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Impact of MySTEM Ambassador UPM Club on Students' STEM Engagement
(Kesan Kelab MySTEM Ambassador UPM terhadap Penglibatan STEM dalam Diri Pelajar)

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ABSTRACT

The MySTEM Ambassador UPM Club was established in 2020 under the Student Affairs Division (BHEP). The club was established at the request and encouragement of the Ministry of Higher Education (KPT) Malaysia. Each public higher education institution (IPTA) is asked to establish its respective MySTEM Club to develop science among young people, especially among school students. It explores how the program has influenced students' perceptions and involvement in STEM (Science, Technology, Engineering, and Mathematics) fields. The club aims to open students' minds to the significance of science, technology, and innovation in everyday life, fostering a deeper appreciation for these areas. By establishing strong relationships between higher education institutions and the community, particularly schools, the program seeks to enhance understanding and interest in STEM among students. The initiative also focuses on developing students' skills and creativity in applying STEM concepts, thereby empowering them to engage more actively in STEM learning. This study delves into the effectiveness of the MySTEM Ambassador UPM program in achieving these objectives, providing insights into its role in cultivating a future generation of skilled and innovative STEM professionals. The findings underscore the club's role in promoting STEM education and suggest that expanding similar initiatives could further strengthen the STEM pipeline in Malaysia.

Keywords: innovation, STEM education, student knowledge, promoting STEM

ABSTRAK

Kelab MySTEM Ambassador UPM ditubuhkan pada tahun 2020 di bawah Bahagian Hal Ehwal Pelajar (BHEP). Kelab ini ditubuhkan atas permintaan dan galakan daripada Kementerian Pengajian Tinggi (KPT) Malaysia. Setiap institusi pengajian tinggi awam (IPTA) diminta untuk menubuhkan Kelab MySTEM masing-masing bagi mengembangkan sains dalam kalangan anak muda, khususnya dalam kalangan pelajar sekolah. Ia meneroka bagaimana program ini telah mempengaruhi persepsi dan penglibatan pelajar dalam bidang STEM (Sains, Teknologi, Kejuruteraan, dan Matematik). Kelab ini bertujuan untuk membuka minda pelajar terhadap kepentingan sains, teknologi, dan inovasi dalam kehidupan seharian, memupuk penghargaan yang lebih mendalam untuk bidang ini. Dengan mewujudkan hubungan yang kukuh antara institusi pengajian tinggi dan komuniti, khususnya sekolah, program ini bertujuan untuk meningkatkan pemahaman dan minat terhadap STEM dalam kalangan pelajar. Inisiatif ini juga menumpukan kepada pembangunan kemahiran dan kreativiti pelajar dalam mengaplikasikan konsep STEM, seterusnya memperkasakan mereka untuk melibatkan diri secara lebih aktif dalam pembelajaran STEM. Kajian ini mendalami keberkesanan program MySTEM Ambassador dalam mencapai objektif ini. Hal ini memberikan pandangan tentang peranan kelab ini dalam memupuk generasi masa depan profesional STEM yang mahir dan inovatif. Penemuan ini menggariskan peranan kelab dalam mempromosikan pendidikan STEM dan mencadangkan bahawa memperluaskan inisiatif serupa boleh mengukuhkan lagi saluran paip STEM di Malaysia.

Kata kunci: Inovasi, Pembelajaran STEM, pengetahuan murid, mempromosi STEM

INTRODUCTION

What is Stem?

STEM is the acronym of the words Science, Technology, Engineering, and Mathematics, hence can be described as a conceptual definition that synthesizes a coherent vision of education, research and innovation. All the branches of STEM are critical to the development of contemporary society, as they exist as separate disciplines, while embracing similar approaches and tools for identifying and addressing issues. The connection of these disciplines is necessary for enhancing mankind's experience as well as for stimulating economic development and solving global problems.

Science, the first pillar of STEM, focuses on the study of the physical world, while Technology uses scientific knowledge to create tools, methods, and devices that improve human capabilities (Bahrum, Wahid, & Ibrahim, 2017). Engineering is crucial in transforming theoretical knowledge into practical applications, while Mathematics provides the analytical framework for problem-solving across these fields (Eilam et al., 2016). Finally, Mathematics gives the exact tool, which is a language, and theories employed in measuring, analyzing and solving challenges in STEM disciplines.

These four disciplines thereby create an integrated strategy for innovation and learning, thus enabling a person to meet the challenges of the contemporary world with the required flexibility and tools. There should not be any doubt regarding the significance of STEM as it makes the foundation for growth and development of human society through science and technology.

Stem in Malaysia

STEM education has gained a central role in the Malaysian educational reforms as the country aims to prepare students for the increasing importance of technology. Introducing STEM has been based on the understanding that the subjects of STEM are crucial in driving innovation and growth of the economy and therefore the country has embarked on several strategic measures towards encouraging uptake of the disciplines (Idris et al., 2023). Osman and Saat (2014) further emphasize that STEM education is a cornerstone of national development, as it equips students with the knowledge and skills needed to thrive in a technology-driven economy. However, challenges such as a low level of student concern for STEM subjects still persist, particularly in secondary education (Rashidin, Bacotang, & Govindasamy, 2023).

PROBLEM FACING

Lack of student interest in STEM subjects represents one of the major concerns related to STEM education in Malaysia. Most students are inclined to think that the disciplines that belong to the STEM field are challenging and disconnected from what they consider to be reality. This is due partly to the short supply of time students get to practice real-life situations that depict actual applicability of STEM in life. Therefore, students are unable to understand the need to embrace STEM and this will result in least interest and participation.

SOLUTIONS

In this regard, the Malaysian government through the Ministry of Education has come up with The National STEM Education Strategy. This strategy is to start the development of science and technology right from the junior classes with an aim of having creative, skilled and professional students in science, technology, engineering and mathematics courses. The implication here is that science is regarded as a tool that needs governmental support in steering the nation’s development as well as shaping its competitiveness in the global market.

To extend more support to the government’s strategy, schools all over the country are urged to start STEM clubs. These clubs offer students the flexibility of learning STEM-related subjects in an interesting and friendly manner as compared to the traditional methods. Therefore, belonging to STEM clubs will enable students to carry out projects as well as activities that illustrate ways in which academic lessons can be applied. The notable goal that is pursued by exposing learners hands-on with technology is to close the theory-practice gap that is expected to develop further interest as well as understanding of STEM subjects.

Besides, and for the same interest, the government of Malaysia has also urged universities to incorporate the promotion of STEM education. Not only that, universities are to deliver STEM graduates of the highest possible quality but also perform related outreach activities for students to motivate them about STEM kinds of jobs. This directive is in line with the general goal of developing a talent pool in the STEM fields who will feed the nation’s innovation system.

Collectively, these initiatives will help build

Malaysia's STEM capability among students and inspire more students concerning STEM careers. Partnership with STEM clubs, government, and universities to ensure holistic support and development of students' interest in STEM has been established. It is believed that as students master more content knowledge in STEM subjects, there shall be an implication of an increase in the enrolment in STEM disciplines that are very essential for Malaysia's economic growth and development in the global economy.

MySTEM Ambassador UPM Club

The MySTEM Ambassador UPM Club is a partnership initiative intended to close the academic transition between universities and secondary schools. This concept is based on the premise that positive relations between universities, on the one hand, and the community, especially schools, on the other, will enhance students' perception and interest towards STEM. The club extends its focus from appreciation to practical skill-building, aiming to nurture students who can creatively apply STEM knowledge in real-world scenarios.

One of the primary objectives of the MySTEM Ambassador UPM Club is to empower students by providing them with the tools and opportunities to explore STEM fields more deeply. Through hands-on activities, workshops, and mentoring, the program encourages students to develop a strong foundation in STEM disciplines, fostering creativity and critical thinking. By doing so, the initiative contributes to the broader goal of producing a future workforce that is equipped to meet the challenges of an increasingly technological world.

In the context of the article, the author is interested in the influence that the MySTEM Ambassador UPM Club has on the students' STEM participation and experiences, particularly the changes that have occurred in students' interest, abilities, and attitudes towards STEM. Specifically, the study is focused on the role of the program in attaining its goal and objectives as well as improving the advancement of STEM education among Malaysian students. Thus, as STEM dominates the future, it is essential to identify the determinants of students' interest in these disciplines as the development of effective approaches for the preparation of the new generation is urgent.

RESEARCH PROBLEM

Despite the efforts of the MySTEM Ambassador UPM Club, students often perceive STEM subjects as abstract and disconnected from daily life. This perception limits genuine engagement and makes it harder to sustain long-term interest. The club faces the challenge of translating theoretical concepts into relatable, practical experiences that students can connect with. To improve effectiveness, it is crucial to evaluate whether current strategies successfully bridge this gap and foster meaningful participation in STEM education (Vennix, Brok, & Taconis, 2016).

One of the primary objectives of this club is to increase students' awareness of the importance of science, technology, and innovation in their daily lives. Despite this goal, a persistent issue is the lack of a clear connection between the abstract concepts taught in STEM subjects and their practical applications in everyday scenarios. Many students continue to view STEM disciplines as distant or irrelevant to their personal lives, which poses a significant obstacle to fostering genuine interest and engagement. This disconnect prompts the need for research into how effectively the MySTEM Ambassador UPM Club bridges this gap and whether its activities are making STEM more relatable and meaningful for students.

The program also seeks to produce students who are not only knowledgeable but also skilled and creative in applying STEM concepts. Achieving this objective requires more than just imparting technical knowledge; it necessitates the development of critical thinking, creativity, and problem-solving abilities. A key challenge lies in determining whether the club successfully nurtures these competencies in students. There is a concern that students may be acquiring STEM knowledge without necessarily developing the creativity and innovation needed to apply this knowledge in real-world contexts. This issue underscores the need for research to assess how well the program fosters both the technical and creative aspects of STEM education.

Finally, the overarching goal of empowering students through a deeper understanding of STEM fields and their foundational principles presents another set of challenges. True empowerment implies that students feel confident, motivated, and equipped to pursue further studies or careers in STEM. However, factors such as a lack of resources, socio-economic disparities, and gender biases may impede the program's ability to fully empower all students. Investigating how the MySTEM Ambassador UPM Club addresses these barriers and the extent to which it succeeds in empowering students is crucial for understanding the program's overall impact. These challenges highlight the need for comprehensive research into the effectiveness of the MySTEM Ambassador UPM Club in achieving

its objectives. By exploring these issues, this study aims to provide valuable insights that can help refine and enhance the program, ensuring it more effectively engages and empowers students in STEM fields.

RESEARCH PURPOSE

i. To evaluate the effectiveness of the MySTEM Ambassador UPM Club in increasing students' engagement with STEM fields.
ii. To investigate how the program empowers students to pursue further studies or careers in STEM.
iii. To provide recommendations for enhancing the MySTEM Ambassador UPM Club to improve STEM engagement among students in Malaysia.

METHODOLOGY

This study employs a qualitative research approach to explore the effectiveness of the "Outreach STEM" program in a secondary school setting. Data were collected through semi-structured interviews with three teachers who are actively involved in implementing the program. These teachers were selected based on their experience with STEM education and their willingness to participate in the study. Their insights were invaluable in assessing the effectiveness of the outreach program (Struminger et al., 2018). All teachers participated voluntarily in the session and their characteristics are shown in Table 1.

TABLE 1. Teacher's Characteristic as responds.

Characteristic	Teacher A	Teacher B	Teacher C
Gender	Female	Male	Male
Teaching experience	30	35	29
Major	Physics	Physics	Physics

To begin with, certain criteria must be considered when selecting teachers for this study. First, the teachers must be employed at primary or secondary schools. Additionally, they should have substantial experience and expertise in teaching STEM subjects, which are Science, Mathematics, Engineering and Technology. Lastly, the teachers must consent to the use of video and audio recordings during the interviews, as well as the sharing of relevant documents after the sessions conclude.

The table presents the demographic and professional backgrounds of three teachers participating in a qualitative study on the "Outreach STEM" program's effectiveness in a school setting. The participants include one female and two male teachers, all with extensive teaching experience ranging from 29 to 35 years. Each teacher has a major in Physics, providing them with the relevant subject-matter expertise to assess the program. This diversity in gender, coupled with their deep experience and specialized knowledge, ensures that the qualitative data gathered will offer valuable insights into the program's impact and effectiveness in enhancing STEM education.

RESEARCH RESULTS AND DISCUSSIONS

The qualitative analysis of the interviews conducted with three teachers actively involved in the MySTEM Ambassador UPM Club program revealed key insights into the program's effectiveness, challenges, and areas for improvement. The teachers' perspectives provided a comprehensive understanding of how the program influences student engagement in STEM, the extent to which it empowers students to pursue further studies or careers in these fields, and recommendations for enhancing the club's impact.

Each teacher highlighted the valuable insights into the effectiveness of current STEM education initiatives. They discussed various aspects of student engagement, the challenges students face in understanding STEM concepts, and the importance of integrating real-world applications to sustain interest in STEM subjects. Additionally, the teachers emphasized the need for greater exposure to STEM careers, mentorship opportunities, and the incorporation of innovative teaching methods to enhance the overall effectiveness of STEM programs. This discussion

outlines the key themes identified in these interviews, offering a comprehensive overview of the areas where improvements are necessary to better support students in their STEM education journey.

Table 2 presents a synthesis of the interview findings, illustrating the key quotes, corresponding codes, and the categories they fall into, mapped to the relevant research purposes of this study.

TABLE 2. The coding and Transcription Data for Teachers Interview

Quotes	Codes	Categories
…students seem more interested in STEM when they see real-world applications…T1	STEM applications	Student Engagement in STEM
…outreach programmed are good because it involves students to do by themselves, but not all students fully engage because they struggle with basic concepts…T2	Hands-on workshops	
…the program helps students understand the importance of STEM…T3	Student understandable	
…the club activities make them curious, but they need more exposure to STEM careers to keep them motivated…T1	Need more exposure	Empowering Students for STEM Careers
…some students show interest in STEM careers, but there's a need for more guidance and mentoring…T2	Interest in STEM careers	Recommendations for Program Enhancement
…empowering students is the key, and we need to focus on how to sustain their interest beyond the classroom…T3	Sustaining interest beyond classroom	
…we need more resources to keep the momentum going, especially in underfunded schools like our school…T1	Need for more resources	
…I think adding more career talks and industry visits would help students see the real potential of STEM fields. I like the way of presentation by all of you, it makes students understand easily…T2	Career talks	
…to improve, we could integrate more technology and be innovative in your outreach activities. it makes students to feel more interact to participate…T3	Integrating technology	

The analysis of the interviews conducted with the three teachers involved in the MySTEM Ambassador UPM Club reveals critical insights into the program's impact on student engagement and the effectiveness of STEM education. The coding and transcription data from the interviews are summarized in Table 2, which categorizes the teachers' responses into several key themes: student engagement in STEM, empowering students for STEM careers, and recommendations for program enhancement.

One of the main findings from the interviews is the importance of student engagement in STEM. The teachers' interviews revealed that students tend to show greater interest in STEM when they can relate it to real-world applications. Teachers noted that students seem more interested in STEM when they see its real-world applications; however, there remains a gap in understanding among students, particularly those who struggle with basic concepts during hands-on workshops (Eilam et al., 2016). In line with this, Vennix, Brok, and Taconis (2018) found that STEM outreach activities significantly motivate students and improve their attitudes towards STEM, suggesting that more interactive and hands-on activities could

further enhance student engagement. This suggests that while the UPM MySTEM Ambassador UPM Club is successful in sparking initial interest, there is a need for strategies that ensure all students can fully engage with and comprehend STEM concepts.

Another significant theme is the need for empowering students for STEM careers. Teachers pointed out that while club activities generate curiosity, there is a critical need for more exposure to STEM careers to keep students motivated. This further emphasizes the need for mentorship and career exploration in the program (Azman et al., 2021). Moreover, Tillinghast et al. (2020) stress the importance of STEM outreach activities in creating a connection between students and potential STEM careers, which can enhance students' motivation and provide them with a clearer understanding of the career paths available in these fields. Some students have shown interest in pursuing STEM careers, but there is a clear need for additional guidance and mentoring to sustain this interest beyond the classroom. This finding highlights the importance of long-term support structures within the program to help students transition from interest in STEM to actual career paths in these fields.

Finally, the interviews underscored the need for program enhancement to improve the effectiveness of the MySTEM Ambassador UPM Club. Teachers identified several areas for improvement, such as the need for more resources, especially in underfunded schools, and the potential benefits of integrating more career talks and industry visits. Additionally, there was a call for incorporating more technology and innovative teaching methods to maintain student engagement. Several teachers suggested enhancing the MySTEM Ambassador UPM Club by integrating more technology and providing additional resources for underfunded schools (Syed et al., 2025). This would ensure greater accessibility and participation in STEM programs, especially for students from less privileged backgrounds. Furthermore, the importance of integrating career talks and industry visits was emphasized, as these activities could help students better understand the practical applications of STEM. Flash et al. (2017) support this recommendation, as their study on academic library STEM outreach programs highlights the value of continuous evolution in program delivery to keep students engaged and motivated. These recommendations align with the broader goal of the program to continuously evolve and address the challenges faced by educators in promoting STEM education.

In conclusion, the findings from the teacher interviews provide valuable feedback on the strengths and areas for improvement of the MySTEM Ambassador UPM Club. These insights are vital for refining the program's direction, ensuring it continues to promote meaningful STEM learning while empowering students to explore future academic and career opportunities.

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