

Enhancing STEM Awareness through Community Engagement Project

Community Engagement Project

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Abstract:- A community service project, held by 20 bright students from Universiti Teknologi PETRONAS held a program entitled STEM For the Future, was conducted to 129 Form 3 Students in SMK Malim Nawar Perak. This project aims to provide an interactive learning approach to the students while cultivating interest towards the Form 3 students in STEM subjects, especially in the field of engineering. This is due to the decline of students that took science stream subjects upon enrolling in their Form 4 with their location located in suburban area of Perak, risk a concern, as it may be due to lack of exposure to the students on the importance and wonders of STEM and the students' own misconceptions on the STEM subjects. The program was deemed successful as physical survey was conducted and shows increase in interest of the students in enrolling science stream field upon entering their Form 4, from only 10 students prior to the program, to 43 students at the end of the program. Some of the highlight activities done thought the program are rocket launching contest, ETP exhibition booth, treasure hunt and straw tower building contest. This program opened a gateway for more collaboration between UTP and SMK Malim Nawar in nurturing science knowledge to the students in the future.

Keywords:- Community Engagement Project; Undegraduate Students; STEM; Education; Secondary School.

I. INTRODUCTION

STEM For the Future is a social venture that aims to cultivate the interest of high school students in STEM subjects, specifically engineering stream. STEM stands for science, technology, engineering, and mathematics and a few wider ranges of academic discipline, for instance astronomy and biochemistry. STEM For the Future is a project that is organized and conducted by 20 students under the requirement of Mata Pelajaran Umum (MPU 4) or Community Engagement Project (CEP). This course evaluates the community-based project's social and value emphasis, which is also in accordance with UTP's objective to generate graduates who are well-rounded and have comprehensive, balanced viewpoints. These subjects are extremely important because they foster a desire for innovative problem-solving while fostering the ability to think critically. In the perspective of engineering students which is the majority of UTP students, it is highly important to cultivate the interests in engineering

stream as it will be a base for the upcoming innovation and invention in the near future among the high school students.

Next, the beneficiary or stakeholders of this project are 129 Form 3 students of SMK Malim Nawar which is located in Malim Nawar Perak. The school is a perfect location to conduct the project because of the geographic location of Malim Nawar as a small-town district (suburban area) in Perak. In other terms, the ambiguity of STEM is obvious and indicated by the interview with the principal of SMK Malim Nawar itself through a face-to-face meeting with the high committee members and exco. As an addition, it had also been reported by the principal of the school of the declination of the number of students in the school to take STEM field upon reaching Form 4, instead prefer of taking literature subjects which were perceived to be much easier field of study. Therefore, it is crucial to expose the high school students in SMK Malim Nawar to the concept of engineering as it will be a stepping factor for them especially in the age of globalization and technology. This program also might be able to nurture interest of the students to take STEM subjects upon reaching their Form 4 by providing proper exposure of STEM towards the students. The Form 3 students will engage in two days period workshop which will consist of theoretical and practical engaging activities which will correlate to the concept and elements in engineering studies stream. This project will be a captivating alternative to stimulate the interest in scientific and theoretical concepts in the engineering stream.

In order to foster a sense of learning interest among the students, this initiative will introduce them to the broad field of STEM subject especially engineering stream in a pleasant environment. Through their volunteer work, the committee members will learn about their social obligations and new experience of nurturing seed of interest in engineering fields into much younger generation. The students will assess their personal interest in effectively resolving engineering-related difficulties at the conclusion of this project.

The mission and aims of this project are to foster volunteerism among the team members while promoting STEM (Science, Technology, Engineering, and Mathematics) knowledge precisely the stream of engineering study among high school students and raising public awareness and perception towards engineering course. The project also aims to increase the potential engineering students in the future to

be a part of the development of the country. The objectives are:

- To cultivate the interest in science, technology, engineering and mathematics (STEM), especially engineering stream among secondary school students.
- To provide an interactive learning approach for students to gain interest in STEM subjects, specifically in engineering courses.
- To expose the secondary school students on how STEM knowledge can be applied to real world applications.

II. COMMUNITY ENGAGEMENT PROJECTS

A. *Treasure Hunt*

Every groups need to go to every stations, where they need to complete the mini game and were given a science-related quiz to be completed to get a clue for the next station. The mini games included are:

- Pyramid Cups (Building pyramid using cups, that were moved by using multiple rubber bands from all angles)
- Soapy Fish (Designed a fish using Styrofoam and use dishwasher soap to move it along a water tray)
- Ping-Pong (Moved a ping-pong ball through a distance using rope, that were held by the whole team)
- Volcano Experiment (Made a volcano eruption using safe daily-life chemicals)
- Straw Bottle (Moved a bottle using straws)

B. *Exhibition Booth*

An exhibition of variety ETP Projects from the facilitators themselves, as well as UTP Syntech robots, drones and games. 10 booths were set up in the hall, where students can freely visit them all, ask questions and play games.

C. *Water Rocket*

Each group were given a set of materials to build their own rocket using their own creativity. All those rockets were then being launched using rocket launchers in the field.

D. *Straw Tower Building*

By using only straws and sellotape, each group needs to build a tower that is stable.

III. MEASUREABLE OF OBJECTIVES

The STEM For the Future Project is align to the UTP University Social Responsibility (USR) Framework which is under the Education Section. One of the objectives of this project is to cultivate interest in Science, Technology, Engineering and Mathematics (STEM) especially engineering streams to the targeted participants which are Form 3 students of Sekolah Menengah Kebangsaan Malim Nawar. The way this project will be implemented is not through class-to-class session but in a more interactive learning approach through fun science and engineering related activities. In addition, the activities done will also sharpen the students' critical thinking skills in solving STEM problems and exposing them on how STEM knowledge can be applied to solve real word issues. Therefore, it is likely to be believed that this project is considered under the Education section since the students can

learn more about STEM and hoping that the students will choose STEM related fields to further studies when they graduated from their school.

IV. PROJECT OUTCOMES

Yes, we have achieved all 3 of our objectives. It is proven by the examples as follow. Our first objective for this project is to cultivate the interest in Science, Technology, Engineering and Mathematics (STEM) specially to pursue more in engineering stream among secondary school students.

As a prior before executing the modules in our project, we have conducted a pre-survey where we wanted to observe the current interest of SMK Malim Nawar students toward STEM. Unfortunately, the result shows only approximately 10 out of 129 students would like to pursue STEM related field after their high school. Therefore, we decided to implement various modules such as Water Rocket Activity, Straw Tower Building, and many more in hoping to increase their interest by at least a significant amount. In measuring the impact of these modules, we decided to conduct a quick post-survey regarding this subject. Luckily, the result shows a positive drastic increment of their interest in STEM. This is by far a proud and greatest achievement for all of us, and really proves the accomplishment of our first objective.

Secondly, the second objective of our project is to provide an interactive learning approach for students to gain interest in STEM subjects, specifically in engineering course. During ice breaking session where the students of SMK Malim Nawar was divided to groups and 1-2 facilitators oversaw the group, we found out one of the main reasons of their loss of interest towards STEM was because of the difficulties in comprehending STEM. Therefore, to tackle this issue, we wanted to provide a more fun and interactive learning approach, so the students can comprehend STEM in an easier way plus cultivating their interest at the same time. One of the approaches is through the Treasure Hunt Activity. In this activity, students can solve science related puzzles with their friends and with the guidance from their facilitators. They can learn from their friends especially on the parts that they have difficulties in understanding, as the saying goes two heads is better than one. As a result, each group managed to complete the Treasure Hunt Activity in the required time without any difficulties. This also applies to other modules where the students were given hands-on projects and examples, so they can visually observe on the things they have learned in classes. In addition to that, we believed that this togetherness learning approach is one of the best interactive learning approaches to make students gain more understanding and interest in STEM.

Thirdly, the third objective for this project is to expose the secondary school students on how STEM knowledge can be applied to real world application. This objective is achieved through the module of Exhibition Booth Programme, whereas under the Engineering Team Project (ETP) Exhibition section, the MPU4 committee members brought their ETP projects and present them to the students. Each ETP projects are created in a purpose to solve the

specific problems that occurred around the world. This is an exceptionally effective way in showing the real-life applications of STEM knowledge in helping others who are in need. The session went by groups by groups, where in each group session, the students were very keen on the projects we brought by. They asked many questions, saw how the project works and even try it themselves. In addition, the Exhibition Booth Programme were also joined by UTP's own Syntech Club, where the club brings robotic innovations and show them as a demonstration to the students. In overall, we believed the students enjoy themselves and they can really acknowledge on how STEM can be applied to real world application, in hoping that they one day become an innovator themselves.

V. IMPACT OF ACTIVITIES TO PARTICIPANTS

A. Community Development: Sustainability factor

Our project STEM for The Future with the main purpose in cultivating interest of students toward STEM can be sustained through several ways.

One of the ways is through the school's own action which is the school can create a Science Day Programme in a monthly basis. The Science Day Programme is on the purpose to show how fun and interesting STEM is towards the students. Sometimes in classes, students might have troubles in understanding STEM related subjects, but through visually and hands-on approach, the students can gain more than in classes. This monthly basis programme in a long run can plant the seed of interest in the students' hearts and hoping one day, when they graduated from schools, they can try to take the challenge in entering these STEM related fields.

Moreover, our MPU4 committee have provided the schools' staffs and students with templates for this project. This template can act as a memorandum and as a reference where the teachers can refer to, when they want to hold another interesting Science related events. In this way, this template can act as a key for sustaining the concept of our project in the future.

Lastly, our MPU4 committee members especially the facilitators for each group have created a WhatsApp group with the students. This WhatsApp group is created with the purpose of interacting more with the students, asking them on how their wellbeing and promoting more STEM related contents because we believed that students nowadays are more attached to their phones rather than their parents. In addition, the WhatsApp group can also act as a platform where the students can ask for the proper steps after they have graduated their high school. For example, if they are interested in entering Universiti Teknologi PETRONAS, they can ask for guidance and how to apply scholarships or some sort. In this way, this can also sustain their interest in STEM plus provide a clearer path for them, if they are interested in continuing the path of engineering related streams.

B. Significant Efforts and Key Achievements of the Project

Stem For The Future is a project with the objective of promoting engineering stream to the secondary school students or specifically SMK Malim Nawar form 3 students. Thus, a good indicator of effectiveness of the programme would be a good measure to indicate the level of impact to the beneficiaries. One of the impacts is that there is a significant change of interest between the initial and the end of the project execution. A quick survey has been done during the speech of Project Director and it was measured that only approximately 10 out of 129 students would like to pursue science stream whilst a significant increment of students at the end of the programme (43 students). This shows that by implementing engaging science and engineering theme activities, a huge interest towards science stream can be planted to the mind of the beneficiaries.

Besides, a physical survey has been done prior and after the event to measure the level of changes in terms of the interest. The questions have been prepared based on the suitability for the purpose of interpretation and data collection. Pie charts have been done for the purpose of analysis and it is observed that there is increment of interest based on the questions generally. For example, a promotion of STEM occupational stream has been continuously made especially in engineering stream such as mechanical engineering, electrical engineering and computer engineering while promoting the enrolment to UTP. Based on the survey, it shows an increment of the number of students that knows the stream of engineering. This is a good indicator to measure the level of impact to the form 3 students of SMK Malim Nawar.

Lastly, even though the increment could not reach hundred percent in terms of percentage, it is believed that by-standing effect can be created which can gradually increase the number of students taking science stream during form 4. By having a number of students interested to pursue science stream, this will motivate the others as well which could slowly reach our objective. To conclude, Stem For the Future has created a big impact to the beneficiaries and simultaneously labelling the event as a good initiative to promote engineering stream in the future.

C. Creativity and Innovation

The STEM For the Future Project promotes Creativity and Innovation to the students of Sekolah Menengah Malim Mawar through science and engineering related activities. One of the main modules for the project, which is called Water Rocket Activity, highly promotes creativity among the students, whereby the students are required to design their own rocket as creative as possible up to their interest with the guidance from the committee members. In the same module, the students are required to think together on how to build up the water rocket launcher from the ground up. In the sense of promoting Sustainability, the students are encouraged to innovatively think ways with a greener approach on completing their task. Hence, this will increase their innovation and critical thinking skills with this single module.

D. Impact to the Community

The impact of the STEM For the Future Project to the Community is majorly on the future contributions from the students of SM Malim Mawar. The project is mainly to cultivate and plant the seed of interest on STEM in the heart of the students. When the students manage to become successful in the STEM fields, they can contribute back to the society by improving more technological aspects in Malim Mawar. Hence, in the future, Pulau Pangkor will no longer only be known as a tourism place but also as a technological inspired place as well.

VI. CONCLUSION

As conclusion the implementation of the MPU4 Project: STEM For the Future had been able to achieve its 3 objectives which are cultivating interest of the 129 Form 3 Students of SMK Malim Nawar in STEM knowledge especially in engineering field, provide interactive learning approach for students to gain interest in STEM subjects especially in engineering field and to expose the secondary school students of SMK Malim Nawar on the application of STEM knowledge in practical scenario. These objectives were evident by the increase in the number of positive responses from the students which is 10 students that shows interest of pursuing STEM subjects upon entering Form 4 to 43 students who shows this interest after the program had been executed. The second objective of providing interactive learning approach of students on learning STEM knowledge was deemed successful as the exposure given by the committee such as interactive session with the facilitator, exhibition booth and treasure hunt has helped the students in changing their perception and increase their understanding in the importance of STEM subjects. The last objective that had been successfully achieved is giving the exposure of real-life application of STEM subjects to the students. This is done by having a talk session from ICP and having the ETP exhibition booth.

All comprehensive and engaging sessions provided by the program had also shown a satisfactory outcome where physical survey that had been conducted before and after program had been shown an increment of from 10 students to a circa of 43 students of Form 3 from SMK Malim Nawar that had shown interest of enrolling in pure science subjects upon entering Form 4. This shows that continuous exposure of students to STEM related activities that enable them to engage with the students in conjunction with packed of insightful information with it, is an effective way of nurturing future engineers, doctors and more.

In a nutshell, the program was deemed successful as it was able to achieve its outlined objectives and hopefully, more collaborative works between UTP and SMK Malim Nawar will ensue for the future engineers that will lead the country.

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REFERENCES

- [1]. Breiner, J. M., S. S. Harkness, C. C. Johnson, and C. M. Koehler. (2012). What is STEM? A discussion about conceptions of STEM education and partnerships. *School Science and Mathematics*, 112(1): 3-11.
- [2]. Atkinson, R. D. (2012). Why the current education reform strategy won't work. *Issues in Science and Technology*, Spring 2012: 29-36.
- [3]. Bybee, R. W. (2010). Advancing STEM education: A 2020 vision. *Technology and Engineering Teacher*, September, 2010: 30-35.
- [4]. Sanders, M. (2009). STEM, STEM education, STEMmania. *The Technology Teacher*, December/January, 2009: 20-26.
- [5]. Wang, H., T. J. Moore, G. H. Roehrig, and M. S. Park. (2011). STEM integration: Teacher perceptions and practice. *Journal of Pre-College Engineering Education Research*. 1(2): 1-13.
- [6]. Weber, E., S. Fox, S. B. Levings, and J. Bouwma-Gearhart. (2013). Teachers' conceptualizations of integrated STEM. *Academic Exchange Quarterly*, 17(3): 1-9.