STEM EDUCATION IN MALAYSIA: BARRIER AND CHALLENGES

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ABSTRACT

This concept paper is presented to review about barriers and challenges of STEM education in Malaysia. Malaysian government has introduced a new National education Policy in 2013. The main objective of this policy is to produce a workforce that can compete in the international arena and drive the country’s economy forward. To realize this dream steps have been taken by our government. The 21st century learning technique and an emphasis on STEM (Science, Technology, Engineering, Mathematics) are a few wise steps taken by our government. Teachers play vital role to make this plan to work. However recent studies shows that this STEM education in Malaysia are not showing positive outcome. Lack of subject contents knowledge, shortage of STEM teaching skills among teachers, non-option teachers, lack of motivation and guidance, lack of time are some of barriers to implement STEM in Malaysia. There are few suggestion that can be taken by government in order to make this STEM education successful. Involving professionals in science and mathematics to guide science and mathematics curriculum and make it more contextual and based on every day life. The trainee teachers of science and mathematics should be taken from the outstanding students. Besides that they should offered programs to study Bachelor of Education that provides knowledge to teach STEM education to future generation.

Keywords: STEM, STEM Malaysia

INTRODUCTION

STEM Education

Science, technology, engineering and mathematics are four fields that drawn attention in worldwide (Hwang, & Taylor 2016). Almost all the developing as well as developed countries are spending big amount of money to develop these four fields. These four fields of research and practice are framed as the acronym “STEM” (Jayarajah et al. 2014). According to Gonzalez and Kuenzi (2012), the term "STEM education" refers to the teaching and learning in science, technology, engineering, and mathematics; usually include educational activities at all grade levels, from pre-school to post-retirement, and in classroom settings formal and informal.

Özlem Özçakır Riverside (2016) believes that STEM education can contribute to the development of 21st century skills. Scientific investigation involves the formulation of questions that can be answered through investigations. Meanwhile the engineering design involves the formulation of a problem that can be solved through the construction and evaluation. STEM education brings these two concepts together through four disciplines (Kennedy, TJ and Odell, MRL, 2014). In 2013 Bybee (2013) clearly states that the overall objective of education is to continue to develop STEM for a STEM literal community.

Ciftci (2017) strongly believes that the STEM education will educate students an interdisciplinary perspective. Moreover it can develop 21st Century skills among students. Knowledge about creative problem-solving, critical thinking and scientific process skills will be learned by students too. It contributes to develope a positive
attitude towards STEM disciplines among students. STEM education also can contribute to the economic development of the countries. It supports the upbringing of individuals who are innovative, inventor, self-confident, and technology literate. STEM proficient students will prepare the nation to be a global leader in an increasingly global economy (Hwang, & Taylor 2016). Students with innovation, creative, independent, logic, and IT-savvy will be created by STEM education (Khairani 2017).

According to Hwang & Taylor (2016) regardless of its importance, however, “STEM” is still a buzzword in education that is ambiguous and has no clear definition or framework. More scientist is trying their best to recognize and interpret STEM in educational perspectives. Some researchers have referred STEM education as a broad education category involving mathematics, science, engineering, or technology education; thus, teaching any one of the four disciplines can simply be referred to as STEM education.

**STEM Education In Malaysia**

Malaysia is in the aim to become a developed nation in 2020. To achieve that, it requires a sizeable number of skilled workers in science and technology sectors. To meet this requirement, the government has turned its attention to encourage students to enrol in Science, Technology, Engineering, and Mathematics (STEM) subjects through the integration of STEM education in teaching and learning in the year 2017. (Khairani 2017)

The roadmap for STEM integrated education in Malaysia is well documented in the Malaysian Education Blueprint 2013-2015. The blueprint underlines three steps to strengthened STEM education interest. Firstly, is to increase students’ learning approaches as well as improved curriculum. Strategies that can be implemented range from the inclusion of higher order thinking skills to making subject content relevant to everyday life. Secondly, by improving teachers’ skills and competencies through continuous training. Thirdly, the Ministry of Education has also put efforts to increase both students and parents awareness about the importance and opportunities in STEM fields (Khairani 2017).

Malaysian science education is aiming at making science more appealing to students and indirectly inviting more students to pursue their studies in science-related areas to realize Malaysia’s goal of becoming an industrialized country (Saat, 2012) (Jayarajah et al. 2014). With respect to the research areas in Malaysian STEM education, compelling evidence has shown that there is a clear dominance of studies on technology compared to other STEM disciplines in Malaysia (Jayarajah et al. 2014).

**Barrier and Challenges**

STEM education in Malaysia still in a very early phase. There are a lot of barriers and challenges that faced by the teachers to implement STEM education in their teaching and learning process. In this concept paper I would like to highlight some of them.
Lack of Knowledge of Subject Contents

Content of knowledge in the subjects among teachers is an important issue that has been studied extensively in research. Strong content of knowledge has been consistently identified as a key element for teachers to carry out an effective teaching STEM (Alabdulkareem Abdullah Saleh, 2016). But a study conducted regarding the teaching of STEM found that many teachers who teach all four subjects, are less knowledgeable in their field. This causes teachers who are less interested in STEM education carry out teaching and learning that make students not or less understand the STEM subjects.

Shortage of STEM Teaching Skills

Studies show that most teachers do not have the skills needed to provide an effective STEM education when they begin their teaching profession (Balikesir, 2014). Teachers should familiarize themselves with new knowledge. However, it’s not the teacher’s job to provide answers to all the students questions; Rather, the purpose of the teacher is to enable students to conduct independent research and form their own opinion and evaluation (Wong, 2008). Students who are in the 21st century are supposed to move on their own without depending entirely to the teachers.

Highly successful science teachers use their professional knowledge to engage their students in learning science (Avraamidou, 2015). These teachers also use student engagement to produce learning (Spratt and Florian, 2015). Skills such as these are less applied by novice teachers. This would subsequently lead to low quality of teachers and less attractive STEM teaching and learning process.

Non Optional Teachers

Many rural schools face the problem of lack of teachers. Due to the shortage of teachers, teachers who specialize in other areas are sometimes required to teach STEM subjects. Teachers who are not in this option are usually not prepared and are not comfortable with the teaching of these subjects (Friedrichsen et al., 2007). This results in severe drop in student achievement for STEM subjects. The Non optional teachers can not run the STEM teaching and learning process effectively. This in turn can lead to the drop of the STEM subjects.

Experience While Being A Student

The experience of a teacher when he or she was a student and how STEM subjects are also applied to them is very important factor too. It is widely accepted by science teachers, teaching in general that they are influenced by the way they learn science. They maintain their classroom practice same like how their teacher taught them decades ago. However, it is clear from the observations of their classroom that they teach properly like the way they were taught (Dolphin and Tillotson, 2015). But it is not necessarily the correct pedagogy to teach STEM for the 21st century.

Research by Volkinsteine et al. (2014) concerning the skills to organize student’s scientific investigations shows that teachers are fail to understand that the investigation process requires active participation by students in STEM teaching and learning process. The changing role of the teacher from the provider of information to
the consultant is still not accepted by most teachers. Therefore the teacher still apply conservative way in which they studied STEM subjects in the past

Lack of Motivation and Resources

The quality of a good teacher to some extent depends on the motivation and the resources provided to the teacher. The teachers in rural and remote areas do not have adequate resources to handle this STEM teaching and learning process. Apart from that they also lack of guidance from experienced STEM teachers. This is recognized by Kasey (2014) in which the lack of guidance given to the new rural STEM teachers and limited opportunities to collaborate with other STEM teachers in rural schools. This in turn will affect the quality of STEM teachers in rural areas. Teachers who do not receive sufficient resources and motivation can not successfully conduct STEM teaching and learning process.

Time Limitations

STEM teaching requires a long time. This is because the students have to participate actively in the STEM teaching and learning process. Although teachers have a responsibility to recognize that a variety of teaching science method or activity can stimulate the intellect in them, they also complain that it can be time consuming (Kasey, 2014)  

Apart from the syllablesthat needs to be taught is very long. Indirectly Malaysia practice exam-oriented teaching. So many of the teachers teaching and learning process of STEM focus on the exam. The teachers have a lot of syllables to cover and train the students to answer the exam questions. The teachers find teaching and learning process of STEM as a burden and a waste of time.

Improvement of STEM Education

Here are some recommendations for improvement that can be used in our country to improve STEM.

Quality improvement of curriculum and training of teachers in the context of Malaysia

a. Involving professionals in science and math to guide science and mathematics curriculum and make it more contextual and based on everyday life. They may also be invited to the school to teach students about some of the scientific concepts in a teaching session.

b. Teaching and learning process based on exam, and a teacher-centered lecture (chalk and talk) should be minimized. It should be replaced by student-centered teaching and learning applied means (meaningful learning) using a variety of techniques and tools such as ICT and objects that can be found around the students and the school.
c. At least 50% of the proposed practical science in the curriculum must be implemented so that students can understand the concept of science and master the science process skills that are important.

d. The teachers of science and mathematics should be taken from among the outstanding students and be offered programs to study Bachelor of Education that provides content balanced knowledge and pedagogy.

e. Aspects of Pedagogical Content Knowledge (PCK) must be emphasized with regard to the curriculum of Bachelor of Education balanced in terms of content knowledge and skills in science and mathematics pedagogy.

f. The teachers of science and mathematics who have completed their postgraduate studies by using study leave scheme such as the Federal Training (HLP) must agree to serve in rural areas for at least 5 years.

g. Graduate training programs in science and mathematics teachers in higher education institutions should be strengthened. Students studying science and mathematics as well as science and mathematics teachers should be seen as an important and critical to national development. Science and mathematics teachers should be encouraged to obtain a qualification of at least a Master's degree in Education. Among the countries most successful in school education are Finland (Burridge, 2010) in which teachers undergo education and training program for 5 years covering two degrees, namely Bachelor of Education and Master of Education (Smith, 2009; OAJ, 2008).

h. Kursus Dalam Perkhidmatan (KDP) and the Professional Development conducted in-house to monitor its effectiveness.

i. Monitoring and supervision of science and mathematics teachers should be done at least 4 times a year, either by the Committee for science and mathematics, the fields of science and mathematics teachers, Principal, District Education Officer, Education Department or Officer of the Inspectorate. Supervision reports should be discussed with the teacher and can be used as a valuation for critical allowance.

j. Mentor-mentee system between experienced teachers and new teachers need to be carried out more openly.

k. The issue of increase in science and mathematics teachers also give an indication that the school is able to open more classes for science and mathematics that have smaller class sizes. The ratio of science and mathematics teachers to the number of students in science and mathematics classes should be examined (Fatin Aliah Phang et al., 2014)

Conclusion

It is clear that the quality of teachers is important in the implementation of STEM education in our country. However, we can’t point the finger at teachers and put the burden 100% on the teachers to make STEM education successful. The MOE should provide resources, expertise and motivation to teachers. Students and parents also need
to be more open minded and parents need to motivate students to be more of a 21st century student. Students must study a subject with the inquiry method in which the teacher acts only as a facilitator.
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