Evaluation of the Effectiveness of School Attack 2019 Program at SMK Skudai, Johor

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ABSTRACT

The Malaysian Education Development Plan 2013-2025 (PPPM 2013-2025) is a plan that emphasizes the importance of applying Science, Technology, Engineering and Mathematics (STEM) to meet Industry 4.0 challenges. This is to produce skilled human capital in the area of future technology that is at the core of Industry 4.0. In Malaysia, the implementation of STEM is seen in the second wave as governments, statutory bodies, associations, non-governmental organizations (NGOs) and external agencies work together to promote STEM to the community. In support of this initiative, a program called School Attack 2019 was held at SMK Skudai attended by 100 students selected from Form One. There are six different modules designed for the syllabus for this school and are taught in a fun way by students from various backgrounds from Universiti Teknologi Malaysia (UTM). Therefore, the purpose of this paper is to study and analyze the effectiveness of the module, facilitator efficiency and evaluate the success of the program. The results show that student satisfaction gradually increases for the best-managed modules, indicating that proactive implementation of appropriate responses to student feedback on their learning journey is effective in enhancing student satisfaction and learning.

Keywords: Science, Technology, Engineering, Mathematics, Education

1. INTRODUCTION

Malaysia places high importance on education as a driver for achieving the goal of becoming a developed nation capable of meeting the challenges and demands of the economy driven by Science, Technology, Engineering and Mathematics (STEM) by 2020 \[1\]. In general, the Malaysian government has introduced a 60:40 Science / Technical: Literature in education since 1967, and in particular began to implement the policy in 1970. The policy refers to the Ministry’s aim to increase the ratio of students with significant STEM education compared to those who focus on Literature. Nevertheless, the policy is reported to be a failure \[2\].

It has been reported that in 2011, only 45% of students graduating from the school system were science students, including technical and vocational students. The percentage of secondary students who are eligible for a science course after the PMR, but opting out of it has increased by almost 15%. This raises concerns about the ability of the education system to provide enough STEM graduates to meet the economic needs of the country. According to the National Council for Scientific Research and Development, Malaysia will need 493,830 scientists and engineers by 2020. According to current pace and development, the Ministry of Science, Technology and Innovation (MOSTI) estimates there will be 236,000 manpower shortages.

In addition, the results of the PISA 2009+ (Malaysia’s first entry) show that Malaysia still has to work towards delivering STEM-based education to students. PISA 2009+ is a direct comparative method of quality education across multiple systems. This method assesses various cognitive skills such as application and reasoning. The results show that Malaysia ranks third among 74
participating countries, and below the international average and the Organization for Economic Co-operation and Development (OECD). These figures indicate the need for interventions to achieve the goal of increasing STEM graduates and enhancing future student achievement. Therefore, the government decided to revise the policy and proposing the Malaysian Education Development Plan 2013-2025 (PPPM 2013-2025). One of the action plans is to strengthen STEM delivery across the education system, which is divided into three waves. Wave 1 will focus on strengthening the existing program and encouraging upper and lower secondary students to pursue a science stream. Wave 2 emphasized the building of the foundation by increasing support from various stakeholders in the informal learning sector. Wave 3 will evaluate the initiative and provide an action plan for further innovation.

Driven by this initiative, Kolej Datin Seri Endon (KDSE), Universiti Teknologi Malaysia (UTM) led by the Student College Committee took the leap to develop a STEM-based teaching and learning program for high school students. This program is designed to teach in a more enriching and interesting manner, and interdisciplinary in nature to keep curiosity alive as encouraged by [3] through the concept of fun learning activities.

This article consists of five parts. Section 2 presents related works on STEM education methods. The method developed for STEM education is explained in Section 3. Results and evaluation are discussed in Section 4. The conclusions and future studies are drawn in Section 5.

### 2. LITERATURE REVIEW

According to [4], in order to achieve the 21st-century skills for Malaysia context, the currently existing approach in Malaysian Education Curriculum needs to be changed into an interdisciplinary approach called STEM curriculum. Interdisciplinary can be defined as a knowledge view and curriculum approach that consciously applies methodology and language from more than one discipline to examine a central theme, issue, problem, topic, or experience [5]. Hardy et al., stated that an interdisciplinary approach is implemented with the idea that subject-specific learning is neither important or relevant to young school leavers in the 21st-century [6]. Preparing them without offering the exposure and experience with engineering and technology, will fail to survive in the competitive environment [7], [8]. Jayarajah et al. stated that though Malaysian research in the technology and engineering fields is well established and is in fact still succeeding, research trends indicate that the emphasis in both these fields has been focused on university graduates [9]. This indicates that research on technology and engineering has been focused on the most advanced level of education, leaving students and teachers in primary and secondary schools with much less attention. DeJarnette stressed that fewer opportunities exist for elementary students and their teachers [10]. Research has shown that early exposure to STEM initiatives and activities positively impacts elementary students’ perceptions and dispositions [10]–[12]. DeJarnette added that by capturing students’ interest in STEM content at an earlier age, a proactive approach can ensure that students are on track through primary and secondary school to complete the needed coursework for adequate preparation to enter STEM degree programs at institutions of higher learning. These interests could also lead students to pursue their careers based on STEM education [13].

### 3. METHODOLOGY

#### 3.1. Research Design and Sample

This program employed a basic survey towards the effectiveness of the program, modules, and facilitators. The sample comprised of 100 Form One students. All the students from the sample completely answered the survey form. These students consist of 57 females and 43 males. Table 1 shows the distribution of these students in each gender while Table 2 shows the list of modules conducted.

| Table 1 Number of students by gender |
|------------------------------------|
| Gender | Total |
| Male   | 43    |
| Female | 57    |
| Total  | 100   |

#### 3.2. Instrument

The questionnaire is divided into two sections, namely Section A and Section B. Section A contained items on the students’ demographic data such as gender. Section B contained 18 items on assessments in STEM-related subjects according to the relevance towards each module being shown to the students. These items are divided into six (6) modules where each module has three questions. The STEM-related subjects in the secondary school curriculum are Biology, Chemistry, Physics, Science, Mathematics and Additional Mathematics. All the modules are creatively designed according to the syllabus by Malaysia Education Ministry. Meanwhile, all the items in the survey form had a four-point Likert scale response option, namely strongly disagree, disagree, agree and strongly agree. The students’ responses to each item received weighted values from 1 (strongly disagree) to 4 (strongly agree).

| Table 2. Modules designed and their description |
|-----------------------------------------------|
| Module Title       | Materials and Description |
| Water Under Candle | ● To understand how temperature affects pressure  |
|                   | ● Cover a burning candle with a pitcher so that the candle is in an air-tight |
Room sealed by the water at the ground

Pressure Fountain
- To demonstrate an understanding of how air pressure works
- The air inside the balloon is under pressure as it is squeezed by the rubber. When you place the inflated balloon on top of the bottle, the air pressure on top of the bottle becomes higher. That pushes down on the water in the bottle, pushing it through the straw and making the fountain stronger.

Photosynthesis
- To study the presence of starch in leaves as the presence of sunlight helps plants in the process of photosynthesis and starch production.
- Use leaves, tissue paper, syrup and methanol

Elephant’s Toothpaste
- The foam you made in this classic Elephant’s Toothpaste reaction is extra-special because each tiny foam bubble is filled with oxygen
- This module is called Elephant’s Toothpaste because the chemical reaction produces a large foamy mess that looks like toothpaste squirting out of a tube. It is so big that only an elephant could use toothpaste this large

Oobleck
- Oobleck is a mixture that has fluid and solid properties depending on the force applied to the Oobleck mixture.
- If the applied force is low, the liquid characteristics are shown
- Materials are corn flour, water and food coloring.

Dry Ice
- Dry ice is a carbon dioxide gas in solid form
- The module planned to put part of the dry ice in hot water, causing it to produce steam or mist clouds.

Table 3. The detail elements asss for the program

| Code | Assessment |
|------|------------|
| A1   | The objective of this program is to provide exposure to Science, Technology, Engineering and Mathematics (STEM). |
| A2   | The content of the program is in line with school learning. |
| A3   | The activity of each station is effectively managed. |
| A4   | Use of effective teaching aids / experimental materials. |
| A5   | Deliverable and effective facilitator. |
| B1   | The program execution journey went smoothly |
| B2   | The time allocated for each station is appropriate. |
| C1   | My understanding of Science, Technology, Engineering and Mathematics (STEM) has improved since before joining the program. |
| C2   | After this program I can apply the knowledge learned. |
| C3   | I can tell about the knowledge learned throughout this program to my family and friends |
| C4   | Overall the program was successful and rewarding. |

Based on the analysis, the majority of the students' answers either 'Agree' or 'Totally Agree' towards all the elements been asked which bring out the total of minimum 75% to 99% of students. Meanwhile the remainder engaged in A2 (8%), A3 (1%), A4 (5%), A5 (7%), B1 (3%), B2 (15%), C1 (8%), C2 (8%), C3 (6%) and C4(1%). The A2 element which asked either the content of the program is in line with school learning engaged in 8% that falls into the ‘Disagree’ and ‘Totally Disagree’ range. From here, we would revised again several modules to ensure that the modules are syllabus-based. However, majority students agree with the suitability of the modules presented. Meanwhile, for B2 element that asked either the time allocated for each station is appropriate shows 12 students disagree. During the event day, we allocated 15 minutes each stations before the students move to the next stations. This shows that we need to consider the number of students in each group and the number of activities done in each station before allocated the time.

4. RESULTS AND FINDINGS

This section discusses the effectiveness of the program through the feedback survey forms. There are three important elements been assessed through the feedback form which is; (A) The aim and objectives of the program, (B) how the program been managed and lastly (C) the effectiveness of the program from the student's perspectives. All of these criteria are important to ensure the effectiveness of the programs and for an improvement in the future. The details elements in the feedback forms are as stated in Table 3 meanwhile the survey results are tabulated in Figure 1.
Figure 1 The result from feedback form

5. CONCLUSION

A study done by [9] stated that STEM education in Malaysia is more focused on higher education and less emphasis on the school level. This is not surprising because, in universities and colleges, many Malaysian students are offered engineering courses as well as other STEM related courses for example the Engineering Design approach is not widespread for all schools. Thus, as a conclusion, this study is expected to be a catalyst for STEM students. The collaboration between universities, schools and other teachers also provide opportunities for UTM students to develop communication skills, leadership skills and thinking skills.

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