 2012; Nguyen, 2016; Saligumba & Tan, 2018; Sappaile & Djam'an 2017; Sunardi, Anwar, Andayani & Shaari, 2016; Tan, 2012; Yahya, Wahab, Atan & Ibrahim, 2019; Zulnaidi & Zamri, 2017; Zulnaidi, Oktavika & Hidayat, 2019); peer factors (Mokhtar et al., 2012), school factors (Ismail & Awang, 2012; Muttaqin, Wittek, Heyse & van Duijn 2020; Thien et al., 2015); and policymaker factors (Davrajoo & Letcumanan, 2019; Nguyen 2016). The percentages of factors that influence mathematics achievement in ASEAN countries are shown in Figure 3 which provides a comprehensive analysis of the factors influencing mathematics achievement among ASEAN countries. The findings are shown in Table 4.

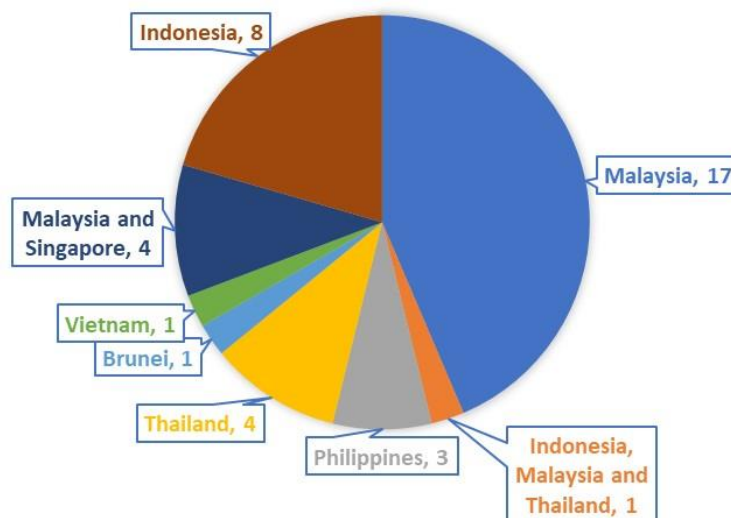


Figure 2. The number of studies by country

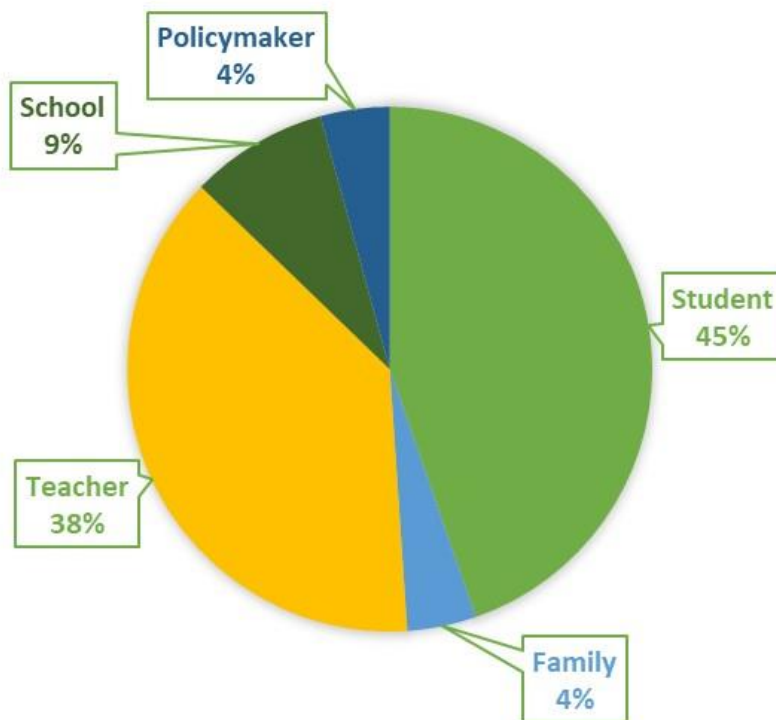


Figure 3. The percentage of factors that influence mathematics achievement in ASEAN countries

Table 4. The findings

No	Authors/Countries	Main study design	Factors				
			Student	Family	Teacher	School	Policymaker
1	Abdullah et al. (2017) – Malaysia	QN	√				
2	As'ari et al. (2019) – Indonesia	QL			√		
3	Awang and Fah (2013) – Malaysia and Singapore	QN	√				
4	Bringula et al. (2017) – Philippines	QN			√		
5	Cabrera (2017) – Philippines	QN			√		
6	Damrongpanit (2019) – Thailand	QN			√		
7	Davrajoo and Letcumanan (2019) – Malaysia	QL					√
8	Yahya et al. (2019) – Malaysia	QN			√		
9	Kien-Kheng et al. (2016) – Malaysia	QN	√				
10	Sunardi et al. (2016) – Indonesia	QN			√		
11	Zulnaidi and Zamri (2017) – Malaysia	QN			√		
12	Zulnaidi et al. (2019) – Indonesia	QN			√		

13	Kelanang and Zakaria (2012) – Malaysia	QN			√	
14	Ng et al. (2012) – Malaysia and Singapore	QN	√	√		
15	Tee et al. (2018) – Malaysia	QN	√			
16	Tee et al. (2019) – Malaysia	QN	√			
17	La Ndia et al. (2019) – Indonesia	QN	√			
18	Thien et al. (2015) – Indonesia, Malaysia and Thailand	QN	√			√
19	Thien et al. (2015) – Malaysia and Singapore	QN	√			√
20	Nguyen (2016) – Vietnam	QN	√			√
21	Ali, Norfarah, Syazwani and Ismail (2019) – Malaysia	QN				√
22	Mundia and Metussin (2018) – Brunei	QN	√			
23	Muttaqin et al. (2020) – Indonesia	QN				√
24	Ismail and Awang (2012) – Malaysia	QN	√	√		√
25	Mohd and Mahmood (2011) – Malaysia	QN	√			
26	Hassan and Rahman (2017) – Malaysia	QN	√			
27	Prafitriyani et al. (2019) – Indonesia	QN	√			
28	Saligumba and Tan (2018) – Philippines	QN				√
29	Sappaile and Djam'an (2017) – Indonesia	QN				√
30	Lim and Chapman (2015) – Singapore	QN				√
31	Mokhtar et al. (2012) – Malaysia	QN	√			√
32	Sriphai et al. (2011) – Thailand	QN	√			
33	Bakar et al. (2019) – Malaysia	QN	√			
34	Tan (2012) – Malaysia	QN				√
35	Hoon et al. (2010) – Malaysia	QN				√
36	Jing et al. (2017) – Malaysia	QN				√
37	Lay et al. (2013) – Malaysia and Singapore	QN	√			
38	Yusran et al. (2019) – Indonesia	QN	√			
39	Hogan et al. (2013) – Singapore	QN				√
40	Lounkaew (2013) – Thailand	QN	√			

QN = Quantitative; QL = Qualitative; MM = Mixed method

### 3.1. Factors that influence mathematics achievement in ASEAN countries

In this section, the researchers focus on the factors that influence mathematics achievement and how these factors solve the problem of mathematics underachievement in ASEAN countries. There are



five identified types of factors that influence mathematics achievement in ASEAN countries: student factors, family factors, teacher factors, school factors and policymaker factors.

### 3.1.1. Student factors

A total of 21 out of 40 studies focused on student factors influencing mathematics achievement. Student factors constitute the largest percentage of mathematics achievement studies in ASEAN countries, i.e., 45%. Nine studies were conducted in Malaysia (Abdullah et al., 2017; Bakar et al., 2019; Hassan & Rahman, 2017; Ismail & Awang, 2012; Kien-Kheng et al., 2016; Mohd & Mahmood, 2011; Mokhtar et al., 2011; Tee et al., 2018; 2019), three studies in Indonesia (La Ndia et al., 2019; Pratifitriyani et al., 2019; Yusran et al., 2019), two studies in Thailand (Lounkaew, 2013; Sriphai et al., 2011) and, one study each in Brunei (Mundia & Metussin, 2018) and Vietnam (Nguyen, 2016). Meanwhile, there were four studies combining Malaysia and Singapore (Awang & Fah, 2013; Lay et al., 2013; Ng et al., 2012; Thien et al., 2015) and one study combining Indonesia, Malaysia and Thailand (Thien et al., 2015).

This systematic review explains student factors such as students' skills (Abdullah et al., 2017; Awang & Fah, 2013; Hassan & Rahman, 2017; Tee et al., 2018); cognitive abilities (Kien-Kheng et al., 2016); affective characteristics (Lay et al., 2013; Tee et al., 2019; Thien et al., 2015); attitude (Ismail & Awang, 2012; Mohd & Mahmood, 2011; Mokhtar et al., 2012); intelligence (La Ndia et al., 2019; Pratifitriyani et al., 2019); motivation (Tee et al., 2018; Yusran et al., 2019); gender (Ismail & Awang, 2012; Ng et al., 2012); demographics (Lounkaew, 2013; Nguyen, 2016); interest (Mokhtar et al., 2012); beliefs (Bakar et al., 2019); self-efficacy (Mundia & Metussin, 2018; Tee et al., 2018), learning style (Mundia & Metussin, 2018; Sriphai et al., 2011); additional support and exposure to academic enrichment activities (Awang & Fah 2013); task-value and mastery goal orientation (Tee et al., 2018) and, coping mechanisms and study strategies (Mundia & Metussin, 2018).

Abdullah et al. (2017) identified the effect of students' metacognitive competence on non-practice mathematic problem solving in an effort to help improve mathematics achievement in Malaysia. Awang and Fah (2013) further tested the contribution of knowledge of technological tools and technology to the mathematical achievements of eighth-grade students in Malaysia and Singapore. Hassan and Rahman (2017) identified the relationship between problem-solving skills and mathematics achievement in Malaysia. The findings of these researchers were that students with high levels of metacognitive skills, problem-solving skills and knowledge of technological tools and the internet also had high mathematics achievement.

Kien-Kheng et al. (2016) determined students' cognitive abilities such as prior mathematical knowledge and statistical reasoning as well as their misconceptions of mathematics achievement in Malaysia. Prior mathematical knowledge and statistical reasoning significantly predicted mathematics achievement but misconceptions did not. In addition to student's cognitive abilities, students' affective characteristics and attitudes are also linked to their achievements. Tee et al. (2019) examined the link between student's affective characteristics, i.e., self-confidence and positive emotions, and mathematics achievement. The results showed that self-confidence and positive emotions are predictors of mathematics achievement in Malaysia. Thien et al. (2015) tested students' emotional relationship at the student and school level with mathematical achievement in Indonesia, Malaysia and Thailand. The results revealed differences by country. The strongest predictor at the student level for Indonesia and Malaysia is self-efficacy, and for Thailand, it is perseverance. Thien and Ong (2015) found that at the understudy level, the record of economic, social and cultural status (ESCS), math self-viability and science uneasiness effectively affect math accomplishment in Malaysia and Singapore.

Furthermore, students' attitudes are also associated with mathematics achievement (Ismail & Awang, 2012; Mokhtar et al., 2012). Students' attitudes such as patience, confidence and willingness to solve problems have significant effects on mathematics achievement (Mohd & Mahmood, 2011).



Problem solving is the heart of mathematics. Therefore, every student must master the problem-solving skills to achieve high mathematical achievement. In addition, intelligence is also an important quality in determining mathematical achievement. Examples of intelligence associated with mathematical achievement are spatial intelligence and mathematical logic intelligence (La Ndia et al., 2019). Both intelligences had significant relationships with mathematics achievement in Indonesia. However, emotional intelligence also plays an important role in determining mathematical achievement in Indonesia (Prafitriyani et al., 2019). The higher the degree of passionate knowledge, the higher the math learning accomplishments acquired by the understudies. Alternatively, they decrease the degree of enthusiastic insight, by decreasing the learning accomplishments of arithmetic understudies.

Researchers in Thailand (Lounkaew, 2013) and Vietnam (Nguyen, 2016) focused on demographics to solve student problems in mathematics. Ng et al. (2012) found statistically significant predictive effects of gender on mathematics achievements of students in Malaysia and Singapore. Ismail and Awang (2012) agreed with this finding which is consistent in stereotyping females in having mathematics inferiority compared to males (Else-Quest, Hyde & Linn, 2010). Students' interest (Mokhtar et al., 2012), beliefs (Bakar et al., 2019), self-efficacy (Mundia & Metussin, 2018; Tee et al., 2018) and learning style (Mundia & Metussin, 2018; Sriphai et al., 2011) were also featured as predictors of math achievement in ASEAN countries. Mundia and Metussin (2018) also determined student's coping mechanism and study strategies and mathematics achievement. Students who received additional support and gained exposure to academic enrichment activities had a significant relationship with their mathematics achievements in Malaysia and Singapore (Awang & Fah, 2013). Additional support means having a calculator, computer, internet connection, study desk and dictionary at home. Indeed, the student factors have been important topics in the study of mathematics achievement in ASEAN countries. Table 5 shows the findings regarding student factors.

Table 5. Findings regarding student factors

No.	Authors (Years)	Student factors	Country
1	Abdullah et al. (2017)	Metacognitive skills	Malaysia
2	Awang and Fah (2013)	Additional support, gaining exposure to academic enrichment activities and knowledge of technology tools and the internet	Malaysia and Singapore
3	Kien-Kheng et al. (2016)	Cognitive skills	Malaysia
4	Ng et al. (2012)	Gender	Malaysia and Singapore
5	Tee et al. (2018)	Motivation, self-efficacy, task value, goal orientation, deep cognitive strategy and critical thinking skills	Malaysia
6	Tee et al. (2019)	Affective characteristics and metacognitive skills	Malaysia
7	La Ndia et al. (2019)	Spatial intelligence and mathematical logical intelligence	Indonesia
8	Thien et al. (2015)	Affective characteristics	Indonesia, Malaysia and Thailand
9	Thien et al. (2015)	Affective characteristics	Malaysia and Singapore
10	Nguyen (2016)	Demographics	Vietnam
11	Mundia and Metussin (2018)	Coping mechanism, study strategies, learning styles and self-efficacy	Brunei
12	Ismail & Awang (2012)	Gender and attitude	Malaysia
13	Mohd and Mahmood	Attitude	Malaysia

	(2011)		
14	Hassan and Rahman (2017)	Problem-solving skills and metacognitive awareness	Malaysia
15	Prafitriyani et al. (2019)	Emotional intelligence	Indonesia
16	Mokhtar et al. (2012)	Interest and attitude	Malaysia
17	Sriphai et al. (2011)	Learning style	Thailand
18	Bakar et al. (2019)	Beliefs	Malaysia
19	Lay et al. (2013)	Affective characteristics	Malaysia and Singapore
20	Yusran et al. (2019)	Motivation	Indonesia
21	Lounkaew (2013)	Demographics	Thailand

### 3.1.2. Family factors

Only 2 of the 40 studies focused on family factors influencing mathematics achievement. They represent 4% of the factors that influence mathematical achievement in this systematic review. Family factors in this review are represented by languages spoken at home and parental education (Ng et al., 2012), instructive assets, for example, the quantity of books in the home, an investigation work area and PC possession in the home (Ismail & Awang, 2012). Combined studies of mathematical achievement in ASEAN countries involving family factors were only conducted in Malaysia and Singapore (Ng et al., 2012) and in Malaysia only (Ismail & Awang, 2012). Statistically speaking, there are significant relationships between mathematics achievement and language spoken at home, parental education and educational resources. Table 6 shows the findings regarding family factors.

Table 6. Findings regarding family factors

No.	Authors (Years)	Family factors	Country
1	Ng et al. (2012)	Languages spoken at home Parental education Educational resources	Malaysia and Singapore
2	Ismail and Awang (2012)	The number of books in the home Study desk ownership in the home Computer ownership in the home	Malaysia

### 3.1.3. Teacher factors

A total of 18 out of the 40 studies focused on teacher factors influencing mathematics achievement. They represent 38% of the factors that influence mathematics achievement in this systematic review. Teacher factors are represented by teaching and learning strategies. Based on the systematic reviews that we conducted, we found that there are three types of instruction and training approaches practiced by teachers in the classroom: teacher-centred (As'ari et al., 2019; Damrongpanit, 2019; Gunarhadi, Anwar, Andayani & Shaari, 2016; Hogan, 2013; Mokhtar, 2012; Nguyen, 2016; Sappaile & Djam'an, 2017); material-centred (Bringula et al., 2017; Hoon et al., 2010; Jing, 2017; Kelanang & Zakaria 2012; Lim & Chapman, 2015; Saligumba & Tan, 2018; Tan, 2012; Yahya et al., 2019; Zulnaidi, 2017; 2019) and student-centred (Cabrera, 2017).

In Indonesia, As'ari et al. (2019) tested the teaching effects of seeking truth and open-mindedness. Students who are exposed to seeking truth and open-mindedness tend to show critical thinking when solving math problems. This has led to an increase in student mathematics achievement. Gunarhadi et al. (2016) used Cluster-Based Instruction (CBI) and Sappaile and Djam'an (2017) determined problem-solving methods to improve mathematics achievement. In Vietnam, Nguyen (2016) used learning approaches to improve mathematics achievement. Meanwhile, in Malaysia, Mokhtar et al. (2012)

used teachers' role in shaping students' anxiety and to ensure that the students achieve the required performance. While in Singapore, Hogan et al. (2013) determined despite any curricula, the logic of instructional practice is considered to improve mathematics achievement effectively.

Ten studies in ASEAN countries tested the effectiveness of materials-based strategies to improve mathematics achievement (Bringula et al., 2017; Hoon et al., 2010; Jing et al., 2017; Kelanang & Zakaria, 2012; Lim & Chapman, 2015; Saligumba & Tan, 2018; Tan, 2012; Yahya et al., 2019; Zulnaidi, 2017; 2018). Material-centred strategies such as audio-visuals (Pedagogical Agent) (Bringula et al., 2017; Hoon, 2010), GeoGebra (Zulnaidi, 2017; 2018), Video Tutorial Screencast SketchUp Make (VTS-SUM) (Yahya et al., 2019), graphic calculators (Tan, 2012), history as a tool (Lim & Chapman, 2015) and modules (Jing et al. 2017; Kelanang & Zakaria, 2012; Saligumba & Tan, 2018) to improve mathematical achievement. Only one study in the Philippines used student-centred strategies such as Outcomes-Based Education (OBE) to improve mathematics achievement (Cabrera, 2017). Table 7 shows the findings regarding teacher factors.

Table 7. Findings regarding teacher factors

No.	Authors (Years)	Teacher factors	Country
1	As'ari et al. (2019)	Truth-seeking and open-mindedness	Indonesia
2	Bringula et al. (2017)	Pedagogical agent (PA)	Philippines
3	Cabrera (2017)	OBE	Philippines
4	Damrongpanit (2019)	Modern teaching	Thailand
5	Yahya et al. (2019)	VTS-SUM	Malaysia
6	Gunarhadi et al. (2016)	CBI	Indonesia
7	Zulnaidi et al. (2017)	GeoGebra software	Malaysia
8	Zulnaidi et al. (2019)	GeoGebra software	Indonesia
9	Kelanang and Zakaria (2012)	Numeracy Intervention Programme	Malaysia
10	Nguyen (2016)	Learning approaches	Vietnam
11	Saligumba and Tan (2018)	Gradual Release of Responsibility Instructional Model	Philippines
12	Sappaile and Djam'an (2017)	Problem-solving methods	Indonesia
13	Lim and Chapman (2015)	History as a tool to teach mathematics	Singapore
14	Mokhtar et al. (2012)	Role of teacher and peers	Malaysia
15	Tan (2012)	Application of graphing calculator	Malaysia
16	Hoon et al. (2010)	Interactive courseware	Malaysia
17	Ting (2017)	Variation theory	Malaysia
18	Hogan et al. (2013)	Assessment and the logic of instructional practice	Singapore

### 3.1.4. School factors

Four out of the 40 studies focused on school factors influencing mathematics achievement. They represent 9% of the factors that influence mathematical achievement in this systematic review. School factors in this review are represented by ESCS (Thien, 2015; Thien & Ong, 2015), organisational and ideological differences (Thien et al., 2015), homework and school environment (Ismail & Awang, 2012).

In Malaysia, Ismail and Awang (2012) discovered that schoolwork and school climate effectively effects on mathematics performance. An examination in Indonesia, Malaysia, and Thailand found that

there are various examples of connections between understudy level and school-level in arithmetic accomplishment (Thien et al., 2015). The basic variable is thinking about the expected increase in achievement for the Indonesian, Malaysian, and Thai models. At the low level, self-training is the basic predictor for the Indonesian and Malaysian models, while it is the guarantee for the Thai model. Next, at the high school rank, adapting to mathematics subjects is a predictor in the Indonesian model and a special response to basic intuition in the Thai model. School involvement, subjects and examination orientation are predictors of the decline in Malaysian model scores. Thien and Ong's (2015) results demonstrated that the record of ESCS, science self-amplessness, and number juggling disquiet influence mathematics execution in Malaysia and Singapore at the understudy level. The number of young men at the school level has no huge consequences for arithmetic execution among Malaysian and Singaporean understudies. ESCS at the school level has good and noteworthy impacts on arithmetic execution in Malaysia, but not in Singapore. Table 8 displays the findings regarding school factors.

Table 8. Findings regarding school factors

No.	Authors (Years)	School factors	Country
1	Thien et al. (2015)	Affective characteristics	Indonesia, Malaysia and Thailand
2	Thien and Ong (2015)	Affective characteristics ESCS	Malaysia and Singapore
3	Thien et al. (2015)	Organisational and ideological differences	Malaysia and Singapore
4	Ismail and Awang (2012)	Homework and school environment	Malaysia

### 3.1.5. Policymaker factors

Three out of the 40 studies focus on policymaker factors to improve mathematics achievement. They represent 4% of the factors that influence mathematics achievement in this systematic review. Policymaker factors that are represented in this review are School Improvement Specialist Coach Plus (SISC+) (Devrajoo & Letchumanan, 2019), Computerised-adaptive test (Ali et al., 2019) and organisational and ideological differences (Muttaqin et al., 2019).

In Malaysia, the SISC+ Programme was established by the Ministry of Education Malaysia to help instructors improve their pedagogical skills. One study carried out by Davrajoo and Letchumanan (2019) found that SISC+ helped to improve teachers' pedagogical skills and students' mathematics achievement. Ali et al. (2019) show that the Computerized-adaptive test (CAT) cut down exam concern regarding mathematics tests in comparison with classical examination. This study implies that the CAT has gain students in terms of cut down exam concern with regard to mathematics examinations in Malaysia. Muttaqin et al. (2020) found that student and gap achievement vary across independent Islamic school trail and flow in Indonesia. Table 9 displays the findings regarding the policymaker factors.

Table 9. Findings regarding policymaker factors

No.	Authors (Years)	Policymaker factors	Country
1	Davrajoo and Letchumanan (2019)	SISC+	Malaysia
2	Ali et al. (2019)	Computerised-adaptive test	Malaysia
3	Muttaqin et al. (2020)	Organisational and ideological differences	Indonesia

This systematic review was handled to analyse factors influencing mathematics achievement in ASEAN countries. This is because mathematical achievement in ASEAN countries is still lagging behind

other countries in international assessments such as PISA. The average score obtained by ASEAN countries participating in this assessment is below the OECD average. However, there is still one ASEAN country in the best position – Singapore. This systematic review used a strong database source to find 40 studies related to mathematics achievement in ASEAN countries. The results of this study found that student, family, teacher, school and policymaker factors influence mathematics achievement in ASEAN countries. We also found that student factors were the largest number of factors that researchers used as variables in mathematics achievement studies.

The results of this study also found that the ASEAN country with the most research on mathematics achievement was Malaysia. Many mathematical achievement studies in this literature review were conducted in Malaysia, followed by Indonesia, the Philippines, Thailand, Vietnam, Brunei and Singapore. This reflects the commitment of researchers in Malaysia to reducing the gap in mathematics achievement in the country. It likewise demonstrates that there is still void in math accomplishment in Malaysia.

#### **4. Conclusion**

This systematic review analyses factors that influence mathematics achievement in ASEAN countries. The results show that student, family, teacher, school and policymaker factors influence mathematics achievement in this region. These results confirm the findings of previous studies linking students, family, teachers, school and policymakers with student mathematical achievement (Akiba et al., 2007; Al-Agili et al., 2012; Caponera & Losito, 2016; Effandi et al., 2012; Mohammadpour & Compus, 2014). However, most studies in ASEAN countries focus on student factors to improve mathematics achievement. Specifically, student factors that influence mathematics achievement are gender, demography, skill, knowledge, attitude and student's engagement. Family factor that influences mathematics achievement is socioeconomic status. Next, teacher factors that influence mathematics achievement are pedagogical content knowledge, competency, teaching strategies and attitude. School and policymaker factors that influence mathematics achievement are school engagement and socioeconomic status; policy, respectively.

#### **5. Implication and recommendations**

This systematic study provides information to policy-makers in ASEAN countries on the factors influencing the mathematical achievement of the region. Although ASEAN consists of a combination of countries that have almost the same socio-cultural factors, the factors that influence the achievement of Mathematics in each country are different. These differences can be used as a guide to ASEAN countries in overcoming the problem of Mathematics achievement in their respective countries. Educators and the Ministry of Education in ASEAN countries can cooperate bilaterally in solving Mathematics achievement problems in ASEAN countries. This is because ASEAN countries have the same problem of low student Mathematics achievement except Singapore. Also, this deliberate investigation has suggestions for the significance of the educating and learning measure in ASEAN nations. The evidence is shown in this systematic study where student and teacher factors dominate the influence of Mathematics achievement. Teacher and student components are related to the teaching and learning process. Cooperation between ASEAN countries is expected in an effort to realise the goal of improving students' mathematics achievement. The proposal for future studies is to study mathematics achievement problems by combining the factors of students, families, teachers, schools and policy makers. In this way, the problem of mathematical achievement can be seen as a whole especially in the context of ASEAN countries. Likewise, more qualitative studies or mixed-method studies are needed in order to fill the gap in terms of methodology. This review found that 38 out of 40 studies were quantitative studies, and none are mixed-method studies.

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