Empowering Malaysia's Youth: Assessing the Impact of STEM Education

Noramalina Abdullah (Corresponding Author)
School Of Electrical and Electronic Engineering,
Universiti Sains Malaysia
Nibong Tebal, Pulau Pinang
Email: eenora@usm.my

Zuraini Dahari
School Of Electrical and Electronic Engineering,
Universiti Sains Malaysia
Nibong Tebal, Pulau Pinang
Email: eezuraini@usm.my

Roslina Hussin
School Of Electrical and Electronic Engineering,
Universiti Sains Malaysia
Nibong Tebal, Pulau Pinang
Email: eeroslina@usm.my

Azniza Abd Aziz
School Of Electrical and Electronic Engineering,
Universiti Sains Malaysia
Nibong Tebal, Pulau Pinang
Email: aznizaaziz8@gmail.com

Journal of Entrepreneurship and Business
E-ISSN: 2289-8298

Vol. 12, Issue 2, pp. 57-66. Sep. 2024

Faculty of Entrepreneurship and Business, Universiti Malaysia Kelantan
Locked Bag 36, 16100 Pengkalan Chepa
Kota Bharu, Kelantan, Malaysia
http://journal.umk.edu.my/index.php/jeb

Date Received: 19th December 2023
Date Accepted: 31st August 2024

DOI: 10.17687/jeb.v12i2.1195

Abstract – The objective of this study is to assess the effectiveness of a Science, Technology, Engineering, and Mathematics (STEM) initiative in attaining the objectives specified in Malaysia's Education Development Plan (PPPM) 2013- 2025. This study emphasises the significance of incorporating STEM education in Malaysia, with a specific focus on its contribution to the development of analytical thinking, problem-solving abilities, and creative thinking among the youth. The focus of this study is specifically directed towards the country of Malaysia. This underscores the need to employ a comprehensive and interdisciplinary methodology while developing a strategy The present study involves the analysis of replies provided by participants enrolled in a STEM education program. The dataset comprises demographic data of students spanning from Forms1 to 5, together with information pertaining to their levels of interest in STEM. The analysis of post-program surveys indicates a notable increase in agreement and high agreement, particularly in the subjects of Mathematics and Engineering. This trend suggests an increasing level of enthusiasm among individuals toward pursuing careers in the STEM disciplines. A large majority (78%) of participantssaid the program influenced their future STEM interests, especially in engineering.
Keywords: "STEM Education", "Problem Solving", "Analytical Thinking", "Engineering"

1. Introduction

The purpose of the PPPM 2013-2025 in Malaysia is to establish a solid foundation for STEM-related entrepreneurship, business development, and technological advancement. This plan extends beyond academic achievement. The purpose of this study is to examine the relationships between STEM education and other disciplines of study, with a particular emphasis on the results of a survey of students and teachers. Education in the sciences, technology, engineering, and mathematics (STEM) is essential for the development of critical thinking and problem-solving skills, which are essential for fostering entrepreneurship and producing innovation.

STEM education takes an interdisciplinary approach, which encourages students to develop their ability to establish connections between a wide range of academic disciplines. In turn, this assists students in cultivating their creativity and fostering innovation. STEM-educated students are better endowed with the knowledge and mindset required to identify opportunities for entrepreneurial endeavours, take risks, and promote innovation. In addition, individuals with STEM degrees are typically the backbone of the support system for new technology companies, which fosters innovation in a variety of industries. The presence of individuals with STEM education is highly sought after by organisations ranging from manufacturing to finance, and as a result, these individuals contribute significantly to the expansion of the overall economy.

Education that emphasises science, technology, engineering, and mathematics contributes to the development of cutting-edge technologies, which facilitates the growth of technology-driven enterprises. After conducting comprehensive research on STEM exposure, we identified several obstacles. To maximize the potential of this ecosystem, sufficient funding must be allocated to STEM education and the technology sector's infrastructure. In addition, there is a need for the formation of collaborations between educational institutions, private businesses, and public agencies, which could contribute to the promotion of innovation and entrepreneurship.

2. Literature Review

STEM courses include science, math, design, technology, basic computer science, biology, physics, and chemistry (Amelia & Lilia, 2019). STEM was previously known as SMET, and the US National Science Foundation chose STEM (Saunder, 2009). STEM education incorporates scientific, mathematical, engineering, and design principles with appropriate technologies (Bryan et al 2015). Halim (2018) states that STEM education aims to "build the capacity of every student to meet the needs of the STEM industry." A continuous process. Science has been properly promoted, particularly in education, to produce more STEM-skilled workers to support the economy. If this endeavour is more open and systematic, it will benefit students by exposing them to the importance of scientific knowledge and its connection to STEM careers. This will happen because early exposure will teach pupils about science and STEM jobs.

Students are more motivated to study science when they see how it connects to their daily lives. According to Duschl (2019), kids' love for science is one of the biggest influencers in

their STEM career choice. The self-determination theory states that long-term science learning requires motivation. This approach incorporates self-efficacy, self-determination, accomplishment, and intrinsic drive to achieve learning goals (Lee,2017). Long-term science learning requires motivation. Guan et al. (2016) also note that motivation can help students maintain internal support when studying STEM courses. Motivated students who excel in high school science can develop a STEM interest (McFadden & Roehrig, 2020). Thus, motivation's role in shaping students' STEM career development desires is crucial for integrating students' knowledge and preparedness for STEM business. Students' STEM industry knowledge and preparationmust be unified.

A new curriculum will only be meaningful if it matches students' scientific knowledge and skills. Students can use the knowledge to develop an interest in STEM subjects, which will help them achieve their professional goals (Li et al., 2020).STEM must be taught holistically to students to foster a positive STEM attitude and increase 21st-century learning skills (Unlu, Dokme & Unlu, 2016). Students will develop good STEM mindsets and 21st-century learning skills. According to Dare, Ellis, and Roehrig (2018), teachers' understanding of students' needs might boost motivationand potential.

3. Methodology of Study

The methodology that was selected is one that makes use of both qualitative approachesand content analysis, with the primary emphasis being placed on literary study and analysis. Quantitative research methods were also applied in order to obtain data from a group of respondents. Quantitative research methods are an approach in research thatis generally recognised and effective. Due to the special nature of the setting and the goals to be achieved, this study, which focuses on Malaysia, employs a technique that is both thorough and interdisciplinary. The research was conducted with data collected from the USM-MICRON YOUNG WISE STEM education program that took place in2021. This initiative sought to close the gender gap in the field of engineering by focusing on young women in an effort to pique their interest in the STEM (science, technology, engineering, and mathematics) disciplines. Northern Malaysian secondary schools, including those in the states of Perak, Pulau Pinang, and Kedah, were eligibleto take part in the competition.

The students' levels of interest in science, mathematics, engineering, and technology are also included in the dataset along with their demographic information. The students'ages range from Form 1 to Form 5. Notably, the study of post-program questionnaires suggests a large increase in agreement, particularly in the fields of mathematics and engineering, which indicates increased excitement for jobs in STEM fields. The methodology for this study consisted of analysing the answers that program participants provided to a number of questions. The data were normalised by displaying them in proportion to the total number of students in the study. The first group of questions asked students about their impressions of the mystery and excitement that are associated with subjects that are related to STEM. The next questions enquired about the respondents' interests in various STEM-related activities, such as their desire to create new goods, their interest in studying and fixing electronic devices, and their interest inlearning how electronic devices function.

4. Findings and Discussion

There are several essential enquiries about program participants' interests. A few selected questions' analytical results are presented and discussed in this paper. Student demographics from Form 1 to Form 5 are shown in Figure 1. To standardise pre- and post-survey analysis, graphs show student percentages. Do they find science, math, engineering, and tech interesting and exciting? See Figures 2 and 3 for findings. Figure 3displays the pre- and post-survey results on whether science, math, engineering, and technology are interesting. Overall, the post-survey had more agree and strongly agreeresponses than the pre-survey. In general, the post-survey showed a higher percentage of agree and strongly agree portions compared to the pre-survey.

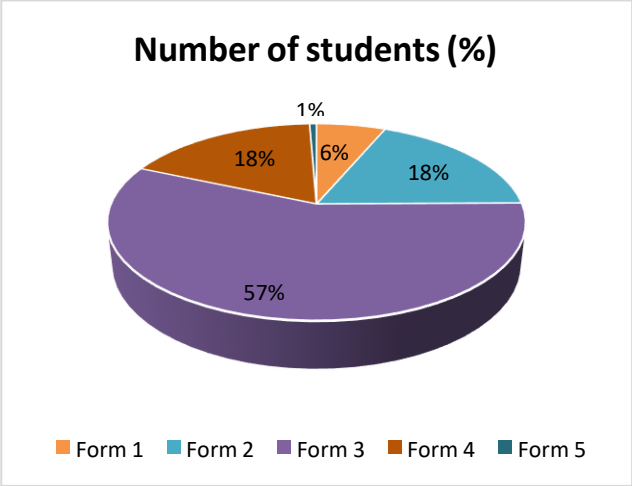

Figure 1: Demographic of the Respondents

Based on Figure 2(a), the statement for the Science subject received positive responses,with a total of 61% agreeing (Agree + Strongly Agree) during the pre-survey stage. This percentage increase for the post-survey shows a slight increase, where it shows the total percentage of students who agreed was 64%. However, there are also a considerable number of neutral responses, which is 33% for the pre- and post-survey. For the mathematics subject, there was significant interest in the post-survey, where the percentage of students who agreed rose significantly from 54% to 62% for the post-survey.On the other hand, we can see that the neutral portion of 42% in the mathematics subject has shifted to the agree/strongly agree portion.

Nearly half of engineering respondents were neutral on the proposition (Figure 2(c)). After the program, the neutral response dropped from 50% to 34%. Both agree and strongly agree to show an increase from 46% to 61% pre-survey to post-survey. As shown in Figure 2(d), agree sections increased from 61% pre-survey to 65% post-survey in the Technology section.

Figure 2: Results of Pre and Post-Survey: Is (a) Science, (b) Mathematics, (c) Engineering and (d) Technology Fascinating?

Next, respondents were asked where these topics excite them. Pre- and post-survey findings are shown in Figure 3. Overall, all subjects and areas that were questioned showed a favourable trend. In science, strongly agreed responders increased from 31% to 43%. The program may have made respondents more interested in science (Figure 3(b)). Like mathematics, neutral people have likely altered their minds to agree and strongly agree. The strongly agreed portion rose from 29% to 41%.

5. Discussions

Figure 3: **Results of Pre and Post Survey: Is (a) Science, (b) Mathematics, (c) Engineering and (d) Technology Exciting?**

The same trend can be observed for the Engineering and Technology field in Figures 3(c) and 3(d). From these responses, it's evident that the majority of respondents foundcareers in STEM fields to be either fascinating or exciting after the webinar. The next question was to find the respondents' inclinations on the activities related to the STEMprogram. The three questions asked were, 1) They are interested in knowing how electronic products work, 2) they wish to create new products; and finally, 3) they like to fix and explore electronics. The results of this survey are shown in Figure 4. It shows thatmore than 70% of the respondents have given positive feedback on these activities. Participants' views on engineering were also asked. A survey found that 42% of respondents found engineering an intriguing career path. Additionally, 37% thought engineering was a smart job. Alternative employment possibilities were associated withhigh wages, work dangers, and coolness by the remaining participants.

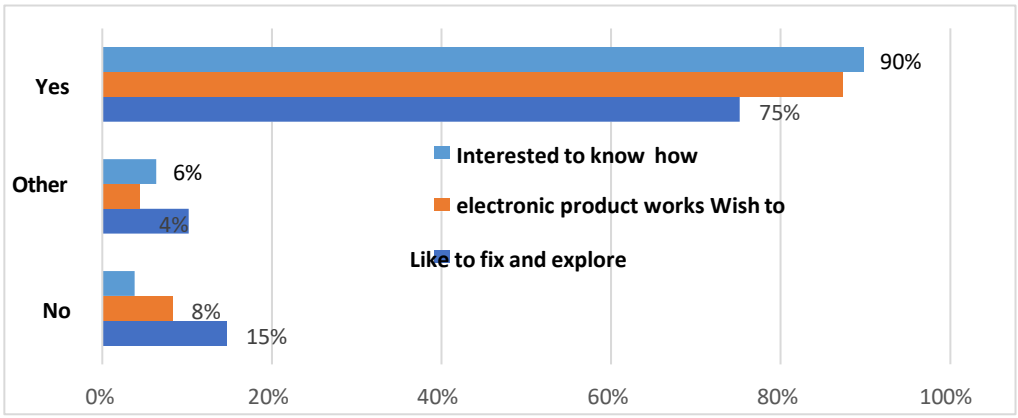

Figure 4: Survey results to identify respondents' inclination toward activities related to STEM

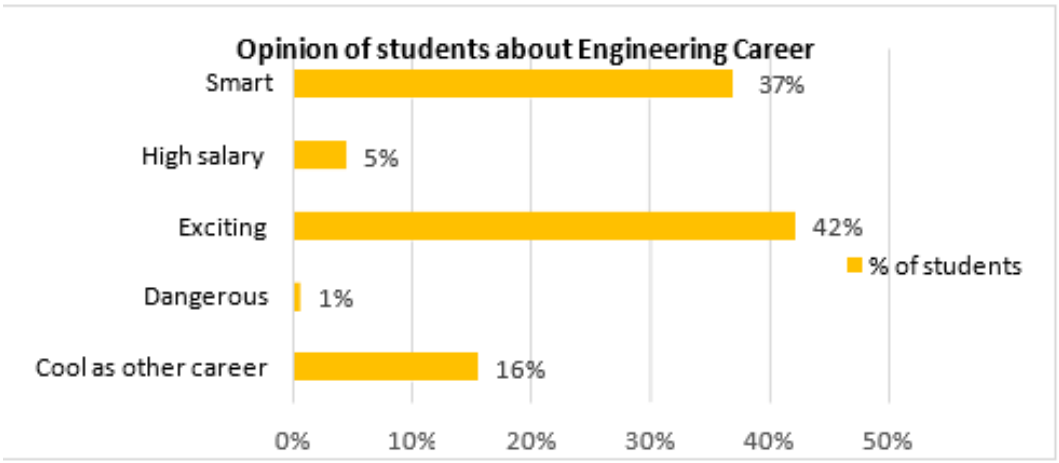

Figure. 5. Respondents' Views on Engineering Career

Lastly, the final question is to gain feedback regarding the impact of the STEM Program. The results are demonstrated in Figure 6. The majority of the respondents (78%)agreed that the program was beneficial for them in choosing an engineering program for their future plans. 23% were neutral, followed by 1% of them who disagreed. The results showed that more students found science, math, engineering, and technology interesting post-survey. More students find math and science interesting. We are pleased that the STEM program reduced neutral replies and increased the percentage ofkids who agreed or strongly agreed that these disciplines are intriguing. More than 70%of respondents were interested in these activities, showing a favourable influence on STEM involvement. This shows that the STEM program has inspired STEM education and jobs. Increased STEM interest among young participants could lead to more kids choosing STEM education and careers, boosting innovation, workforce development, and economic growth.

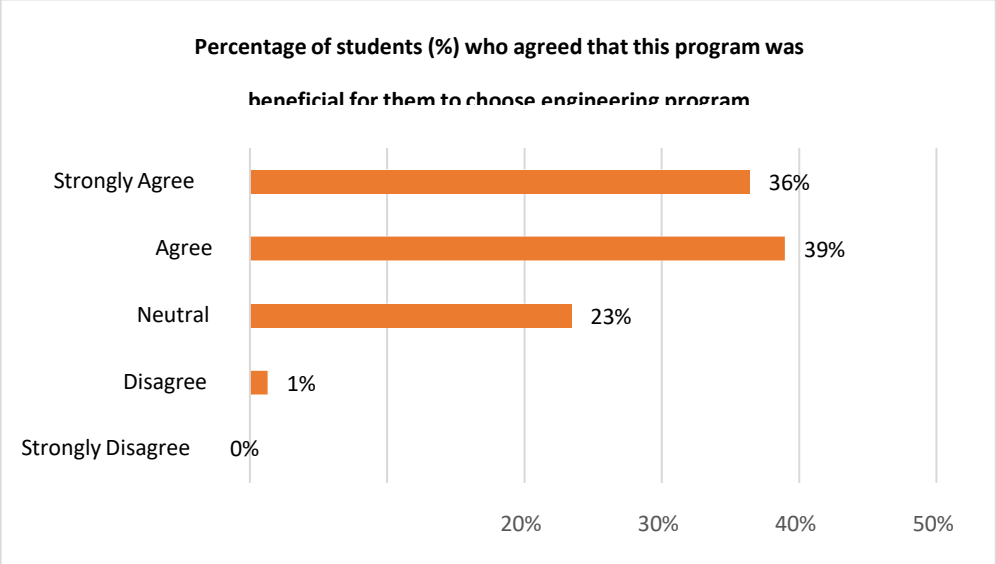

Figure 6: Feedback on the impact of STEM Program

6. Conclusions and Recommendations

This study assessed the effectiveness of a STEM initiative aligned with Malaysia's Education Development Plan (PPPM) 2013-2025. The results highlight the significant role of STEM education in enhancing analytical thinking, problem-solving skills, and creativity among Malaysian youth. The program demonstrated a positive impact, especially in the fields of Mathematics and Engineering, with a notable increase in students' interest and enthusiasm for STEM careers. A majority (78%) of participants acknowledged that the program influenced their interest in STEM, particularly in engineering. To further amplify interest, the STEM program should be expanded to cover additional STEM disciplines, ensuring a holistic exposure for students.

7. Limitations of the Study

The study was primarily limited by its focus on students from Forms 1 to 5 within a specific STEM program, potentially restricting the generalizability of the findings to a broader student population. Additionally, the study did not account for external factors such as socio-economic status, parental influence, or prior exposure to STEM education, which might have impacted the results.

8. Suggestions for Future Research

Future research could focus on several areas to build on the findings of this study. First, exploring the impact of parental involvement on students' engagement with STEM education could provide valuable insights into how family support influences interest in these fields. Additionally, examining the effectiveness of STEM programs across a broader range of disciplines beyond Mathematics and Engineering, such as Technology and Science, would help to understand how different fields engage students. Another promising area of research is the role of community engagement initiatives in sustaining students' long-term interest in STEM. By connecting students with local projects and real-world challenges, these initiatives can make STEM subjects more relevant and practical.

Disclosure Statement
No potential conflict of interest was reported by the authors.

Funding
No funding was involved in this research.

Acknowledgement

The authors wish to extend their heartfelt appreciation to Micron Malaysia, the School of Electrical and Electronic Engineering, Universiti Sains Malaysia and all the committees involved in the USM-MICRON YOUNG WISE STEM Program for their invaluable contributions and support in achieving successful outcomes for this research study.

References

Amelia, A., & Lilia, H. (2019). The Challenge of Integrating STEM Education in the Malaysian Curriculum. Education Discourse Seminar, 2019.

Bryan, L. A., Moore, T. J., Johnson, C. C., & Roehrig, G. H. (2015). Integrated STEM education. In C. C. Johnson, E. E. Peters-Burton, & T. J. Moore (Eds.), STEM roadmap: A framework for integration (pp. 23e37). London: Taylor & Francis.

Saunders, M., Lewis, P., & Thornhill, A. (2009). Research methods for business students (5th Ed.). Essex: Pearson Education Limited.

Halim, L. (2018). STEM Education: Issues and Way Forward, STEM Education in Malaysia (pp.37-58). Department of Higher Education, Ministry of Higher Education: Malaysia.

Duschl, R. A. (2019). Learning progressions: framing and designing coherent sequences for STEM education. Disciplinary and Interdisciplinary Science Education Research, 1, 4. https://doi.org/10.1186/s43031-019-0005-x

Lee, J. (2017). Influence of Career Motivation on Science Learning in Korean High-School Students. Journal of Mathematics Science and Technology Education, 8223(5), 1517–1538. http://doi.org/10.12973/ eurasia.2017.00683a

Guan, M., Capezio, A., Restubog, S. L. D., Read, S., Lajom & Li, M. (2016). The role of traditionality in the relationships among parental support, career decision-making self-efficacy and career adaptability. Journal of Vocational Behavior, 94(2), 114–123. http://doi.org/10.1016/j.jvb.

McFadden, J., & Roehrig, G. (2020). Missed expectations: teacher and coach tensions at the boundary of STEM integration in an elementary classroom. Disciplinary and Interdisciplinary Science Education Research, 2, 4. https://doi.org/10.1186/s43031020-00021-8

Bergeron, L., & Gordon, M. (2015). Establishing a STEM Pipeline: Trends in Male & Female Enrollment and Performance in Higher Level Secondary STEM Courses, International Journal of Science & Mathematics Education, 11(10), 44-57. http://doi.org/10.1007/s10763-015-9693-7

Li, Y., Wang, K., Xiao, Y., & Froyd, J. E. (2020). Research and trends in STEM education: a systematic review of journal publications. International Journal of STEM Education, 7, 11. https://doi.org/10.1186/s40594-020-00207-6

Dare, E. A., Ellis, J. A., & Roehrig, G. H. (2018). Understanding science teachers' implementa-tions of integrated STEM curricular units through a phenomenological multiple case study. International Journal of STEM Education, 5, 4. https://doi.org/10.1186/s40594-018-0101-z

Unlu, Z. K., Dokme, I., & Unlu, V. (2016). Adaptation of the science, technology, engineering, and mathematics career interest survey (STEM-CIS) into Turkish. Eurasian Journal of Educational Research, 16(63), 21-36.