

# Learning Science and Mathematics using the Second Language: Yea or Nay?

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**Abstract:** *Science and Mathematics are irrefutably essential and critical in the development of a country. The significance of these disciplines have been globally acknowledged. With this cognizance, many countries have resorted to teaching these two subjects in English, including Malaysia. This is prominent in countries with English as their second language. Indubitably, in learning Science and Mathematics in English, students are deemed to be armed with good language proficiency, to exude positive attitudes in their learning process and to demonstrate high level of confidence. Thus, this study intends to discover students' perceptions of learning Science and Mathematics in English and the reasons underlying this move, as well as the challenges confronted. There were 201 students participated in this study. Questionnaire and open-ended questions were employed to disclose the students' views. The findings unveiled mixed responses concerning the students' perceptions. Furthermore, in-depth perspectives pertaining to this matter were also unravelled, and several hindrances were unearthed. In brief, learning Science and Mathematics by using English is a positive move aiming to arouse students' interests in the three domains. However, more thorough discoveries are needed to improve the current state of this issue. Otherwise, the history of PPSMI may dishearten the system once again.*

**Index Terms:** *Second Language; English; Language Skills; Attitudes; Confidence; Science and Mathematics.*

## I. INTRODUCTION

Science and mathematics are fundamental in realising Malaysia's aspiration to become a developed nation. Many high-paying jobs in developed countries are in the fields of science, technology, engineering and math (STEM) (Lu et al., 2017). In reference to that claim, it becomes essential for the provision of quality mathematics education as this arena is instrumental in boosting the scientific and technological knowledge field. Furthermore, science and technology is part of challenges that curriculum experts and educational institutions ought to face in achieving Vision 2020. As science and technology (S&T) innovations are increasingly important in the trend of 21st century, it is vital for Malaysia to produce students who are S&T-innovation-savvy as a contribution to the well-being of mankind and to develop the country's economic growth (Lay & Osman, 2017).

As science and mathematics field is associated to the use of English, this has been a worrying issue to many countries

around the world. Countries in which English is not the official or national language face dilemma in adapting English as the language in the field of science and mathematics. In South Africa for example, teachers did not usually use English in the facilitation of learning science (Mokiwa & Msila, 2013). They were more inclined in mixing between the target language (English) and the national language in the process of teaching and learning. This is also posited by Mthiyane (2016) asserting that English is a barrier in students-teachers' understanding of Science concept apart from lacking confidence in the ability to teach using the English language. Apparently, Olugbara (2008) contended that though English is beneficial teaching science and mathematics, code-switching is seen to be more prevalent and promising.

The issue of using English in the teaching of science and mathematics subjects is not only ubiquitous in South Africa as this occurs in other regions too. Studies done in the European countries (Fernandez-Sanjurjo, Fernandez-Costales & Blanco, 2017; Karabay, 2017; Mifsud & Farrugia; 2016) have demonstrated that English is used widely in the teaching and learning of science and mathematics in the education field. Issues such as students' performance in the subjects, teachers' competency, the practice of bilingual strategy are commonly discussed in the aforementioned studies. This indicates that using English in the teaching and learning science and mathematics is often faced with obstacles. In addition, the collation of Asian countries like Philippines (Racca & Lasaten, 2016; Yanagihara, 2007); Hong Kong (Lin & Wu, 2015); Vietnam (Nguyen & Thi Kieu, 2015); and Cambodia (Lee, Watt & Frawley, 2015) has also witnessed different views and perspectives concerning the use of English in the teaching and learning of science and mathematics. Hence, it is indisputable that the situation may also prevalent in Malaysia.

Malaysia has once implemented a policy concerning English as the instructional medium in teaching and science and mathematics, widely known as PPSMI. The Malaysian government made English the means of instruction for Science and Mathematics subjects starting from the year of 2003 as a means to address the deterioration of English proficiency (Azman, 2016). The policy came into practice as people have started to think that mastering the English language would equip them with the necessary skills needed to embrace globalisation. English is a language that is officially acknowledged as the country's second language and has been made compulsory for

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students at all levels of education (Colin & Samuel, 2017). Furthermore, Samah (2008) believed that mastery of the English language, together with a strong performance in Science, Mathematics and IT would guarantee Malaysia's competitiveness on the global scene in trade and commerce and ensure the full realisation of Vision 2020. Holding to those premises, the policy was obligated to be executed in all Malaysian schools, primary and secondary. This involved all science and mathematics subjects in all levels of education, and it was also proposed to be practised in the tertiary education level.

Conversely, this policy was unable to cater to everyone's needs in the system. It lasted only for a decade after being sensationalised for its weakness from numerous domains. Ha, Kho and Chng (2013) believed that the implementation is perceived from various angles as a decade of failure though Suliman, Nor and Yunus (2017) affirmed that PPSMI derived as the result of maximising human potential besides moving towards the developed nation status. The execution of the policy has raised concerns from various parties and ethnicities on the status of other languages. Similarly, the policy is deemed unable in improving the students' achievement in the two subjects, especially for students in the rural area. Additionally, teachers and students' language mastery is also identified to be a challenge when this policy was implemented. Consequently, PPSMI was abolished in 2012 which was then replaced with the Upholding Malay Language Strengthening English Language (MBMMBI) policy.

At present, the teaching and learning of Science and Mathematics in English is still conducted in certain schools, via the Dual-Language Programme (DLP). It is more on a voluntary basis, as compared to the PPSMI era when it was implemented on a compulsory basis. Study done by Teo and Rasul (2017) revealed that rural school students were more on the negative side regarding the learning of Mathematics in English. This was somehow in line to the findings of Suliman, Nor and Yunus (2017) which stated that students were moderately confident and ready to learn the subjects in English apart from facing major obstacles dealing with their language mastery. Sharing the same view, Unting and Yamat (2017) postulated that students' language proficiency was among the major challenges in the execution of DLP. A few researches conducted on the issue of teaching and learning science and mathematics in the post-PPSMI era lead to this study which aims to address the research questions below:

- What are the students' perceptions of learning Science and Mathematics in English?
- Why are Science and Mathematics learnt in English?
- What are the challenges faced in learning Science and Mathematics in English?

## II. LITERATURE REVIEW

The integration of content and language in one lesson irrefutably may be challenging yet appealing at the same time. Despite its difficulties, it needs to be perceived positively considering the benefits gained from integrating

content and language learning known as Content and Language Integrated Learning (CLIL). Widodo (2016) affirmed that the issue of content is associated with content-based instruction (CBI) or content and language integrated learning, henceforth CLIL. Besides, Moghadam and Fatemipour (2014) stated that CLIL can be an effective approach for language teaching at all stages of instruction, from primary school to university level in both second and foreign language teaching settings. This acknowledges the link between learning a language in the context of content knowledge.

Otwinowska and Forsy (2015) argued that in the context of CLIL education, constructing knowledge involves complex cognitive operations on the material to be internalised. This deals with teachers engaging students in the teaching and learning process. It might pose challenges with the integration of two domains – language and content knowledge. Therefore, assistance and scaffolding from the teachers are necessary for the students to comprehend the lesson besides sustaining students' focus. As reinforced by Coyle, Hood and Marsh (2010), the role of teachers is to boost the cognitive engagement of the learners by involving them in creative thinking, problem solving and cognitive challenges. Then, students will become more positive and optimistic to overcome any hurdles besides restructuring knowledge and gaining new overviews. This indirectly exploits students' potential. Furthermore, the role of teachers in a foreign language learning is one of the decisive factors to the success or failure of the learning process (Widiati, Suryati & Hayati, 2018).

In teaching any subject in the content area, a certain mastery of the English language has to precede the understanding of the subject (Domingo, 2016). This is deemed crucial in the case of Science and Mathematics teaching and learning in the English language. Students will need to arm themselves with sufficient language mastery to comprehend the lesson taught. It is a concern that lacking language competency may impede the learning process. This may result in difficulties to comprehend the content knowledge. As argued by Racca and Lasaten (2016), students need to be proficient in English for a better grasp of knowledge in Technology, Science and Mathematics. This is even acknowledged by Mokiwa and Msila (2013) who stated that language has far reaching effects on educational quality, hence critics usually link achievement to language of learning and teaching. This emphasises the fundamental need for the students to equip themselves with competency and proficiency which later aid their learning process. Additionally, it nurtures their content knowledge and enhances their language mastery.

Proficiency in the target language assists students' understanding of the lesson. It may lessen challenges in the learning process, and they may offer help and assistance to their peers facing problems in the lesson. Racca and Lasaten (2016) believed that the more proficient the students are in the English language, the more likely they will perform

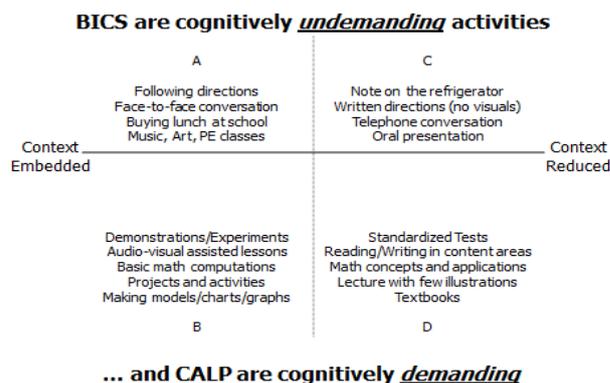


well in their academic subjects. Concurrent to the former claim, poor performance in subjects such as Mathematics is a result of a lack of English understanding and this is due to the difficulty in understanding and translating the mathematical language (Mifsud & Farrugia, 2016). It was further added that by learning Science in English, it improves students' general competence in English. Indisputably, the role played by English mastery is pivotal in the case of learning Science and Mathematics in the target language.

Learning Science and Mathematics in the English language enables students to explore knowledge globally. In tandem to this, it also escalates the students' potential in the workforce (Suliman, Nor & Yunus, 2017). Additionally, it entitles the students to have more contact hours to the English language as a means to enrich their language competency and proficiency (Unting & Yamat, 2017). In the Malaysian context, learning Science and Mathematics in English is in line with the Malaysian Education Blueprint (2013-2025) which is to produce students who are at least bilingual in the Malay language and English language (Ministry of Education, 2013). Indubitably, there are students who learn Science and Mathematics better in English than in Bahasa Melayu. This was reiterated by Probyn (2015) in her study indicating that majority of teachers and students used more English in the lesson. In addition, Besar and Jali (2010) disclosed that urban students as well as fully residential school students were more interested to learn Science and Mathematics in the English language. Hence, this is the avenue for a group of students to immerse in learning the subjects via their preferred language of instruction, as in this case, English. The crucial idea is that the students' comprehension in the lesson could be enhanced irrespective of which language is used.

### A. Theory

This study is based on Jim Cummin's Theoretical Framework specifying on Cognitive Academic Language Proficiency, henceforth CALP. CALP suggests the ability of an individual to engage with the academic emphasis in the learning of various subjects. CALP involves the ability to make complex meanings explicit in an oral or written form by means of language itself, rather than by gestures or intonation (Otwindowska & Forys, 2015). As CALP is obtained in a less contextually rich situation, it is perceived to be more challenging and difficult to master unlike Basic Interpersonal Communication Skills, henceforth BICS. Cummins (1991) stated that while many children develop native speaker fluency within two years of immersion in the target language, it takes between five to seven years for a child to be working on a level with native speakers as far as academic language is concerned.



**Fig 1.** Cummins' Grid

It is evident that CALP is deemed necessary for the learners in engaging with the content lessons and academic lectures. If BICS is normally located in quadrant A, CALP, on the contrary, focuses on quadrant D. Cummins asserted that for majority of these learners, direct teaching of the language in the academic context is necessary in order to achieve the required levels of academic language proficiency. This is prevalent in the case where the linguistic environment is unable to equip the additional models, in the context of cognitive academic type in the target language. CALP reflects a combination of language proficiency and cognitive processes that determine success in school (Cummins, 1991).

In the case of this study, CALP is more prevalent as compared to BISC as it deals with the students' language proficiency in engaging with the learning of academic subjects, especially Science and Mathematics. Mastering CALP necessitates understanding and content discussion in the classroom, requires high intellectual involvement and places high cognitive demands on the learner. Students need to develop their cognitive ability for the learning process to take place. The language used in Science and Mathematics classes may not be a familiar language that students commonly use and hear daily. Thus, it is deemed crucial for students to be familiarised with the specific terms and registers used in Science and Mathematics lessons.

As the terminologies in Science and Mathematics subjects may be challenging and of high register, CALP is of paramount needs than BICS. This is in accordance to Otwinowska and Forys (2015) who claimed that CALP lessons demand far more specialized context-related terminology together with words and language functions needed to verbalise higher-order cognitive operations for seeking relationships, drawing conclusions and others. Domingo (2016) affirmed that the language of mathematics is context-reduced and cognitively demanding which exerts the use of what Cummins termed as CALP. Likewise, Racca and Lasaten (2016) believed that students who have not yet developed their CALP may encounter difficulties in learning Science, Mathematics and academic subjects. Hence, CALP is seen prevalent in the context of this study.

Review of Past Studies  
There are many studies that



have been conducted in relation to the learning of Science and Mathematics in the English language. In Spain, Fernandez-Sanjurjo, Fernandez-Costales and Blanco (2017) investigated 709 grade six students' performance in science subject. The study found that students learning science in their first language performed slightly better than those learning in a second language. The issue of language mastery was highlighted in Mthiyane's (2016) and Olugbara (2008), asserting that the use of code-switching was the solution for learners whose home language is not English. In fact, the code-switching group of students outperformed the students who learned only using the English language. Similarly, Mokiwa and Msila (2013) revealed that teachers might use the students' first language instead of English in order to enhance the meaning and understanding in the physical science class. On the contrary, Karabay (2017), who administered the study in Kazakhstan, found that the students had positive perceptions about learning using English and believed that English is advantageous for learning Science.

In the context of Asian regions, several studies conducted revealed mixed findings. Yanagihara (2007) who intended to verify the difference in the degree of understanding between Cebuano and English in the Philippines indicated that the sixth-grade students agreed that Mathematics is easily understood when it is taught using the English language. In fact, almost 90% of the grade six students wanted their teachers to speak in English during Mathematics lesson. Still situating in the context of the Philippines, Racca and Lasaten (2016) contended that grade eight students' academic performance in Science subject was significantly related to their English language proficiency. They even remarked that students with high English language proficiency would tend to perform well in both Mathematics and English. Furthermore, they discovered that the proficient students perform better in the Science, Mathematics and English subjects.

Meanwhile in Hong Kong, Lin and Wu (2015) observed a Science lesson in a secondary school in Hong Kong and came to a conclusion that the learners were faced with struggles in finding the correct linguistic structure in constructing meaning. Though 95% students agreed that their teachers' English was clear and understood, the same portion of students were pleased with the teacher's bilingual strategy in the lesson. Additionally, students in Cambodian bilingual schools performed better in Mathematics as compared to their peers in the monolingual schools as reported by Lee, Watt and Frawley (2015). Nguyen and Thi Kieu (2015), who studied 100 students in Vietnam, came to a conclusion that though the students' listening and writing skills were limited, 70% of them felt more interested to learn using English. All of these studies have demonstrated that different regions encounter different challenges and exude different perceptions. Perhaps, the context they are in contribute to these differences.

**B. Methodology**

This preliminary study is quantitative in nature,

employing survey research design. Questionnaire and open-ended questions were employed in order to gather the data. The instrument, which is a five-point Likert-scale questionnaire, was adopted from Ishak and Mohamed (2010). Likert-scale was chosen as Kothari (2011) claimed it to be a good instrument of choice because it is relatively easy to construct, each statement is subjected to empirical test for discriminating ability, it is easy to use, and it takes less time to construct. The questionnaire consists of four sections: demographic profile of the respondents, students' language skills, students' attitudes and students' confidence. The questions in the demographic profile of the respondents are class, gender and one general question on students' view of the learning process. The students' language skills construct has seven items; students' attitudes construct consists of six items while students' confidence construct has eight items. These sub-questions represent the students' perceptions.

As for the open-ended questions, participants were asked two questions. These questions were designed to capture the unheard voices of the respondents and to further support the findings of the questionnaire. Furthermore, these open-ended questions will provide insights to the research questions. The open-ended questions posed are as follows:

- Why do you think the subjects should be learnt in English?
- What are among the challenges you face in learning those subjects in English?

The instruments have been validated, and pilot test has also been conducted to ensure its reliability. Changes have been made to the instrument based on experts' recommendation. Similarly, some items have been omitted based on the reliability test result. The Cronbach's Alpha value obtained was 0.878, denoting high reliability. The final questionnaire had twenty-one items in total. The findings were later analysed using a statistical software and descriptive statistics involving frequency, percentage and mean was employed. As for identifying the level for each construct, the mean score was categorised into three classifications as depicted in the following table. On the other hand, responses from the open-ended questions were analysed using content analysis approach.

**Table 1.** Classification of Mean Score

Mean Score	Classification
1.00 – 2.33	Low
2.34 – 3.66	Moderate
3.67 – 5.00	High

The respondents of this study were 201 students from one fully residential school in the east of Malaysia. This comprised Form Three and Form Two students, learning both subjects in English. They were chosen based on purposive sampling technique. They have been learning Science and Mathematics in English for more than a year on compulsory basis, unlike other schools which can be voluntary. Purposive sampling was used as this study involved a specific group of people and according to Merriam (2009), purposeful



sampling should be used to include people who know the most about the topic. With regard to the data collection, the researcher distributed the questionnaires and clarified the details of the study and the requirements needed from the respondents.

### III. FINDINGS

#### A. Demographic Profile of the Respondents

There were 201 respondents involved in this study. Majority of the respondents were form three students, female and displayed positive vibe in learning the subjects using English. The profile is further presented in the table below.

**Table 2.** Demographic Profile of the Respondents

Form	Two	46.0%
	Three	54.0%
Gender	Male	35.1%
	Female	64.9%
Positive to Learn Science and Mathematics in English	Yes	72.8%
	Unsure	25.2%
	No	2.0%

#### B. Students' Perceptions of Learning Science and Mathematics in English

As for the first research question, their perceptions will be illustrated via three domains. They are language skills, attitudes and confidence level. Table 3 depicts items pertaining to the students' language skills.

**Table 3.** Students' Language Skills

No	Item	Mean Score	Level
1	I can master the English basic	3.92	High
2	I can read in English	4.24	High
3	I can write in English	3.87	High
4	I can understand the S&M information in English	3.92	High
5	I can communicate in English	3.58	Mode rate
6	I can understand the S&M textbook, notes or references in English	4.17	High
7	I can understand the S&M exam instructions in English	4.11	High
TOTAL MEAN SCORE		3.97	High

As illustrated in Table 3, the highest scoring mean was from 'I can read in English well', with 4.24. This shows that the respondents were very confident with their reading skill. Items (1) - 'I can master the English basic well', (3) - 'I can write in English well' and (4) - 'I can understand the S&M information in English well' scored 3.92, 3.87 and 3.92 respectively. This is even concurrent to item (6) - 'I can understand the S&M textbook, notes or references in English well' and item (7) - 'I can understand the S&M exam instructions in English', with 4.17 and 4.11 mean score respectively. In addition, only 71.3% of the respondents agreed that they could master the English basic, 69.3% of the respondents agreed that they could write well in English, 76.7% could understand S&M well in English, 85.2% agreed that they could understand the S&M

textbooks, notes and references in English well and 80.1% agreed they could understand the S&M exam instructions. The results show that the respondents were more well-prepared in their reading skills, as denoted by 91.6% agreement. Hence, all these might have contributed to the lowest mean score, item (5) - 'I can communicate in English well', which scored 3.58. Overall, the students' language skills were considered to be high with 3.97 mean score.

This study has disclosed that the respondents in this study were highly competent and positive in learning using English but lacking in terms of their confidence level. Since almost 72% claimed to be positive in learning using the English language, this shows that some of them were still having uncertainty with their own abilities. It is compelling to note that after being exposed to the English language formally for more than six years, the respondents were still gauging their language competency and proficiency issue. Out of the four language skills, only reading skill seems to be appealing among the respondents. This is also portrayed via the two last items, reflecting the understanding of textbooks and exam instructions which rely heavily on reading skill. It further portrays that the respondents were more comfortable with their receptive skills (reading & listening) as compared to their productive skills (writing & speaking). This is then followed by listening and writing skills. Nguyen and Thi Kieu (2015) affirmed that students' listening and writing skills are limited. Moreover, the least competent skill would be speaking, with only 53% claiming to be competent although Manan and Shamsudin (2012) stressed that among all language skills, speaking skill is affirmed to be the most important English language skill particularly in the current world.

In addition, this finding reiterated Suliman (2014) and Suliman, Nor and Yunus (2017) revealing that speaking skill is perceived as the most task-demanding skill by majority of the respondents in their studies. The findings have proven that the respondents possessed a good level of language proficiency, except for speaking skill. Productive skill e.g. speaking should be nurtured and developed because students are in dire need of this skill especially in the future when they are seeking for job opportunities. They may enhance their speaking skill by getting involved in group discussions or even by offering themselves to present ideas in class. One common way is by engaging in conversation with peers or even the teachers in the target language. Language competency and proficiency is pivotal when it comes to learning Science and Mathematics in the target language. This is crucial as Racca and Lasaten (2016) strongly affirmed that the more proficient the students are, the better they perform in Science and Mathematics. This highlights the effect brought by acquiring language competency in the learning of Science and Mathematics. Table 4 describes items pertaining to the students' attitudes.

**Table 4.** Students' Attitudes Towards Learning Science and Mathematics in English



No	Item	Mean Score	Level
1	I will answer S&M exam questions in English if I am given the choice	3.59	Moderate
2	I try to answer the S&M oral questions given by the teacher in English	3.96	High
3	I can follow the S&M teaching and learning process in English	4.10	High
4	The knowledge of Science/Mathematics in English is needed for my career in future	4.60	High
5	I hope the teacher can teach Science/Mathematics bilingually	4.43	High
6	I like to communicate in English with my teachers and friends	3.33	Moderate
TOTAL MEAN SCORE		4.00	High

Table 4 depicts the level of students' attitudes towards learning Science and Mathematics in English. The average mean score revealed the attitudes to be on high level, with 4.00 mean score. The highest scoring item was item (4) - 'The knowledge of Science/Mathematics in English is needed for my future', with 4.60. This was then followed by items (5) - 'I hope the teacher can teach Science/Mathematics bilingually', (3) - 'I can follow the S&M teaching and learning process in English', (2) - 'I try to answer the S&M oral questions given by the teacher in English' with 4.43, 4.10 and 3.96 mean scores respectively. Only two items recorded moderate level which items are (1) - 'I will answer S&M exam questions in English if I am given the choice' and (6) - 'I like to communicate in English with my teachers and friends' with mean scores of 3.59 and 3.33 respectively. About 93% of the respondents agreed that English is important for their future whereas 86% of the respondents hoped to be taught bilingually. On the contrary, less than 43% of the respondents agreed to communicate in English with their teachers and peers.

In regard to students' attitudes, the respondents were also found to be positive towards learning Science and Mathematics in English. As contended by Wolff (2007), CLIL learners are more motivated than those in regular classrooms. Indubitably, their positive attitudes may initially derive from their motivation in learning. A high number of them agreed that English is essential for future purpose. This is even reiterated in their open-ended responses. Having the idea that English is beneficial for them in the long run indirectly influences their positive attitudes in learning. They clearly understood and acknowledged the importance of English for their career prospect. This is in accordance to what Hugo (2018) proposed. Language attitude research has shown that views towards any aspect of a language reflected attitudes towards the speakers and users of that language. Ishak and Mohamed (2010) even put forward that the learning of Science and Mathematics in English is important for English mastery and career prospect in the future. The open-ended responses have also justified the reasons leading them to learn the subjects in English, as described in the open-ended responses. This seems concurrent to Ministry of Education (2015) that Malaysia would need workforce who are able to use global English not only for external purposes,

but also as globalisation came to Malaysia, within the country itself.

It seems that students wished for the subjects to be taught bilingually. Similarly, it was also foreshadowed by the item on answering exam questions. This reiterated the findings by Domingo (2016), Mifsud and Farrugia (2016), Mthiyane (2016), and Mokiwa and Msila (2013). This finding demonstrates the attitudes of the respondents reflecting that they were not totally positive about learning in English as they hoped for the integration of the national language in the learning process. Hugo (2018) mentioned that language attitudes were tantamount to language-based social evaluations, as well as explicit preferences and judgments of a language and its speakers and users. This wish opposes their earlier agreement on how English aids their future. If this scenario persists, the same situation as PPSMI may repeat by itself. Bilingual strategy may be employed, but it is a big concern if the national language usage would infest the teaching and learning process more. Ironically, students might opt for bilingual strategy as their language mastery is not up to the par.

The lowest scoring item deals with the preference to communicate in English. This replicated the earlier finding which placed respondents' speaking skill as the least competent skill. With this, it further emphasises how respondents' speaking skill needs to be enhanced and polished. In contrast, students were also found to attempt in answering oral questions given by teachers despite their disfavour of communicating in English. This emphasises that students were still giving themselves a good try although they had hesitance in using the target language. Similarly, high level of mean was found concerning the ability to follow the teaching and learning process. This may have connection to what was found in the language skills domain. Perhaps, listening and reading skills play a dominant role here as students would have to listen to their teachers teaching and read their notes as a means of understanding the lesson. As elucidated earlier, receptive skills were more persistent in students as opposed to the productive skills in the context of this study. Table 5 describes items pertaining to the students' level of confidence.

**Table 5.** Students' Confidence Towards Learning Science and Mathematics in English

No	Item	Mean Score	Level
1	I can answer the S&M questions in English	3.77	High
2	I am brave to give opinions in English to my friends	3.51	Moderate
3	Learning Science/Mathematics in English is easy	3.60	Moderate



4	My English skills is enough to understand Science/Mathematics in English	3.55	Moderate
5	The S&M questions given by the teachers are easy	3.40	Moderate
6	I answer the S&M questions in English orally	3.51	Moderate
7	I present the work in class using English	3.37	Moderate
8	I can follow the lesson if the S/M teacher uses English fully	3.61	Moderate
TOTAL MEAN SCORE		3.54	Moderate

From the table above, the students' level of confidence was found to be on the moderate level, with the total mean score of 3.54. Only one item was found to be on the high level, item (1) - 'I can answer the S&M questions in English', with 3.77 mean score. The other items (8), (3), (4), (2) and (6) recorded almost similar mean score in the range of 3.50 to 3.60. Two items (5) - 'The S&M questions given by the teachers are easy' and (7) - 'I present the work in class using English' recorded the lowest mean scores, 3.40 and 3.37 respectively. Glancing through the percentage of agreement, only item (1) had about 63% agreement from the respondents whereas the remaining items disclosed an agreement percentage of below 56%. It can be assumed that the respondents were moderately confident in learning both subjects using the English language.

Though the respondents were found to be competent and possessed positive attitudes in their learning process, their confidence level denoted the opposite. They were found to be moderately confident in their language skills, answering questions, presenting task and even offering opinions in the class. Nevertheless, they were still found to be moderate in giving opinion to their friends in English and in presenting their work in class using English. This again strengthens the issue of lower productive skills. Furthermore, the respondents were also moderately confident in their language skills, focusing on the understanding of Science and Mathematics in English. This reinforces the significant needs of equipping themselves with sufficient language mastery. When their language capabilities do not suffice for the learning process to take place, it may indirectly affect their confidence level.

To note, only 55% agreed for the teachers to fully use English in the lesson, which reflected the issue of bilingual strategy. This somehow reiterated the finding from the previous construct on using both languages in teaching. In addition, it was similar to past studies by Olugbara (2008), Tavares (2015), and Lin and Wu (2015). Students should be supported for them to boost their confidence in learning the subjects using the English language. If they are not given support and motivation, this may dampen their learning process. The support should come from every party, either teachers, parents or even peers. Collier, Burston and Rhodes (2016) suggested that STEM teachers must consistently seek activities to scaffold the content and support the language development of students, which is also highlighted by Widiati, Suryati and Hayati (2018). Even though Racca and

Lasaten (2016) hold to the principle that students who were highly motivated and possessed competency in English would perform well, one cannot discard the significance of confidence level in their learning process. To simplify, it encompasses all three domains for the learning process to succeed.

### C. Reasons of Learning Science and Mathematics in English

As mentioned earlier, two open-ended questions were posed in the instrument. The first question 'Why do you think the subjects should be learnt in English' revealed another different dimension of the responses. The respondents clarified the following responses, which were categorised into several emerging themes:

**Table 6.** Reasons of Learning Science and Mathematics in English

No.	Theme	Excerpts
1	Communication Purpose	<ul style="list-style-type: none"> <li>We are going to use it on (sic) future, and it is easy to communicate with outsider.</li> <li>English can help us to communicate with others when go (sic) to other country (sic).</li> <li>English is important to communicate with other people.</li> <li>English is important as everyone knows how to speak and understand it.</li> <li>English is the official world's language and it is for communication with people in the world.</li> <li>English is the language used worldwide and interacting with others would be easier.</li> <li>English helps [us] to communicate with others easily and comfortably.</li> <li>English is a common language that everyone uses all around the world.</li> <li>English is important because in future there are many jobs need English (sic).</li> <li>English is used in our future and all jobs are using English.</li> <li>English opens door to countless advantages.</li> </ul>
2	Job Security	<ul style="list-style-type: none"> <li>With English, I want to become a surgeon in the future.</li> <li>English is important for future work.</li> <li>Since my ambition is to be a doctor, I think English is the best language.</li> <li>It is important for my future life and easy for me to take international exams.</li> </ul>

- English helps us to do things related to different parts of the country.
- English will help me to understand what is going on with social media.
- English is applied in our lives and many people use English in works (sic).
- 3 Ease of Life
  - English is easier to understand.
  - Teach others Science in English because most countries use English.
  - The basic language that everyone knows is English.
  - English is the language everyone has to tackle before learning other languages.
  - English is for our future education and to understand new things better.
  - English helps us to know other languages other than Malay language.
  - To further our studies in another country, it is more likely to be in English.
  - Some science words cannot be translated into Malay and better in English.
- 4 Educational Purpose
  - It is difficult to study in Malay and that will make it harder to understand in university.
  - Technology is in English and I want to study in [the] UK.
  - I can understand the subjects better in English.
  - English opens a new experience for us as and opens more chances to better studies.
  - I am more comfortable to answer the questions in English.

The responses have clearly indicated that English is beneficial for their future. This is prevalent from the aspects of communication, job security, ease of life as well as educational purpose. By learning in English, they would be better prepared for their career and higher education level. The respondents also affirmed that learning Science and Mathematics in English will be the platform for them to achieve their dreams and ambitions. Moreover, they perceived the role played by English language in the sense of communication purpose with other people from different parts of the World. Additionally, they denoted that English is inevitable in their daily lives. The reasons put forward are relevant and signal the cognizance of the respondents. The four themes described clarify the underlying reasons for these students to learn the subjects in English. A very significant purpose is related to the future, and it seems imperative and crucial for them to learn in English.

**D. Challenges in Learning Science and Mathematics in English**

For the second question, ‘What are among the challenges you face in learning those subjects in English’, the responses were collated into two major themes as follows:

**Table 7.** Challenges in Learning Science and Mathematics in English

No.	Theme	Excerpts
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		I find [it] difficult to translate the words we don't know in English. To answer in English and some words I have never found. Some new words that I never knew about before. We are introduced to new words we are not familiar with. It is hard to know the meaning as we are not used to do Science in English. I am confused with the spelling and [it is] hard to memorise it. I don't know how to get the correct grammar. I forget how to spell some words. I have difficulties in answering the questions in English.
1	Language Mastery	I don't understand some words. I can't really understand some words and I can't remember the meaning. Understanding scientific names. It's difficult to understand the meaning of the word. Understanding the questions during exam. I don't understand all English words. There are some words that I don't really understand. There are some words that I don't understand. I don't understand the meaning of the words. I don't understand certain words translated in English.
	Ineptitude of Understanding	

It is evident that the major challenge faced by most of the respondents deals with ineptitude of understanding and language mastery. Occurrences such as the inability to comprehend questions and new vocabularies in English, difficulty to answer questions in English, and inadequate English vocabularies are hindrances faced by the students in the learning process. These obstacles might indirectly dampen their interest in learning as they face difficulties related to the language domain and comprehending the lessons. Additionally, this may somehow deteriorate their performance in the subjects. It calls for the students to acquire English competency which would assist their understanding.

From the responses in the open-ended sections, it was revealed that language mastery presents a very prominent challenge in the learning of Science and Mathematics in English. In teaching any subject in content area, a certain mastery of the English language has to precede the understanding of the subject (Domingo, 2016). As discussed earlier, the students should be armed with sufficient language mastery as this will ease their learning process. If they are unable to engage with the language well, this might



affect their understanding. A language policy that promotes growth in language proficiency at the expense of academic content learning is desirable (Tavares, 2015). Furthermore, there should be no difference in the knowledge of contents in a students' mother tongue as CLIL is intended to promote both languages and not only the second language (Fernandez-Sanjurjo, Fernandez-Costales & Blanco, 2017). In addition, the importance of English for future purposes is indeed inevitable as illustrated in the first open-ended question. Job security, educational advancement, communication – aspects that enhance the quality of life – are some of the reasons leading to the preference to learn Science and Mathematics in English. As voiced by Lu et al. (2017); Lay and Osman (2017), the economic growth is closely related to the country's development in science and technology, and this is where the country should head to. Thus, more actions and provisions are needed to ensure that the learning could attain its objectives.

#### IV. CONCLUSION

This study has demonstrated that language mastery is still a major issue affecting the learning of Science and Mathematics in English though the students demonstrated high level of language skills and displayed positive attitudes in learning. Interestingly, the lack of confidence was also prevalent, especially in relation to the language skills. Mastery of the language as well as the dearth of confidence level require more consideration in ensuring the success of this learning process. Unquestionably, this is a positive notion at valorising the standard of English among the students via the learning of Science and Mathematics. However, it is imperative to arm the students with sufficient English mastery to ensure a more promising outcome. If their learning process is dampened by language mastery, this will pose a serious concern to the teachers and also the school administrators. Learning process may not serve its purpose if certain elements involved are affected, especially in this case where Science and Mathematics are compulsory to be learnt in English.

As this issue occurs in other countries practising the learning of Science and Mathematics in English, it requires a more thorough and detailed plan by the policy makers, especially in regard to the nurturing of language competency. This may be practised by other countries in adapting to the existing actions. Learning Science and Mathematics in English encompasses two domains which are content and language. For the success of the learning process, language mastery should be solidified as it is the foundation in learning the content subjects. With the inception of Dual-Language Programme (DLP) as the current move in the Malaysian education system, it entails for serious preparation to ensure the success of the programme. As proposed by CALP, it takes five to seven years for the students to develop their language proficiency. As for future research, studies may also look into the relationship between English competency, attitudes and confidence and students' performance in Science and Mathematics. Examining the three domains from the views

of locality and types of schools may also be appealing to conduct. Employing observation and semi-structured interviews may discover other dimensions which are not unravelled via this study.

In conclusion, learning Science and Mathematics in English is the platform for students to develop their linguistic repertoire while at the same time engaging them with the content knowledge. Students should not be demotivated and feel inferior if they are faced with any obstacles in their learning process. In addition, students' perceptions in terms of their language skills, attitudes, confidence and even motivation should be consolidated. As this issue happens in other countries around the globe, lessons can be learnt from one another to ameliorate the circumstance. Exchange of ideas between school administrators and teachers may produce a better outcome for the benefits of the nation. Thus, learning Science and Mathematics in the English language should be given provision and support by everyone. At the end of the day, this move needs to be perceived as fostering opportunity instead of posing threat in the students' learning process.

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