

The Issues and Challenges in Empowering STEM on Science Teachers in Malaysian Secondary Schools

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Abstract

As a proactive step to put Malaysia on par with other developed countries, the agenda on empowering STEM has been clearly stated in Malaysian Education Blueprint 2013-2025. However, the issues related to STEM education, that is science teachers' exposure and training for continuous professional development is a concern. Thus, the main purpose of this study is to identify the issues and challenges that science teachers faced in implementing STEM in secondary schools, and to determine the effects of the issues arising on teachers' performance. This study also intends to find out the training required by Science teachers specifically in STEM Education. The research employed qualitative methods where interviews were conducted among 15 Science (Chemistry, Biology, Physics or Science) teachers at respective schools in Selangor, Kedah, Penang and Johor. In this research, findings showed that science teachers exposure and training on STEM, a lack of facilities, inadequate budget, heavy workload, time constraints and also lack of support from school leaders. These issues greatly affected Science teachers' performance because it negatively affected their motivation, level of stress and also job satisfaction when teaching the students. Specific trainings and exposures on STEM were mentioned by respondents to ensure their continuous professional development. Collaboration with university and industries were also among the alternatives proposed for STEM empowerment.

Keywords: STEM, Science Teacher, Teaching and Learning, Continuous Professional Development.

Introduction

STEM education is an approach used to enhance students' interest and skills towards Science, Technology, Engineering and Mathematics. It is one of the initiatives stated in Malaysian Education Blueprint 2013-2025 that underlines important skills, i.e. higher order thinking skills among secondary school students. The approach uses engineering and technology for

teaching and practice in science and mathematics simultaneously (Bahrum, Wahid, & Ibrahim, 2017). It also an approach requires students to explore their learning process between two or more of the four subjects. STEM education in Malaysia is strengthened through Malaysia Education Blueprint 2013-2025 to boost students and teachers' interest towards STEM education. The first STEM was implemented in the United States in the early 90s. The mission was to ensure that the citizens of The United States pursued Science, Technology, Engineering and Mathematics education as well as chooses careers in STEM fields such as engineering, medicine and science (Bahrum, Wahid, & Ibrahim, 2017). Previously, STEM education was known as SMET (Science, Mathematics, Engineering and Technology). However, it was improvised by the National Science Foundation (NSF) to STEM in order to simplify the terms (National Academy of Science, 2007). The focus of STEM education in Malaysia is to educate learners and provide them with the acquired skills for them to become productive citizens. Since Kurikulum Standard Sekolah Rendah (KSSR) and Kurikulum Standard Sekolah Menengah (KSSM) are considered as new curriculum in the current system for government school in Malaysia, therefore, a lot of important steps must be considered to ensure that the implementation runs smoothly. As highlighted in Malaysian Education Blueprint 2013-2025, these curriculums emphasize STEM education as one of the important approaches to be implemented by Science teachers. STEM focuses on teaching and learning based on higher order thinking skills (HOTS), problem-solving, collaborative learning, project-based learning as well as inquiry-based learning. The Malaysian government committed in ensuring that these curriculums meet the characteristics of STEM implementation. This is clearly seen in the 'Blue Ocean Strategy' that contained inside Malaysia Education Blueprint 2013-2015, which is divided into three phases; (i) Wave 1 (2013-2015): Build momentum and lay foundations (ii) Wave 2 (2016-2020): Accelerate system and improvement (iii) Wave 3 (2021-2025): Move towards excellence with increased operational flexibility. The first phase stressed on building momentum and laying foundations for STEM Education. The first phase was successfully achieved in 2015 and now the Ministry of Education is in the second phase; the stage of empowering STEM education.

In the last decades, the number of students taking up STEM subjects has been declining which shows the ratio of science classes compared to art classes is one to five. This ratio indicates that Malaysia needs progressive steps to increase the number of students in taking STEM subjects. As highlighted in Malaysia Educational Blueprint 2013-2025, the government projected 60:40 ratio of Science/Technical:Arts. However, the target was not achieved. In 2014 only 45% of the students taking science stream, technical and vocational subject in their studies. Most of the students choose not to do science in upper secondary school and the percentage is increased to 15%. This proved that there is a declining number of students who enrolled in STEM subject as reported in MEB 2013-2025 (Wave 1) report. According to Subotnik et al (2010), one of the reasons of declining number of students' enrolment for STEM subjects is due to lack of interest which then bringing them to be involved in non-STEM subjects. The secondary students showed lack of interest as well as limited awareness about STEM subjects. Apart from the lack of students' interest in STEM subjects, Malaysia is also facing difficulties concerning with adequate integrated STEM exposure and training. The information and knowledge related to STEM become rapidly updated and outdated that some teachers are left behind in this new advancement and knowledge in Science and Mathematics (Shahali, Ismail & Hashim, 2017). Teachers also have less time to adopt new teaching approaches in their teaching and learning due to heavy workload. Increase in teachers'

workload have caused ineffective teaching performance among Science teachers (Koo, 2008). Moreover, adequate facilities and equipment are crucial aspects that every school must have in order to have successful STEM teaching (McGowen, 2007). However, this is in contrast with the current condition in Malaysian schools where large percentage of schools are not equipped with enough facilities and equipment (Raman & Mohamed, 2013). The lack of proper facilities and equipment in the school affect the students especially in term of active participation and critical thinking of the students in teaching and learning (Afework & Asfaw, 2014). In order to make sure the mission of STEM empowerment is successful, it is vital to determine the issues and challenges experienced by students and teachers as well as the trainings and exposure required by Science teachers' continuous professional development.

The purpose of this study is to identify the issues and effects relating to STEM education faced by secondary school Science teachers. The stated objectives that accompanied the study are:

- 1) To identify the issues and challenges that Science teachers' faced related to empowering STEM in secondary school.
- 2) To determine the effect that arises from the issues and challenges Science teachers faced.
- 3) To find out the training required for STEM related activities, program or even classroom teaching for Science teachers' continuous professional development.

Literature Review

It is important to start STEM education at the early age of childhood because the children can build their interest towards science, technology, engineering, and mathematics at this age. When the children enter primary school, they can continue gaining the knowledge through investigation and exploration activities. Once in the lower secondary level, the children can start to analyze the problems that happen in their daily life as well as solving them. As they passing the upper secondary level, they will explore the activities that will strengthen their STEM skills. Furthermore, the students at tertiary level will learn how they could cope with STEM career challenges and contribute to national productivity simultaneously. The main focus of STEM education in Malaysia is to educate the children and provide them with the acquired skills in order to become a productive citizen. Since KSSR and KSSM are still new in their implementation, there are many actions and steps to be considered to ensure that the implementation run smoothly. KSSR and KSSM curriculum put STEM education as one of the approach elements in its implementation. According to Ministry of Education (2016), STEM curriculum involved three elements; knowledge, skills, and values.

Knowledge in STEM education is all about ideas, theories, principles and understanding of STEM field. The designed and integration of STEM curriculum purposely to cultivate knowledge, skills and values and ethics among the students. This aim can be achieved through series of activities developed by teachers either inside or outside of the classroom during teaching and learning process. Besides students, science teachers also needs to have continuous STEM knowledge and exposure in order to make sure everybody equipped with updated knowledge and development in STEM education.

Skills in STEM education can be defined as the ability of the students to identify and solve the problem and also design and produce product. These skills can be developed through series of activities and projects that already planned in the curriculum. There are two elements in

STEM skills i.e process skills and technical skills. Process skills are the skills that use knowledge that obtained from solving the problem arises. In contrast with technical skills, where these skills more emphasized on practical field and related to mechanical, informational technology and mathematics. Example of process skills are science process skills, thinking skills and design skills, while example of technical skills are the management of tools and machine, knowledge of programming knowledge and manipulative skills.

STEM Education also emphasizes on values and ethics. Good morality and values must be practices during teaching and learning session whereas it is important to have students who are not only knowledgeable but they also having good personality. The important values i.e systematics, objective, think rationally, consistent, innovative, challenging, open-minded and others. In contrast, ethical examples that should be followed are workshop rules, laboratory regulations and safety precautions.

Issues faced by Science Teacher on STEM empowerment in secondary school

There are a lot of factors that contribute to the issues on empowering STEM in school. The issues arise could be internal or external which it can affect the teachers' performance in school. According to Shahali, Ihsan Ismail & Lilia Halim (2017), the teachers lack of pre-requisite knowledge on STEM and lack sufficient opportunities to be critical, creative and innovative. Even though the teachers are provided with STEM education, the information and training that they received are not enough as the time allocated for the courses is limited.

On the other hand, according to the research conducted by McGowen (2007), he analyzed that STEM education also affected by lack of available facilities and equipment in the school. This is true to some extent as highlighted in the Curriculum Development Malaysia (2016) whereby teachers were not able to conduct activities as there were insufficient time, laboratory supplies and equipment, and budget allocated. Thus, barrier limits the students to explore and discover more on the science and mathematics.

In addition, 'Finish syllabus syndrome' is one of the crucial issues occurred in every implementation of new approach in education (Goh, Pauline, Matthews and Bobbie, 2011). Teachers and students are overly attached with the examination-oriented system which required them to finish up the syllabus. Due to that, the teachers are not having enough time and what it worse is they are also burdened with the heavy workload.

In addition, a declining number of students in Science stream indicate a negative effect toward the implementation of STEM. As eloquently stated by Amnah (2014), the declining number of students in science stream occurs due to fear and lack of confidence to proceed in STEM field. This is because they felt science stream have heavy syllabus compared to the other stream.

Lack of support from the administrator is another issues. According to Schwier (n.d.), the support from school administrator is very important in which the school heads need to be open-minded in supporting teachers when it comes to implementation of new approach. In this context, the school administrator does not take part in STEM education. Worsen the situation is when they even do not know the problem faced by the teachers in the school.

Methodology

For this specific study, a qualitative approach is used whereby data were gathered through interviews and supported by document analysis of Malaysia Education Blueprint 2013-2025 produced by Ministry of Education. It is considered appropriate as the information and rich data could be acquired to specifically answer the objectives stated. A set of guidelines on what to ask the respondents was prepared prior to the interviews. The study used purposive sampling. The target population was secondary science teachers who are directly or indirectly involved with teaching of Science related subject in secondary schools in Malaysia. Fifteen Science teachers agreed to participate. All interviews were tape recorded and for the analysis purposes, later being transcribed according to specific themes that correspond to the objectives of the study.

Findings and Discussion

In this section, the discussion focuses on the following features; a) the issues and challenges to align with the objective stated earlier that science teachers' faced related to empowering STEM in secondary school; b) the effect especially on their teaching performance based on the issues that are being highlighted; c) the training required in teaching STEM-related subject for their continuous professional development.

All respondents highlighted many issues faced by them with regards to empowering STEM in school. The most frequent issues mentioned by respondents is on the teachers' exposure and training related to STEM empowerment. Out of fifteen respondents involved in this study, twelve respondents highlighted on this issue. They clarified they knew and being informed on this initiative, but there is no further training given to them.

"...I understand about STEM and most of the teachers were informed about the implementation of STEM. However, there is no enough training ..." (Respondent 2)

"...we were informed on the STEM empowerment. We even participate actively in STEM program and encourage more students to join the activities. However, continuous training is really important. We need the skill to ensure our knowledge and skill related to STEM activities keep updated..." (Respondent 5)

"...I was instructed to do STEM program in school, but only instruction given without any trainings or guideline given..." (Respondent 6)

"...It is so sad to highlight this issue but for the past two years when I joined this school, there is no initiative taken by the school administrator or even my head of science department to do training on this. I always get advise from my friends who experienced conducted STEM program..." (Respondent 8)

"...yes now we need to do many STEM activities during teaching and learning. I just do based on what I understand and read from the internet. No trainings or coaching given to me..." (Respondent 9)

"...the best part is we were given KPI to do STEM activities and program but when I ask any guideline or any example of activities, the answer is no and I need to outsource on my own..." (Respondent 13)

"...I do STEM activities in class and the students really enjoy during the lesson, but sometimes I am also unsure whether what I did is the real STEM skill to be exposed to my students or not..." (Respondent 15)

Besides, some respondents mentioned those who are selected to go for specific trainings or talk on STEM empowerment, there is no action taken by them to do in-house training or exposure to other Science teachers.

"...as far I know, there are many trainings and talk on STEM, normally our Head of Science Department will attend but there is no in-house training conducted to us, sometimes she just shares the notes she got..." (Respondent 1)

"...I don't know how to explain, yes there are trainings provided by ministry but those who attend looks like only for individual exposure because they don't even have initiative to do in-house training. Some of them also like not interested to do STEM activities even they went for training..." (Respondent 3)

"...we have LADAP, but it was not being utilised to do real training for Science teachers. Normally what we have like talk or any presentation related to issue on teaching and learning. It not even helpful to improve our skill in conducting STEM activities or program..." (Respondent 4)

Training and exposure on STEM empowerment are elements that are really important for every Science teachers. Serious initiative need to be taken by school administrator since teacher plays important role to instil students' interest and skill on STEM activities. If teachers are not up to date on this initiative and also lacking of skill to conduct or integrate STEM during teaching and learning or even school activities, thus it will give huge impact on students. Jalil Hamid (2017) in his study mentioned on the importance of continuously attending the professional development programs especially the ones provided with STEM training. Through the program, the integration of STEM in school will be more effective and attract more students' interest in STEM-related subject. Besides, lack of knowledge and skill on STEM will highly impact on teachers to be less critical, less creative and less innovative (Edy Hafizan Mohd Shahali, Ihsan Ismail & Lilia Halim, 2017).

Lack of facilities and budget are also the issues mostly highlighted by the respondents. Most of them mentioned how this issue can give negative impact on the students.

"...There is no enough budget to conduct STEM activities as well as the facilities. Even to conduct the experiment, there is no enough chemical substance available in the laboratory. Thus, this is one of the factors which causes the students to lost their interest in learning Science..." (Respondent 1)

"...Many activities that were planned cannot be run. This is because the budget allocated is insufficient to cover the required costs. That why very difficult in this school to have students interested to be in science stream class..." (Respondent 2)

"...There is no specific budget provided for STEM-related activities. The school even do not take any initiative to outsource for budget. We have to find our own because we have to conduct STEM activities. That is why we cannot conduct big STEM program. The students being selected for the activities and program also very limited from time to time..." (Respondent 4)

When teachers are being forced to conduct STEM activities or program as their KPI, while the biggest challenges is no allocation for budget or not enough facilities, thus, this issue indirectly can affect teacher's motivation in teaching and learning in class. this is consistent with Schneider (2003) where he reported observation done by National Clearinghouse on Educational Facilities found that lack of facilities in the school setting causes the teachers to feel discouraged to teach their students.

Apart from that, workload and time constraint are also becoming important issues highlighted by the respondents. Fifteen respondents mentioned on these issues where some of them highlighted they cannot do much on the STEM activities because the time schedule to finish the syllabus very limited. Besides, they also being given other task and job in school, not only doing Science teaching and focusing on STEM activities and program.

"...STEM activities such as doing project and innovation will take much time in class. The teacher also needs to finish up the syllabus which makes the implementation of STEM in every chapter seems impossible..." (Respondent 11)

"...I have many ideas in my mind to make my class interesting especially doing STEM activities when teaching certain topic. For example, topic salt which I can use so called CSI as one the activity. To conduct the activity like this, the teacher need longer time to prepare for it and for students to complete the task. However, most of the teachers prefer not to do it due to the time taken and workload that they have..." (Respondent 14)

"...from time to time, the workload of the teacher is increasing. Instead of teaching, the teacher must do clerical work such as fill up the online data, preparing reports, etc. For example, during examination session. This is the peak time for every teacher to be surrounded with the workload. Prior to examination, we have to prepare everything starting from preparing question paper, vetting and auditing process. After the examination, we have to do grading, to make report, to complete many tasks and this overwhelmed workload increase our stress level..." (Respondent 12)

"...to empower STEM in school is really good and we really support this initiative. But we couldn't do more because we also need to consider syllabus that need to be completed and also burden with many works given by school. Besides, imagine

we have 40 to 50 students per class and how we want to have effective STEM activities in class? (Respondent 15)

When teachers are given with many workloads, this can make them feel burden and directly affect their preparation in doing or having STEM activities in class. This is true to some extent whereas according to Koo (2008) when teachers have less time for their class preparation due to overloaded workload, thus prevent them to adopt new teaching approaches in their lessons and having effective activities. Besides, to conduct STEM activities in the classroom, it takes more time. These STEM activities require collaboration and cooperation and really need plenty of time to make it effective. But the dilemma to finish the syllabus on time also haunted the teachers. 'Finish syllabus syndrome' is one of the impediments for every teacher in promoting any new approaches in education (Goh, Pauline, Matthews and Bobbie, 2011). Thus, it affects the quality of STEM activities to be conducted and this directly will not give positive impact to the students.

The other issues highlighted i.e. lack of support from school administrator and also lack of students' interest in Science subject.

"...There is no proactive action taken by the school administrator to empowering STEM. The task being given to Science and Maths departments. Even there is no action taken if the teachers simply skip or doesn't participate in STEM activities..." (Respondent 2)

"...School administrator doesn't have any initiative to empower STEM education. She even didn't know about STEM and their implication to the students.. That's why it is very difficult for her to accept and approve some activities plan by us. This is one of the reason causes the students' interest towards science decreases..." (Respondent 3)

"...The school administrator does not support or aware of STEM empowerment to the students or even to the teachers. It is very difficult to get approval from the principle to bring students participant in STEM activities or competition outside from school. Even the budget asks for teachers' training also usually not being approved..." (Respondent 5)

"...most of the students does not want to enrol Science stream class because lack of interest in learning Science. They always perceive that science is difficult..." (Respondent 7)

"...students cannot see the importance of having STEM activities. This is the biggest challenge that we are facing to get them participate in the activities. We cannot blame them because school administrator also doesn't show any effort to inculcate students' interest in STEM activities..." (Respondent 9)

"...it seems difficult to make students having interest in my school. Maybe due to lack of support from the teachers, parent and also they might not understand the reason of having STEM activities..." (Respondent 14)

Even the task were given to Science teachers or Science and Mathematics Department to have many STEM activities and also helping students to participate frequently in STEM related program for their STEM empowerment, but school administrator plays very important role in making this successful. As we know, the principle is the key player for the school. When there is positive support given by the school administrator, everything can be done easily and the mission and vision to empower STEM also can be easily achieved. Schwier (n.d) highlighted in his study where the support is not just only on the monetary form, but the teacher need also support on the initiative, preparation and also on the psychological aspects i.e motivation, understanding and also positive feedback. When there is positive support given, positive environment can be produced and it is easy for the teachers to have many STEM related activities and program besides can inculcate motivation and develop interest of students on STEM. Many students felt science stream have heavy syllabus compared to the other stream because they don't understand and this problem mainly caused by the teachers and from school. Amnah (2014), mentioned even though there is high expectation from careers in STEM subjects, the declining number of students in science stream occurs due to fear and lack of confidence to proceed in STEM field even though they are qualified. On the other hand, students also do not have interest in science because they cannot relate what they have learnt to real life situation (Allen, Webb & Matthews, 2016). Failing to relate lessons to real life indicated poor teaching skill and approach by teachers in school.

With respect to the effect on them especially on their teaching performance based on the issues that they have highlighted, majority of the respondents agreed the issues faced greatly affect their teaching performance in school. The effects can be categorized into three types which are; i) feeling demotivated; ii) Increased or higher level of stress and also; iii) no job satisfaction when teaching students.

"...As a Science teacher, it gives effect to me whereby I want to give as much as many knowledge to them but I cannot. If possible, I want them to discover the learning process by their own through the problem-solving process, collaboration as well as improve their soft skills. Despite that, the issue especially on budget and facilities somehow do not allow me to perform the best teaching in the class." (Respondent 1)

"...The issues do affect teachers' performance in this school. When we were assigned many works to do but unable to complete it, the work will keep rolling around our mind. This can lead to have high level of stress and hypertension..." (Respondent 2)

"...Facilities and budget are the main effects on the implementation of STEM in school. If there are enough facilities provided, all of the STEM activities can be conducted without any challenges. The teachers can start to implement many activities without any hesitation. The lack of facilities and budget causes teacher feelings demotivated to take part in any STEM activities..." (Respondent 3)

"...We cannot give full commitment which also causes no satisfaction on our job. We are facing many difficulties in terms of enough training and exposure on STEM. Besides lack of support from school administrator become another issue

why our students cannot perform well in Science subject. We have been forced to come out with many STEM activities but no training and exposure being given. When we asked budget especially for students' participation in STEM activities, it is very difficult for the school to approve the budget. Then, how to empower STEM?" (Respondent 5)

"...If you ask all Science teachers, I believe they have many STEM activities in their mind to be conducted in this school. But normally facilities and budget become the main issue where school usually ask us to find budget on our own. When there is no positive support from the school administrator, we feel demotivated. Besides, we also being given with many tasks and job especially on the clerical work make us don't have enough time to come out with extra STEM program or activities. On the same time, we also need to finish the syllabus. That's why sometimes we cannot cope and make us feel stress ..." (Respondent 7)

Workload is a significant demotivator for a teacher. Ramachandran (2015) mentioned overload work and task given to the teachers make them not to focus on their main duties which are teaching the students. Addison and Brundrett (2008) other study highlighted that any program or an activity can be truly effective if and only if the staffs and teachers are well motivated and passionate to teach the students. Thus, if too many tasks and unnecessary works given to the teachers, they definitely feel burden and will increase their stress level. This also lead them to feel demotivated, thus going to effect the effectiveness of every STEM program or activity to be conducted. Hence, the schools' leader needs to be aware on this issue because the motivation level of teacher greatly influences the students' interest in Science subject as well as their performance.

Lastly, with regards to the training required in teaching or conducting STEM-related activities for their continuous professional development (CPD), most of them highlighted on specific courses or training to be conducted rather than doing it in general.

"...Science teachers need more hands-on training rather than general talk. Through the specific training on STEM teaching or STEM activities, teachers will be exposed with suitable activities to be conducted. It also good if the teachers are provided with courses such as technology-utilization skills, creativity in STEM, engineering-focused science course, inquiry skills etc because our LADAP in school is not really effective and focusing on general talk instead of specific issue..." (Respondent 12)

"...The teachers especially Science teachers should be given specific course and training on STEM, to increase their knowledge and real understanding of STEM. Moreover, the contents of the course should meet teachers' needs. For instance, suitable activities of STEM for different level and the ability of the students. This will give good exposure to us and develop our knowledge and importance skills..." (Respondent 7)

"...Science teachers should be trained more specific on the skill that we require. For example, now we are really focusing on robotic program. This is part of STEM activity. We only force students to participate but we as a teacher doesn't have

any knowledge at all to deal with this robotic issues or problem. So how to empower STEM if we only ask students to explore on their own because we don't have the skills and knowledge..." (Respondent 14)

"...Technology pedagogical content courses should be provided to the teachers. This is aligned with the mental development of current generation which is more emphasizing on technology rather than traditional method. As we discussed, technology is one of the component in STEM. If teachers still phobia in using technology and doesn't have knowledge or skills on Web 2.0, how to develop students' interest in STEM? ..." (Respondent 15)

Besides, some of the respondents highlighted the importance of collaboration with universities and industries to expose teachers and also students on STEM activities and program.

"...School should collaborate with industries and universities. This collaboration will help teacher's and student's exposure to the real world rather than school environment only. For example, the teacher can learn on new technology that they have been invented and this indirectly can increase their knowledge and skills. Furthermore, collaboration with universities is really important because we know universities have good facilities compare to school. Thus it is a good exposure and can develop interest of students on STEM field for their future..."(Respondent 3)

"...Having good collaboration with universities and Science agencies will create good environment and motivation not only to the students, but to the teachers as well. Through this initiative, the teacher can exchange opinion, ideas and experience on STEM activities and program effectively. Besides, it can reduce many issues especially related to facilities, budget etc. But, the school leaders need to play the important for this collaboration. If there is no support from school leader, we will facing the same issues forever..." (Respondent 5)

Continuous Professional Development (CPD) practices is very important to improve quality of teacher and lead to developing teacher professionalism (Greene, Lubin, Slater & Walden 2012; Lilia Halim & Subahan, 2002) in practicing the curriculum at schools. Based on feedbacks from the respondents, it was found existing CPD practices do not satisfy them. The nature of existing CPD programs do not reach the necessity of those teachers because they prefer specific trainings and exposure to increase their knowledge and skills on STEM activities, program or even classroom teaching. Professional development program in STEM will provide learning opportunities to the teachers in which it could help in deepening their conceptual understanding, engineering practices and developing the sense to appreciate science in the community (Altan & Ercan, 2016); (Babatunde et al., 2014). As the information and knowledge relating on STEM become rapidly updated and outdated, workshops and training on the latest information should be given to the teachers continuously. Tumuti, Wanderi & Land (2013) also highlighted the importance of having collaboration with universities and also industries, where these collaborators could be the vehicle to speed up the effectiveness on the implementation of STEM in school. Through these collaboration, it provides students and

teachers with massive knowledge on the real-life context which can enrich the teaching and learning process and equip the students for the future career development (Yuk, 2008; Anwar, Masrek, & Sani, 2018).

Conclusion

From this study, it can be concluded that Science teachers face many issues to empower STEM in secondary school. These issues directly affect their teaching performance besides affecting their effort to empower STEM in school. Teachers' exposure and training related to STEM is the main issue highlighted by most of the respondents followed by issue of facilities and budget and also teachers' workload. Lack of support from school leader is also one of the issues mentioned. These issues highlighted greatly affect the Science teachers' performance in class because it gives negative effect in terms of their motivation, level of stress and also job satisfaction when teaching the students.

Apart from that, this study also found the specific courses or trainings required by Science teachers to conduct STEM activities, program or even teaching in class. They are aware on the importance to be equipped with current knowledge and skills to improve their instructional practices in order to achieve the quality in teaching and learning process besides to empower STEM in school. Osman, Halim & Meerah, (2006) highlighted on how teachers' themselves should be aware and concern to do self-improvement, especially in changing their classes to be more significant and attractive, which would subsequently lead to enhancement in the student participation in the class. This is not only applicable in class but can also be extended outside of the class especially when Science teachers want to conduct activities or program related to STEM empowerment.

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