Science and Technology Trends
Policy Trajectories and Initiatives in STEM Education

STEM Education in Malaysia: Policy, Trajectories and Initiatives

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1. Introduction

Malaysia places great importance on STEM education as a means of becoming a developed nation, and to achieve the targeted number of STEM workforce and ultimately to meet the challenges and demands of a STEM-driven economy by 2020. Malaysian government through The New Economic Model (NEM) aims to create 1.3 million jobs in STEM discipline in various sectors by 2020, enabling infrastructure and supporting the development of industrial clusters. NEM is an economic plan launched by the Malaysian Government in 2 010 with the main goal to transform Malaysia into an inclusive and sustainable developed nation by 2020. The NEM envisages that Malaysia will be renowned for vibrant transformation arising from the resourcefulness of its people and exemplified by its harmonious diversity and rich cultural traditions. The economy will be market-led, well-governed, regionally integrated, entrepreneurial and innovative. NEM intends to stimulate economic growth by improving worker productivity across all sectors of society. According to The National Council for Scientific Research and Development, Malaysia needs a workforce of 493,830 people in STEM related industries by 2020 to support the current government initiatives in NEM. This means that the rate of increase of STEM should be about 31% per year (MOE, 2013).

1.1. The Issues

Despite the government's commitment to align the STEM initiatives to the objectives of the New Economic Model, Economic Transformation Programme and the Government Transformation Plan launched in 2010, however, there are still challenges in implementing these policies. One of the major issues that Malaysia has been battling is meeting the human capital demand that will be necessary in 2020. The number of students who have chosen STEM fields has continued to decline in recent years (Halim & Subahan, 2016). Currently, only 42% of middle school students in Malaysia chose to do Science, including technical and vocational programmes at high school (MOE, 2016). The percentage of middle secondary school students who met the requirement to study Science at upper

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secondary but chose not to do so increased to approximately 15% (MOE, 2013). The current demand for STEM-capable workers surpasses the supply of applicants who have trained for those careers. The Ministry of Science, Technology and Innovation (MOSTI) estimates that there will be a shortfall of 236,000 professionals in STEM-related fields (MOSTI, 2012). Given these shortfalls for a STEM-capable workforce, the nation's economic future depends on preparing more students to enter these fields.

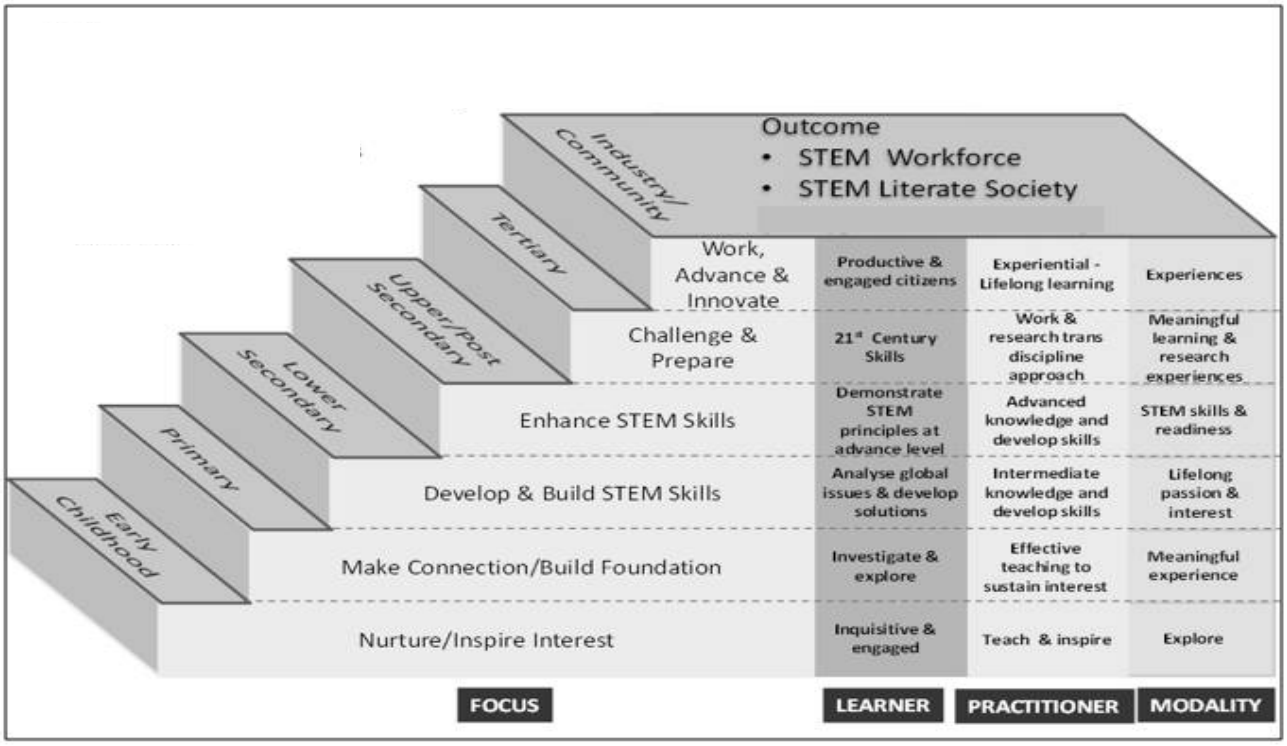
The second challenge is the decline in science and mathematics achievement of Malaysian secondary students in international assessment studies. Malaysia's performance in Trends in International Mathematics and Science Study (TIMSS) between 1999 and 2011 indicates that student performance has fallen. The results of the 2009 Programme for International Student Assessment (PISA) also showed that Malaysia ranked in the bottom third of 74 participating countries, below the international and Organisation for Economic Co-operation and Development (OECD) average. Parallel to this, according to Martin et al. (2012), a total of 18% of Malaysian children have limited prerequisite knowledge and skills in science classrooms; meanwhile, 55% of them had limited prior knowledge in science. According to MOSTI (2008), only 44.9% of Malaysians are interested in new science inventions or discoveries. In contrast, far more Americans (87.0%) and Europeans (78.0%) expressed an interest in these issues, exceeding Malaysians by 42.1% and 33.1%, respectively. These percentages are based on a general sample collection following on the children's interest in Science & Technology fields. As for the Malaysian population, this proves that more than one-third of the children clearly expressed a lack of interest in Science & Technology.

The third challenge is the quality of STEM education. The quality of STEM education is perceived differently by various stakeholders. One of the questions that is frequently asked by employers: Does the quality of STEM education in schools today fulfil the needs of the work force in STEM fields? and Are we preparing our students to meet the demands of the STEM-driven economy?. While for policy makers, the questions asked include whether our students are able to compete globally in international assessments or competitions. Studies shows that teaching and learning approaches are teacher-centred and students lack sufficient opportunities to be critical, creative and innovative (MOE 2013). Some teachers also lack the requisite knowledge in Science and Mathematics subjects. In addition, some teachers invest heavily in preparing their students for examinations, at the expense of the practical elements of the curriculum (MOE 2013). Students are not doing science experiments because the science practical examinations (in upper secondary level) have been replaced by school based assessment for more than 15 years which resulting in teachers are less likely to allow students to explore scientifically and mathematically due to perceived lack of time, resources, tools, professional support and laboratory infrastructure. This factor contributes to reduced student interest levels in this science.

2. STEM Education Conceptual Framework

The Malaysian STEM education aims at ensuring that Malaysia has STEM literate society and a sufficient number of highly skilled qualified STEM workforce that can contribute to new innovation. Cultivating a culture that values STEM at an early age is essential to increase awareness of the importance of STEM in the society. As shown in STEM education conceptual framework in Figure 1, Malaysia puts the importance of STEM education at the early childhood with the focus to trigger and fostering student interest through activities that can stimulate curiosity. At the primary school level,

Figure 1. STEM education conceptual framework



Source: Implementation Guide for Science, Technology, Engineering, and Mathematics (STEM) in Teaching and Learning , MOE (2016)

pupils are exposed to the basic of STEM knowledge and associate their knowledge with daily life situations through investigation and exploration activities. Then, at the lower secondary education level, the focus is to grow and develop students' STEM skills through activities involving analyzing local and global issues as well as problem solving. At the upper secondary level, activities that strengthening and enriching STEM skills will be given a priority. At the tertiary level, STEM education provides students with the ability to cope with STEM career challenges, to prepare them in industry and community as they will contribute to productivity and national development through innovation.

3. The Concept of STEM In Malaysia

To contextualize STEM in the Malaysian education system, various stakeholders in both basic and higher education sectors came together in 2014 to clarify the concept. They resolved that 'STEM' should serve as a benchmark to raise the standard of Malaysian S&T Education, aligning it with international practices. The concept of STEM is defined from three perspectives: STEM field, STEM stream and STEM approach (MOE 2016)

- *STEM field:* STEM as a field covers traditional disciplines such as Science, Chemistry, Mathematics, Sustainability Foundation, Technical Communication Graphics, and Computer Science, as well as the more specialized disciplines such as Mechanical Engineering, Medical, Bio-chemistry, and Computing & Information Systems.

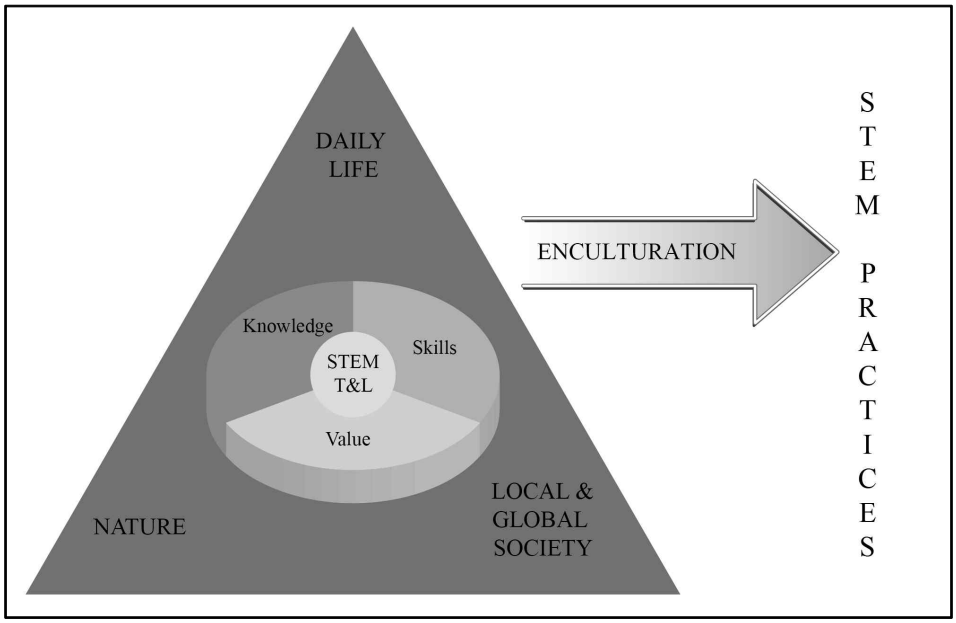
- *STEM Stream:* STEM Stream refers to enrolling of students in upper secondary school to a stream of their choice and inclination. In Malaysia school system, upper secondary students are given the opportunity to choose the stream offered either a Science or Arts Stream. Students who choose Science Stream studied Physics, Chemistry, Biology, Mathematics and additional Mathematics at upper secondary level. MOE then renamed the Science Stream to Science & Technology (S&T) Stream with the introduction of more specialized S&T subjects in school such as ICT and Invention. S&T Stream students were described as upper secondary students who studied a minimum of two sciences and mathematics subjects (Refer Table 1). Currently, 29% of students are taking all three pure sciences (Physics, Biology and Chemistry) with Additional Mathematics, while approximately 13% opt for two S&T subjects with Mathematics. As Malaysia MOE adopts STEM to replace S&T, a change of nomenclature to the STEM stream is being contemplated.

Table 1. Samples of packages offered to Malaysian upper secondary school S&T stream

STEM Subjects	Level	Hours per week (current)	Hours per week (beginning 2017)
Primary School			
Mathematics	1 & 2	3	4
Science	1	1	1.5
Science	2	2	2
ICT/Design & Technology	2	1.5	1.5
Secondary School			
Mathematics	3 & 4	3.3	3.5
Science	3 & 4	3.3	3.5
Design & Technology/Basic Computer Science (either one)	3	-	2
Computer Science	4	-	3
Elective STEM Subjects at Secondary Schools			
Additional Science	4	3	3
Additional Mathematics	4	3	3
Chemistry	4	3	3
Physics	4	3	3
Biology	4	3	3
Technical Graphic Communication	4	3	3
Basics of Sustainability	4	-	3
Invention	4	3	3
Sport Science	4	3	3
Home Science	4	3	3
Engineering Drawing	4	3	3
Mechanical Engineering	4	3	3
Agriculture Science	4	3	3
ICT	4	3	3

Note: Level 1 refers to Primary Year 1 – 3, Level 2 refers to Primary Year 4-6, Level 3 refers to Secondary Form 1-3, Level 4 refers to Secondary Form 4-5

Figure 1. STEM as teaching and learning approach



Source: Implementation Guide for Science, Technology, Engineering, and Mathematics (STEM) in Teaching and Learning , MOE (2016)

- *STEM Approach:* STEM approach refers to teaching and learning strategy that involving the application of knowledge, skills and values of Science, Technology, Engineering, and Mathematics, in an integrated manner to solve problems in the context of life daily, community and environment as shown in Figure 1. This approach encourages students to inquire and explore the environment through inquiries and problem solving related to the real world. Among the teaching and learning approaches are based on inquiry-based, project-based, and problem-based. In this approach, students learn collaboratively and engage in problem-solving activities as they research, investigate, design, evaluate, carry out inquiry activities, innovate and reflect. The learning experiences gained through these inquiry-oriented, problem-based activities, provide opportunities for students to understand relevant issues and ability to think critically as well as creatively about the process of solving related problems. This form of contextual learning involving design thinking in preparing students to face challenges and be competitive at the global level. In engineering design process, scientific and engineering skills are core skills in this approach. STEM students are also provided with learning opportunities to learn independently and to use technology.

In the teaching and learning strategies, STEM knowledge is an idea, concept, principle, theory and understanding in the STEM field that is enacted in the curriculum of all STEM subjects. The curriculum designed and developed aims to provide students with knowledge, skills and values through the activities provided by the teachers inside or out of class while in the classroom. STEM skills are the competence and competence to explore, solve problems, designing and producing products. Such skills can be obtained through the activities, projects or tasks that are desired in all curriculum STEM subjects. STEM skills consist of Process Skills and Technical Skills. Process Skills are the skills used in the learning process and apply knowledge in solving problems. Process Skills involving science

process skills, math process skills, design skills form and computational thinking skills. Technical skills are psychomotor skills involving manipulative skills, management and handling skills of materials, tools and machines in a manner that right and safe. While, values and STEM ethics is a moral and guidelines that must be complied with STEM students. The application of STEM values and ethics is important in producing students who are not only knowledgeable and competent, but has a high personality. Among the values being emphasized are systematic, objective, consistent, rational thinking, persevering, committed, challenging, courageous trying, open-minded, innovative, and more. While ethical examples should have complied with STEM students such as laboratory regulations, workshop rules and steps security measures.

4. STEM Elements in Malaysian Education Curricula

The Malaysian education system encompasses students from pre-school through university. Pre tertiary education (pre-school to secondary education) is under the authority of the Ministry of Education (MOE) while the custodian for tertiary education is the Ministry of Higher Education (MOHE). STEM in Primary School Standard Curriculum (KSSR), Secondary School Integrated Curriculum (KBSM) and Secondary School Standard Curriculum (KSSM) encompass three elements, namely the knowledge, skills and values available in the curriculum of all STEM subjects. Through all of these subjects the STEM Curricula at all levels (preschool to pre-university) in Malaysia are developed to address the needs of all students.

i) Pre-School: The emphasis of STEM at the pre-school level is contained within the National Preschool Curriculum (NPC). NPC emphasis on the acquisition of basic skills in STEM (scientific skills) through its two component which are Early Mathematics and Early Science. In Early Science, children explore nature and the world around them, engage in inquiry learning and acquire basic process skills such as observing, comparing and grouping in the process. In Early Mathematics, children are exposed to number sense, early numeracy activities and simple problem solving activities. Methods of delivery include thematic learning, play-based learning as well as inquiry-based learning. The emphasis of STEM in NPC is important for promotion of inquisitiveness and to develop early science and mathematics process skills.

ii) Primary and Secondary Schools Core Science Subjects: The primary and secondary school core science curricula are compulsory for all students. Primary Core Science and Secondary Core Science Subjects have been designed to reflect the characteristics of STEM education, especially the STEM approach. The curriculum emphasizes thinking skills, science process skills, problem solving in real life situations, designing, innovating, working collaboratively as well as inquiry-based learning using approaches such as the 5E (engage, explore, explain, elaborate and evaluate). Scientific attitudes and noble values are instilled through experiential learning either through spontaneous or planned activities. These attitudes and values, together with scientific knowledge and skills, are used in the process of scientific investigation and conducting projects. The Primary School Science Curriculum is organized under six themes: scientific inquiry, biological science, physical science, material science, earth and

space, technology and sustainable living. The Secondary School Science Curriculum is organized into six content areas, which are Management and Continuity of Life, Man and Variety of Living Things, Matter in Nature, Force and Motion, Technological and Industrial Development in Life, and Astronomy and Space Exploration. School Science education provides opportunities for students to explore through experiments and projects collaboratively.

iii) Primary and Secondary Schools Mathematics: The Mathematics curricula for both primary and secondary schools are designed to develop mathematical thinking among students. Mathematics Curriculum Standards stress on mathematical processes which are: problem solving, reasoning, communicating mathematically and making relationships and representations. Solving both routine and non-routine problems, as well as integrating the use of ICT in teaching and learning of Mathematics is essential in Malaysia's Mathematics curricula. Higher level thinking and non-routine questions are stressed to achieve the desire of the country to produce learners who are thoughtful, creative and innovative, competitive in the globalization era, as well as capable of facing 21st century challenges. The Mathematics curriculum covers content areas of Numbers and Operations, Measurement and Geometry, Relationship and Algebra, Statistics and Probability and Discrete Mathematics.

iv) Secondary School Elective STEM subjects: At the upper secondary level, students are allowed to choose elective subjects to be taken together with the core subjects. There are four groups of elective subjects, which are language, STEM, Islamic studies, humanities and professional arts. The list of STEM subjects and the time allocation is outlined in Table 1.

v) Pre-university STEM subjects: Pre-university courses related to STEM often include Physics, Chemistry, Biology and Mathematics. These subjects are foundation to various STEM subjects and programs at the tertiary level.

5. STEM Education Related Policies In Malaysia

The Malaysian government has identified STEM as one of the catalysts for transforming the country to a developed status by 2020. The value chain of the educational system must be in sync to meet the demand of human capital trained in STEM with STEM-related human capital, resources and infrastructure being the necessary pillars in this endeavour. The Government of Malaysia has painstakingly integrated STEM development into many of its policies as well as developed specific STEM policies in order to achieve the target set by the country. This section highlights some of the important STEM Education-related policies.

5.1. 60:40 Science/Technical: Arts (60:40) Policy

Malaysia places great importance on education as a means of becoming a developed nation to meet the challenges and demands of a STEM-driven economy, by 2020. Accordingly, the Malaysia Higher Education Planning Committee instituted the 60:40 Science/Technical: Arts (60:40) Policy in education in 1967 and started implementing it in 1970. The policy refers to the Ministry's target for the ratio of students with significant STEM education to those with a greater focus on the Arts (science to arts ratio should be 60:40) in order to fulfill the future

demand of a developing nation. The policy has been used as an anchor in planning for students' enrolment, infrastructure prepared, teaching prepared, teaching staff trained in the secondary school and tertiary education in the last four decades. This policy has, however, never been met due to various factors. Currently, 42% of students in upper secondary school level are a STEM stream (MOE, 2016). Although the target of 60:40 has not been achieved, MOE continues to pursue this policy, which has so far contributed to production of a significant proportion of STEM manpower. Science and Mathematics are compulsory subjects for all primary and secondary school students. However, at upper secondary school, students can opt to join a STEM Stream and take more S&T related subjects or remain in a non-STEM Stream taking only one core Science and one core Mathematics subject. Upper secondary school STEM Stream students take an average of five STEM subjects and spend an average of 15 hours per week studying STEM subjects. This curriculum policy prepares the students for future STEM studies or careers.

Under the 60:40 policy, students who score a grade A or B in both Science and Mathematics at the Lower Secondary Assessment which is administered at the end of lower secondary school are automatically placed in the STEM stream at upper secondary level unless there is an objection from the students or parents. For the last four decades, this policy has facilitated selection of students who have the necessary aptitude and academic ability to study STEM subjects.

5.2 Malaysia Education Blueprint 2013-2025 (PPPM 2013-2025)

Strengthening of STEM initiative is one of the 100 major initiatives in the MEB and taking into account the success of the MOE strategies to achieve the 60:40 Science/Technical:Arts Stream Policy. MOE will ensure that it prepares students with the skills required to meet the challenges of a world that is being transformed by the applications of science, technology, engineering and mathematics. It will also work in laying the foundations at the school level towards ensuring that Malaysia has a sufficient number of qualified STEM graduates to fulfil the employment needs of the industries that fuel its economy.

The MOE through the MEB has implemented various strategies to strengthen the STEM related subjects in its effort to produce more experts in the field for national interest. Strengthening STEM is one of the key elements under the shift of 'providing equal access to quality education of an international standard. At the out-set of MEB, factors contributing to enrolment and quality of students' outcomes in STEM were identified, specifically on unawareness, curriculum, quality of teaching and learning and infrastructure. Three core measures under this STEM initiative were identified:

i) Raising student interest through new learning approaches and an enhanced curriculum: incorporating higher-order thinking skills, increasing use of practical teaching tools and making the content relevant to everyday life to increase interest;
ii) Sharpening skills and abilities of teachers: training teachers in primary and secondary schools to teach the revised curriculum; and
iii) Building public and student awareness: increasing parents and students' STEM awareness through national campaigns.

The ultimate aim of the STEM initiative is to ensure Malaysia has a sufficient number of qualified STEM graduates to fulfil the employment needs of the industries that support its economy. STEM graduates are expected to take up jobs in among other sectors, engineering and medicine. Further to

Table 2. Aspects of STEM under MEB

Wave	Focus
Wave 1 (2013–2015): Strengthening the foundations	• Raising students' interest through new learning approaches and an enhanced curriculum emphasizing higher order thinking Sharpening skills and abilities of teachers • Building public and student awareness • Enabling high performing teachers and school leaders
Wave 2 (2016–2020): Building on the foundations of Wave 1	• Rolling out the new primary and secondary schools curriculum (KSSM and Revised KSSR curriculum) • Encourage development of inter-school learning communities • Upgrade existing science equipment and facilities in schools to ensure that they are optimal for effective teaching and learning of STEM • Extension of STEM awareness programmes, to primary school students and parents • 50% reduction in the urban-rural students' achievement gap, 25% reduction in the socio-economic and gender students' achievement gap
Wave 3 (2021–2025): Innovating to the next level	• Introduce fresh initiatives and programmes based on the success of the first two Waves and develop a roadmap for the future • Maintain or improve on 50% reduction in the urban rural, socio-economic and gender students' achievement gap

providing quality STEM education through the academic pathway, MEB also promotes the vocational education pathway. Projections show that by 2020, at least 46% of all jobs will require vocational certificates or diplomas compared to 22% requiring university degrees (MOE, 2013). Majority of these vocational courses are STEM related. This will also contribute towards achieving the 60:40 policy.

MEB is being rolled out in three (3) phases which is called Waves: Wave 1 on strengthening the foundations, Wave 2: building on the foundations in Wave 1, and Wave 3: emphasizing innovations. Aspects of STEM under each Wave are outlined in Table 2.

6. National STEM Action Plan

To deliver the STEM education aspirations as outlined in the related policy, MOE together with Ministry of Science, Technology and Innovation (MOSTI) and Ministry of Higher Education (MOHE) are currently developing a National STEM action plan which involves all government agencies in Malaysia and in collaboration with private sectors. This action plan looks into many aspects of STEM such as awareness, education, infrastructure, research, career opportunities, and information gathering. In terms of information, MOE are trying to get a comprehensive data from both supply and demand sides to set the required number of STEM graduates and the required learning courses.

As part of National STEM Action Plan, MOE is implementing an initiative called STEM Education Initiative. MOE defines its concept of STEM Education as life-long learning which integrates; formal learning for STEM which is based on the national curriculum and assessment; non-formal learning through students' participation in co-academic and co-curricular activities; and informal learning through indirect means at all age level from early childhood, primary and secondary level, at tertiary level up to the industry and community. In other words, it is advocated that all students must be STEM literate with the hope that

through this initiative, more students will choose to be in the science or STEM related stream for their upper secondary education. This is to achieve the target on having 60% of upper secondary students to pursue in STEM related stream.

The outcomes that are hoped to achieve under the STEM initiative are to nurture STEM-literate students who are capable of logical thinking, adept at using technology, have the skills to solve problems, innovate, create new ideas, design or invent new products; skills which shall be acquired through an integrated learning of science, technology, engineering and mathematics, and a teaching and learning process which apply the real world context through open-ended exploration and hands-on approach.

In preparing students with skills to meet the challenges of science and technology which is continuously evolving, and to ensure that Malaysia has sufficient qualified STEM graduates, measures taken to support the STEM initiative include stimulating students' interest in STEM through an enhanced curriculum and new learning approaches, sharpening teachers' skills and abilities to teach and facilitate STEM subjects and activities, and building public and student awareness and understanding of STEM. Among the strategies implemented to support the teachers include:

i) Colloquiums and Conference on STEM – the colloquiums are organised to create awareness among school administrators, teachers teaching STEM subjects as well as school counsellors about STEM and STEM-related careers, while the conference provides opportunities to academicians and other researchers to share their research findings related to STEM, as well as create a platform for professional networking among academicians and school teachers. These would encourage further collaborations among them in enhancing students' awareness and interest towards STEM, sharing best practices in teaching and learning and/or in developing new approaches in teaching and learning;

ii) Developing a series of interactive videos to complement teaching and learning activities known as the Blended Learning Open Source Science or Math Studies (BLOSSOMS). This was started in 2015 in collaboration with Massachuset Institute of Technology (MIT) and University of Technology Malaysia. Now, MOE is collaborating with University of Technology Malaysia to continue developing more videos to assist the teaching and learning of STEM

iii) Developing Exemplar STEM Resources – a teaching and learning module for STEM subjects which employs a project-based approach. 12 modules have been developed last year and 17 more modules are being developed this year;

iv) STEM Teachers Competency Assessment – a diagnostic test on Science and Mathematics teachers to gauge their knowledge and skills in STEM areas. Teachers who did not perform at the 'Good' and above level will be identified and given professional training to enhance their competencies;

v) Science practical training for secondary and primary school teachers.

There are a lot of strategies to support students in this STEM Education Initiative. One of it is the introduction of the STEM+ Club which inculcates creativity and innovation among students through STEM-based activities. This year, this club was established in 30 schools as a pioneer project. This project is also in collaboration with British Council Malaysia and Malaysian Industry-Government Group for High Technology (MIGHT). Among activities in this club are hands-on activities in real

world context related to STEM topics that student has learned in school. For example, application of force and motion where students are encouraged to explore alternative designs for flying objects and create their own. An exploration of how things fly brings endless opportunities for exploration and innovation. In this activity, student uses a "squeeze" bottle to launch a straw "winged missile". This can be done as a competition to see who can create the effective glider for accuracy or distance.

There are also some outreach programmes initiated by higher learning institutions and STEM related agencies who support and expose students to careers in STEM. One of the programmes under STEM education initiative is called STEM mentor-mentee Programme. This is a collaboration between universities and schools where professors/lecturers become mentors to teachers while students from higher education institutions become mentors to school students. The main objectives are to increase/strengthen the content knowledge of the teachers especially with the latest development in STEM field and to increase the interest of students in STEM by doing hands-on activities and relating what they learn in school to the real world contexts with the help from their seniors at university. It is more effective when mentors are among seniors at university as compared to teachers as mentors to students.

MOE has also work with other government agencies as well as private sectors in Malaysia in organising various competitions, hands-on STEM sessions and STEM camps. One example is a competition called School Lab Competition co-organised by British Council Malaysia and the MOE with collaboration from MIGHT and Petrosains. In this competition, students have to create a video describing a STEM concept creatively and with innovation. The video produced can be in a form of an act, a song and others. The video will then be uploaded into YouTube for evaluation. 8 best videos were selected from each state for final event at the state level and 5 videos from all states were selected for final event at the national level. The competition organised early this year has created a lot interest among students and teachers. Many students said that their interest in STEM has increased tremendously through this competition even though their videos were not selected for final event at the state or national level.

MOE has also initiated School-Parents Collaboration to develop parent's role as partners with school to improve children's awareness about the importance of STEM fields and STEM-related careers. MOE are currently developing a STEM based reality TV programme. It is a game show with 12 episodes where in each episode participants need to have strong STEM knowledge in order to advance and win the game. This programme will be aired on our national/private TV channel and can be viewed by public. It is hope that this programme will increase parents' awareness on STEM education.

Engaging volunteer from various STEM-related organisations as their corporate social responsibility (CSR) to collaborate with parents and the wider community, the private sector to support girls in pursuing careers in STEM. We have established an organisation called National STEM Movement. This organisation comprises of members from government agencies, universities, private organisation and people from industry. So far, National STEM Movement is doing a great job in creating awareness on STEM among parents and public as well as getting more students into STEM education through activities such as STEM Carnival, mentor mentee programme and STEM colloquium.

7. The Way Forward

STEM education in Malaysia has undergone various curricula and policy changes. These changes are still ongoing for the goal are not fully met as

well as the need to keep in pace with the ever evolving knowledge in the improvement of STEM education. The way forward for Malaysia future directions of STEM education we believe is to strengthen the (i) quality of STEM curricula and instruction, (ii) enhancing professionalism of STEM teacher through long term continuous professional development plan, (iii) creating quality STEM teacher educator workforce in university and teacher training institution, (iv) more opportunities for informal STEM activities through collaboration with STEM's related agencies, (v) campaigns to educate the public about the diversity of career opportunities in STEM, and (vi) popularizing informal STEM learning centres, using more contemporary youth oriented approach in teaching and learning, and partnership between schools and relevant agencies in collaborative research or projects. Continual research on the effectiveness of the curricula, policies and initiatives should be given priority in the strategic plans related to STEM and STEM education.

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