

**STEM EDUCATION AT MELAKA VOCATIONAL SECONDARY SCHOOL  
AS A PREPARATION FOR INDUSTRIAL EMPLOYMENT**

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**This report is submitted in partial fulfilment of the requirements for the award  
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I / We \* acknowledge that I have read this work and in my / our opinion \* this work  
is sufficient in terms of scope and quality for the purpose of awarding  
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## DECLARATION

“I hereby declare that the work in this report is my own except for summaries and quotations which have been duly acknowledged.”

Signature : .....

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Special thanks to my beloved father and mother, my siblings, project supervisor and friends. Thank for their motivation and their sacrifice.

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## ABSTRAK

Aspirasi negara yang diilhamkan dalam Wawasan 2020 ialah mencapai taraf negara yang maju. Perkara ini telah meletakkan kepentingan yang sangat tinggi terhadap pendidikan sebagai pemacu untuk mencapai matlamat kearah menjadi sebuah negara maju yang mampu mendepani cabaran dan permintaan ekonomi yang dipacu oleh Sains dan Teknologi. Tujuan kajian ini adalah untuk mengenal pasti sejauh mana Pendidikan STEM sebagai persediaan untuk pekerjaan perindustrian. Unsur-unsur atau pembolehubah bebas terdiri daripada persekitaran pembelajaran, pembelajaran campuran, pemikiran komputasi dan kecekapan sendiri pelajar. Pertama, kajian ini akan mengenalpasti sama ada unsur Pendidikan STEM berkaitan dengan pekerjaan industri. Kaedah penyelidikan yang digunakan untuk menjalankan kajian ini adalah melalui pendekatan kuantitatif di mana sampel sebanyak 92 soal selidik diedarkan kepada pelajar, guru dan kakitangan di Kolej Vokasional Melaka Tengah. Dalam penemuan kajian ini, semua pembolehubah bebas dianalisis dengan menggunakan regresi mudah Pearson Correlation dan mendapati bahawa semua pembolehubah berada dalam hubungan dan berkaitan dengan pekerjaan perindustrian pekerjaan. Akhirnya, kajian ini mencadangkan cara-cara untuk menggunakan STEM Education dalam proses pengajaran dan pembelajaran di sekolah dan sebagai persiapan yang baik untuk pekerjaan perindustrian.

Kata kunci: Pendidikan STEM, Persediaan Pekerjaan Perindustrian

## ABSTRACT

One of the aspirations of Vision 2020 is to achieve developed nation status. This puts very high importance on education as a driving force for achieving the goal of becoming a developed country that is able to face the challenges and demands of an economy driven by science and technology. The aim of the study is to identify the extent of STEM Education as a preparation to industrial employment. The elements or independent variables consist of learning environment, blended learning, computational thinking and student self-competence. Firstly, this study will identify whether STEM Education elements partially in relation with industrial employment. the research method used to conduct the study is by quantitative approach where sample of 92 questionnaires was distributed to student, teacher and staff at Kolej Vokasional Melaka Tengah. In findings of this research, all the independent variables were analysed using Pearson Correlation simple regression and found that all the variables are in relationship and related to industrial employment. employment. Finally, this study suggests ways to use STEM Education in teaching and learning process at school and as a good preparation for industrial employment.

Keywords: STEM Education, Preparation for Industrial Employment

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# CHAPTER 1

## INTRODUCTION

The first chapter describes the introduction of study which is all about the research question and research objective. Besides that, there also have the scope and limitation of the study as well as the significant of the study for everyone. The topic of this study is about STEM Education at Melaka Vocational Secondary School as a preparation for industrial employment. STEM is stand for ‘Science, Technology, Engineering, and Mathematics’ where this learning can be said to be in line with 21<sup>st</sup> Century learning. The Ministry of Education through the Education plan has begun implementing various strengthening strategies for Science, Technology, Engineering and Mathematics (STEM) subject in order to produce more experts in the field for the benefit of the nation. The major scope of this study is to know the relation of STEM Education at Melaka Vocational Secondary School partially and simultaneously with preparation for industrial employment. This study will identify how well the benefits of STEM Education contribute to the industrial employment and at the same time improving the skills of the student. The benefits can be indicating as the elements of STEM Education which are consist of learning environment, blended learning environment, computational thinking and self-competency among student. Based on the result, there will be suggesting on how STEM Education can enhance students’ skills, as well as being a student preparation for industrial employment. This study focuses only on Melaka Vocational Secondary School.

## 1.1 Background of Study

The term STEM began in early 90's in the United States in US government policies (Koehler, Binns, & Bloom, 2016). The challenge is to make every US resident to venture into STEM Education and eventually enter STEM related professions such as scientists, engineers, mathematicians, or technologists. Initially the term SMET (Science, Mathematics, Engineering, and Technology) was used, but National Science Foundation (NSF) was converted to STEM to facilitate the mention and reinforcement of its meaning (National Academy of Science, 2007).

In line with the 21<sup>st</sup> Century, the renewal of the movement to give a fresh start to the school-level Science and Mathematics education has begun. One of the reforms is the Integrated or better known as STEM. Bryan, Moore, Johnson, and Roehrig (2016) well-defined STEM Education as “teaching and learning of content and practice of science that incorporate Science and Mathematical elements by integrating Engineering and Engineering Design practices through relevant Technology”. Based on this definition, it is important to note that the goal of STEM Education is to blend the integration of the teaching and learning process. Additionally, Moore, Johnson, Peters-Burton, and Guzey (2016) are detail six STEM Education cores which are:

- I. The use of meaningful and meaningful learning contexts in relation to the real life of the students.
- II. Challenge students' potential by using the Engineering Design approach to form critical and creative thinking through relevant technology-assisted design activities,
- III. To improve existing designs, students can learn from failure in designing solution in Engineering Design.
- IV. Implemented a teaching and learning program that integrates with Science and Mathematics and relevant subjects such as Literature, Humanities, and Social Studies.
- V. Conduct student-centred teaching and learning activities so students are actively involved in the teaching and learning process.

- VI. Train students to collaborate and communicate in carrying out learning activities.

According to expert thinks about early childhood, STEM Education should be started at early stage of life (Katz, 2010). The finding of previous studies show that STEM exposure in education which are consist of: (a) building a foundation for children's future learning and development; (b) assist the development of critical thinking and skills reasoning; (c) increase children's interest in Science and Mathematics learning and interest to STEM related careers; (d) develop curiosity such as asking and investigating; and (e) giving children a broader experience of the natural world and their surroundings (Katz, 2010; Hoachlander & Yanofsky, 2011; National Research Council (NRC), 2011; Bybee, 2013). So, there are some explanation about study on early stage of STEM Education. Back of this study topic, which is about STEM Education in Secondary School stage, which is hope that before 2020, The Ministry of Education has made STEM literacy as part of a compulsory global curriculum for all students at all levels of education in Malaysia.

STEM Education has an important role in modern education. Because future generations will lead the world and they will face more complicated problems in the future. STEM Education aims to create graduates who can adapt to the world of work and be able to compete globally. Therefore, it is important to introduce STEM Education for youth and encourage them to continue subjects related to STEM in class. Along with the emergence of sophisticated technology as today, with STEM Education, every individual is able to utilize the latest technology. So, with STEM Education, students are not only focus with one field, they will learn other related fields as referring to STEM. A part of STEM Education that can really help others is technology. It helps students apply what they learn, using computer and professional application practises such as Computer-aided Design, Computer-aided Manufacturing, simulation and animation software. Applications like technology give students the opportunity to explore STEM subjects in more detailed and practical way (Ceylan & Ozdilek, 2015).

Moreover, one of STEM's pedagogy concerns the 4c elements in 21<sup>st</sup> Century Learning which are 'Collaboration', 'Creativity', 'Communication' and 'Critical Thinking' that are essential for their skills in future career. Which is means, students learn in different ways and method to become creative and critical thinkers as well as collaborators and problem solvers. Based on this study topic, STEM Education consist of four elements which are learning environment, blended learning environment, computational thinking and self-competency among student. This study is about to know how STEM Education elements contribute to the industrial employment and at the same time improving the skills of the student. Regarding the findings, this study come out with few suggestions on how STEM Education can enhance students' skills, as well as being a student preparation for industrial employment

## **1.2 Problem Statement**

This study focuses on the STEM Education at Melaka Vocational Secondary School as a preparation for industrial employment. STEM Education is facing various challenges to compete in with 21<sup>st</sup> Century especially in teaching and learning process. STEM education is a curriculum based on the idea of educating students in four specific areas: Science, Technology, Engineering and Mathematics. Unfortunately, most of students are less interested in Science and Mathematics subject because they think it might be hard to score. Besides that, it also influences the way teachers teach their student for example teachers' over-syllabus and lack of hands-on exercise and experimental activities due to insufficient laboratory materials and equipment. Furthermore, student will be more focus on exercise and memorizing fact to get good grades in exam. In addition, it is understood that some women less interested in the STEM Education due to lack of confidence and assuming that the field is only suitable for men. STEM Education has several concepts of learning that will create a sense of interest and fun in student's self because STEM facilitates the way learning for students better understanding the subjects. For example, by using visual learning video, inquiry based-learning and project based-learning.



### **1.3 Research Question**

This study is to examine about STEM Education which are consist of element such as learning environment, blended learning environment, computational thinking and self-competency can be attributed to the preparation for industrial employment. Besides that, it's also to analyse learning environment at Melaka Vocational Secondary School. Moreover, the study is also to identify blended learning environment at Secondary School. Additionally, it's also about to identify students in computational thinking that related to STEM Education. Furthermore, this study also investigates student's characteristic toward STEM Education at Secondary School. There are several questions according to this study:

- Is the learning environment affecting STEM Education at Melaka Vocational Secondary School?
- How blended learning in relation with preparation for industrial employment?
- How to bring computational thinking in STEM Education syllabus?
- How self-competency can be related in STEM Education learning?

### **1.4 Research Objective**

The general objectives of this study:

- To analyse learning environment at Melaka Vocational Secondary School.
- To identify blended learning at Secondary School.
- To identify students in computational thinking that related to STEM Education.
- To investigate student's characteristic toward STEM Education at Secondary School.

### **1.5 Scope and Limitation of the Study**

The scope of this study is to examine about STEM Education can be attributed to the preparation for industrial employment. Focus of this study will be at Melaka Vocational Secondary School. According from that, the respondent for this study will involve students of Melaka Vocational Secondary School.

### **1.6 Significant of the Study**

From this study, it will help students with the chance to develop skills in the 21<sup>st</sup> Century, which will become increasingly important such as complex problems such as settlement, communication, and cooperation. Therefore, STEM Education is more important as preparing students for industrial employment simultaneously in a technologically advanced world and is very important for the country's competitiveness. The effectiveness of STEM can increase students' attention in Mathematics and Science, and workplace success related to STEM. The current tendency is to association the four STEM disciplines into mega-discipline that is measured more applied and truthful to foster the attention of students towards Mathematics and Science at school. STEM affords students the chance to apply science concepts and mathematics, making education more expressive and stimulating. Concepts of Science and Mathematics when combined into the arena of Technology and Engineering, can be used as a stage to solve real difficulties in life, and to offer experience learning is very effective for students. In this way, the parties who support STEM think the important of STEM Education specially to attract students' attention in Science, Technology, Engineering and Mathematics and in the extended track they will choose the field of learning related to STEM.

## **1.7 Summary**

This study highlights the problem statement which is how does STEM influence or impact in student's life in working environment which is in industrial employment. This chapter also shows the research questions and objectives as the guideline for this study.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.0 Introduction**

This chapter discusses based on the study that had been carried out in command to fold connected information including the secondary data. This chapter also helps to provide more ideas and info to conduct the study. The variables which are independent variables (STEM Education) as well as the dependent variables which is the preparation of industrial employment will be discuss. In this study will explain the four elements of STEM Education which are consist of the learning environment, blended learning environment, computational thinking and self-competency among student that related to vocational secondary school as preparation for industrial employment. This literature review is to carry the information and thoughts have been recognised on the STEM Education topic as well as will be helpful in constructing the questionnaire related to the topic. Moreover, the prediction of study which is the hypothesis also will be present in this chapter. The theoretical framework also will be attached to this chapter.

## 2.1 Learning Environment

“An educational method, cultural setting, or physical setting is learning environment in which teaching, and education happen while the term is usually used as a more decisive alternative to classroom” (Deacon, Jaftha, & Horwitz, 2004). According to past study by Deacon et al. (2004), learning environments are extremely varied in use, education style, organization and educational institution. Deacon et al. (2004) also mention that the culture and setting of a place of organization contains such factors as a way of thinking, acting, or occupied, also known as structural culture. As a matter of fact, physical location, context and cultures as a reference to learning environment. From the early stages of schooling to high school level, students are exposed to learning in a widespread variation of settings, such as outside-of-school locations and out-of-doors environments.

The most important aspect of a positive learning environment is the relationship between teacher and student. School environment is of principal importance in determining and redesigning intelligent skill (Bakar, Mamat, & Ibrahim, 2018). Bakar et al., (2018) mention that helpful and positive school environment augmented with enough learning facilities, and positive weather makes students more relaxed, more focussed on their academic activities that resulted in great academic performance. There are two kinds of learning which submissive learning and dynamic learning. Submissive learning, a key feature of direct teaching, has at its core the distribution of nearly all information and data from a single foundation, the teacher with a textbook delivering educations in lecture-style format (Deacon et al., 2004). Based on Deacon et al. (2004) studied also, Deacon mention that dynamic learning is a model of teaching that attentions the responsibility of learning on learners, not on teacher-led instruction, a model also called student-centred. From this study, it is show that active learning is the most suitable for STEM learning process. Regarding from that, this will enable the STEM learning process at schools to run smoothly and encourage active students that consist of communication, critical thinking, collaboration, and creativity during the learning and teaching process.

This independent variable is chosen because basically learning environment has theoretical and practical activity which involve indoor and outdoor classes. In related with industrial employment, through the learning environment from school, student will automatically adapt with employment situation which is ready with all department in the company and what type of work they will doing. Learning environment consist of three subtopic which are culture, context and location of learning environment.

### **2.1.1 Culture of learning environment**

The Malaysian curriculum framework is a framework that teaches teachers to provide effective learning outcomes for students. The establishment of Institut Pengajian Guru (IPG) also emphasizes the evolution of learning culture in Malaysia. The learning system is also constantly formulated to ensure that the system is in line with time circulation. Preparation of pre-teaching is one of the most important elements to ensure effective learning culture. Teacher's preparations are also supported by organized schedules where good schedules can have a positive impact on teacher and student. So that teacher will well prepare in terms of learning materials, teaching and learning process.

Besides that, the application of professional attitudes in the teacher can give a good result to the students in which diversity of learning patterns that can increase the interest and spirit in student to learn. At the same time, it can improve students' discipline to attend school. This is because the encouragement and support given to a student can increase the interest in learning. The school environment has comprehensive effect on students' learning and development, including an important aspect of their community, emotional and ethical development (Bakar et al., 2018). In particular, the active relationship of students with teachers and their insights that teachers care about them is what stimulates their efforts and arrangements (Eric S., 2005).

In addition, school and parental collaboration also play an important role in providing good minds in shaping the current generation for learning interest while producing good results in the learning system. Furthermore, the exercises provided to the students can enhance understanding and strengthen the student's memory. In this regard, it is related to STEM Education because the development of brain cells at younger ages is more efficient. In other aspects, the principal should encourage teachers to give their best to students. In relation to the matter, among the things that the principal's desirable to do is to be open-minded in giving moral and physical support such as in terms of the financial aspect and so on. Where the biggest investment in the present era is investing in the younger generation who will shape the vision in the future.

The element of love for the student needs to be present within each teacher. This is to create a sense of comfort and excitement for students during a learning session. This can also lead to a cheerful and effective learning environment. A conducive environment in learning classes also helps students to interact with teachers in a comfortable and not in a shy state. The communication between the student and the teacher can provide the students with confidence and comfort to ask questions related to STEM Education which is a new teaching and learning process. Here has also brought a sense of learning and willingness to take the risk of attending class to create creative and critical creativity in the student. To handle the challenges and risks of students who are less interested and bored in the classroom, STEM education is one of the forms of learning that will keep students active. Therefore, teachers need to apply their own values in order to deliver effective learning to the students, in order to create a more brilliant future generation.

Strong emphasis and strengthening of the foundation of Science and Mathematics are essential in the context of STEM Education in secondary school. Most of the students are weak in both subjects because of examination-oriented learning, teaching and learning strategies are not diversified, less understanding because lazy thinking and less practicing in everyday life. Student's weakness in Mathematics and Science can be overcome by changing the learning pattern towards

more practical skills, thinking skills and less complex of learning so that students can understand very well. This can be applied by demonstrating and explaining that Science and Mathematics are an important aspect of the future.

### **2.1.2 Context of learning environment**

A strong foundation in STEM Education is significant to ensure students are clearer and understandable about STEM. The question of STEM characteristics should refer to the STEM meaning enclosed by the field investigators as described by Bryan et al. (2016). The basics of learning must be the aspect of introducing STEM and concepts used in STEM as well as facilitating future learning sessions. The characteristics of the researchers are ideally good, but the main subject is that at the curriculum implementation phase later. Among the key restraints is expert preparation for educators and future educators. In United States, the Mathematics and Science educators are less exposed toward engineering related to science (Roehrig, et al., 2012). When lack of familiarity and skills in Engineering, Mathematics and Science educators cannot efficiently explain using the Engineering Design method as wanted by STEM researchers in the United States (U.S.). Then the call to strengthen expert exercise on STEM Education has been made for mathematics and science educators who are teaching in US schools (Johnson & Sondergeld, 2016).

The professional training of STEM in Malaysia also should be supported, enhanced and supervised to develop capable educators in knowledge, skills and manners in the setting of STEM Education because of very new learning in school environment and lack of an exposure to the STEM approach. The significant step that desires to be occupied for this time is to improve the current Science and Mathematics curriculum and to see the probable being of STEM fundamentals in it. According to Pilot & Bulte. (2006), its highlight that “bring the learning of science nearer to the life and benefits of students” and “show how the use of settings would recover their interest in science and therefore improve their understanding”. Learning that gives STEM exposure to life is a fun way to create and increase student interest.