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Revolutionizing STEM Education: Unleashing the Potential of STEM Interest Careers in Malaysia

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Abstract
STEM education and STEM oriented occupations have emerged as major drivers of talent pool expansion, economic growth, and technical advancement in Malaysia's dynamic terrain, where innovation and progress reign supreme. Malaysia recognises the critical need to create a solid talent pool capable of navigating this fast evolving terrain as the globe becomes increasingly reliant on science, technology, engineering, and mathematics. STEM education, with its multidisciplinary approach that integrates these important disciplines, has become the cornerstone of Malaysia's educational system, empowering a generation of STEM-literate persons ready to face the future's problems and opportunities. Simultaneously, the appeal of STEM interest employment has grabbed aspirant persons, providing avenues that merge enthusiasm and proficiency, ensuring Malaysia remains at the forefront of global innovation. We delve into the domains of STEM education and STEM oriented careers in Malaysia, finding their transformative impact on nurturing and extending the nation's talent pool, boosting economic competitiveness, and propelling scientific and technological brilliance in this enthralling exploration.
Keywords: STEM, Interest, Career, Educational, Talent Pool

Introduction

STEM education and STEM-related occupations have received substantial attention in Malaysia as essential drivers of economic growth, technical innovation, and human capital development. STEM, which stands for Science, Technology, Engineering, and Mathematics, refers to a multidisciplinary approach that integrates various subjects in order to foster critical thinking, problem-solving abilities, and innovation (National Research Council, 2011). With a vision to transform Malaysia into a high-income nation driven by knowledge and innovation, the government and educational institutions have placed a strong emphasis on promoting STEM education and encouraging students to pursue STEM interest careers (Idris & Bacotang, 2023).

According to a study by Idris et al (2023c), STEM education plays a vital role in Malaysia's educational landscape by preparing students for the demands of a rapidly evolving global

economy. The study highlights that STEM education equips students with essential skills, such as analytical thinking, creativity, and digital literacy, which are increasingly valued in the job market (Fallon et al., 2020). Additionally, STEM education fosters a passion for scientific inquiry, technological advancements, and engineering principles, creating a solid foundation for students to pursue STEM interest careers in fields such as aerospace, biotechnology, information technology, and renewable energy (Idris, et al., 2023a).

Furthermore, STEM-related occupations have enormous potential for Malaysia's economic growth and development. According to a research by the National STEM Movement (2021), STEM interest occupations have a substantial impact on the country's ability to compete in the global digital economy. The number of student enrolling for STEM subject has seen a decrease over the past few years (Idris et al., 2023a)

The research emphasises the importance of cultivating a diversified talent pool of STEM workers in order to stimulate innovation, attract investments, and advance Malaysia towards becoming a regional scientific and technology centre. Malaysia hopes to overcome the skills gap, fulfil the demands of developing industries, and place itself at the forefront of the Fourth Industrial Revolution by encouraging students to pursue STEM-related occupations. Effective STEM education is important in generating the human capital and talent pool for economic development and growth (Idris & Bacotang, 2023).

Finally, STEM education and STEM-related employment have become essential components of Malaysia's strategic strategy for economic expansion, scientific advancement, and talent development. Malaysia seeks to produce a future-ready workforce capable of harnessing the power of science, technology, engineering, and mathematics to generate innovation, sustainable growth, and global competitiveness by investing in STEM education and empowering students to pursue STEM oriented occupations.

STEM Education in Malaysia

STEM (Science, Technology, Engineering, and Mathematics) education plays a crucial role in Malaysia's efforts to cultivate a skilled workforce, foster innovation, and drive economic growth (Idris et al., 2023d). STEM education has been an area of great interest in Malaysia (Osman & Saat, 2014). With the rapid growth of technology and the growing demand for STEM experts around the world, Malaysia recognises the necessity of providing its students with the information, skills, and competences they need to succeed in the modern world. This article delves into the current state of STEM education in Malaysia, evaluating the tactics, difficulties, and opportunities for expanding STEM learning.

The government of Malaysia has made significant efforts to promote STEM education across the country. STEM education in Malaysia has its own understanding based on Malaysian Education policy (Ahmad et al., 2019). Various policies and initiatives have been implemented to integrate STEM principles and practices into the national curriculum. According to a study by STEM education research has been become more attractive area in science education for a decade (Chomphuphra et al., 2019). STEM education in the curriculum strives to create a thorough understanding of scientific principles, technological literacy, engineering design, and mathematical reasoning.

Figure 1, depicts the STEM education conceptual framework outlined in the Malaysia Education Blueprint, which includes an interdisciplinary approach that integrates science, technology, engineering, and mathematics to foster critical thinking, problem-solving, and creativity in students, preparing them for the demands of the twenty-first-century workforce.

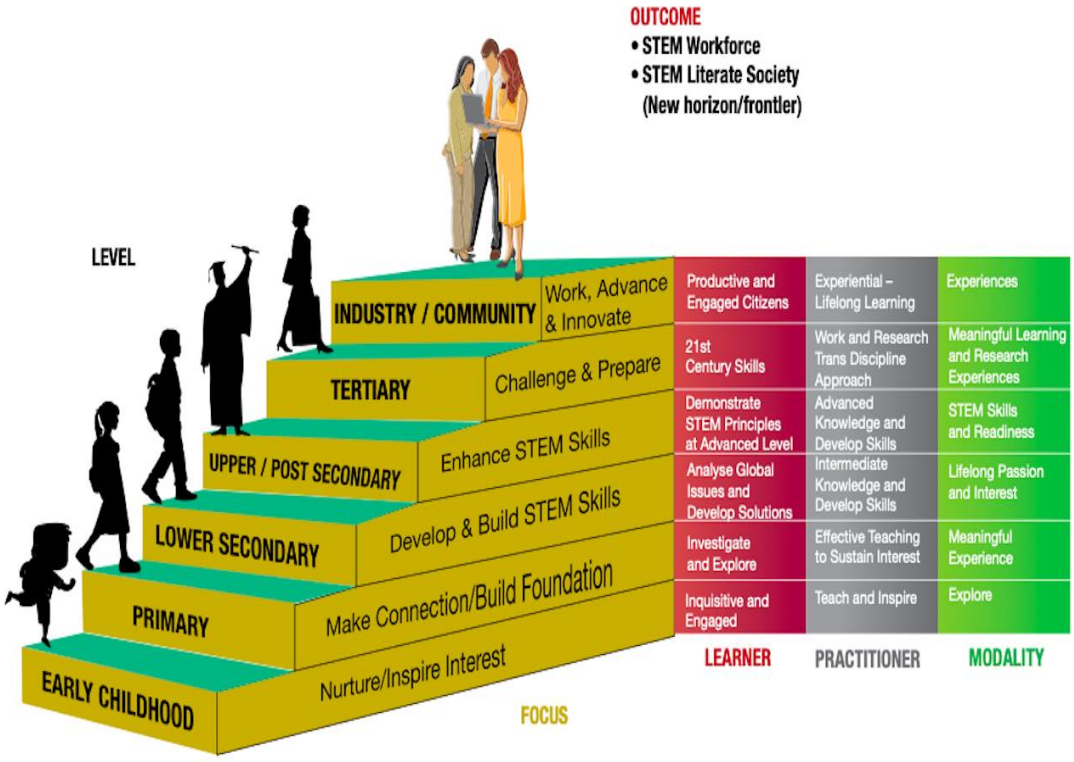


Figure 1. STEM education Conceptual Framework (Source: Malaysia Education Blueprint, 2013-2025)

Nonetheless, despite improvements, STEM education in Malaysia confronts a number of problems. Limited resources, such as infrastructure, equipment, and qualified teachers, are key impediments to effective STEM programme implementation. A study conducted by Idris et al (2023a) highlights the importance of addressing these challenges to ensure the quality and sustainability of STEM education in Malaysia. Adequate investment, professional development opportunities for teachers, and access to modern technology and resources are essential for delivering high-quality STEM education to students.

One of the most important concerns in Malaysian STEM education is the underrepresentation of women, which impedes the full potential of talent and diversity in STEM professions, necessitating aggressive measures to overcome gender imbalances and encourage more inclusivity. The number of female student studying STEM subject at higher education level has be consistently underrepresented, especially in engineering courses (Kho, 2016).

STEM education and careers cover a wide range of topics, beginning with school-based initiatives that emphasise hands-on learning, problem solving, and scientific inquiry and progressing to university programmes that provide specialised knowledge and skills in STEM

disciplines, ultimately leading to diverse and promising career opportunities in industries such as technology, engineering, research, healthcare, and innovation (Hasnah, 2020).

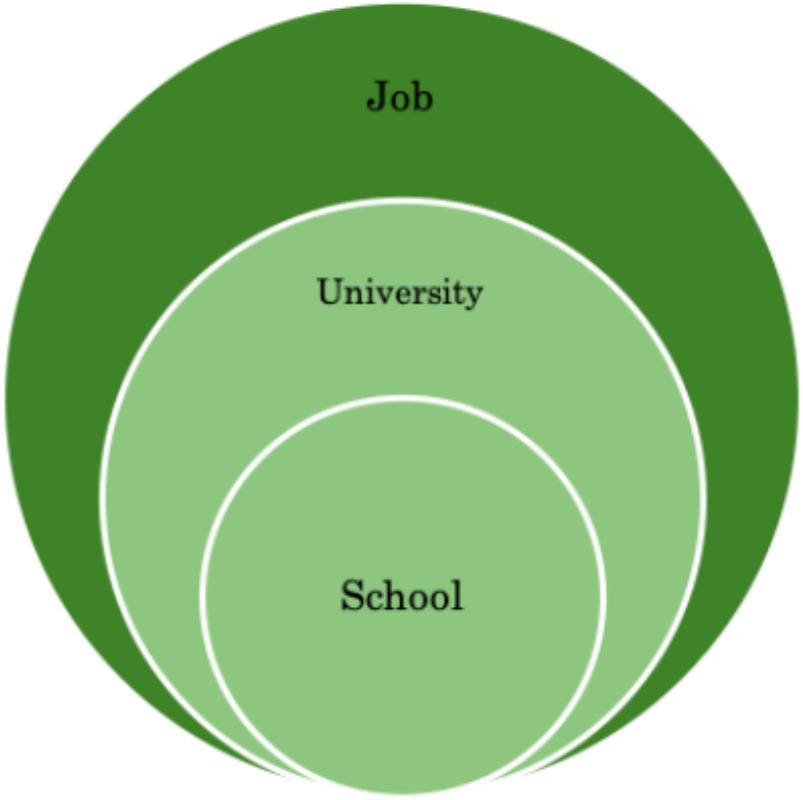


Figure 2. The Scopes of STEM Education and Career. (Source: Hasanah, 2020)

Furthermore, efforts to enhance STEM education diversity and inclusivity are crucial. Women continue to be underrepresented in STEM areas, owing to gender disparities. A study by Idris et al (2023d) empowering self-efficacy among students for STEM education is crucial, and it requires emphasizing the need for promoting gender equality and inclusivity in STEM education to create a more diverse talent pool. Exploring cognitive styles is a vital aspect of empowering STEM education as it allows educators to understand the individual learning preferences, strengths, and challenges of students, enabling tailored instructional approaches that foster engagement, critical thinking, and problem-solving skills essential for success in STEM disciplines (Idris et al., 2023c)

To summarise, STEM education is an important component of Malaysia's educational environment since it prepares students for the difficulties of a quickly changing world. Malaysia can establish a strong foundation of STEM education, equipping its students to achieve in STEM fields and contribute to the nation's progress, by tackling the obstacles, investing in resources and professional development, and fostering inclusion.

STEM Interest Career

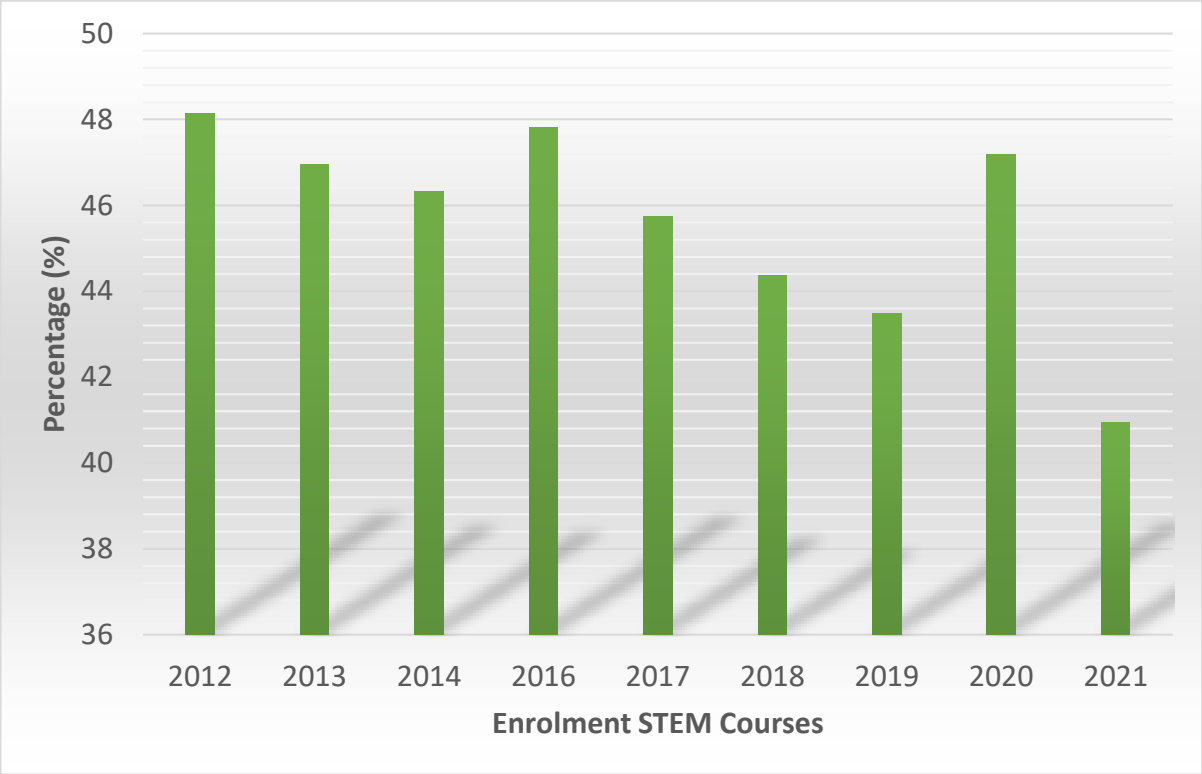
STEM (Science, Technology, Engineering, and Mathematics) interest career have received a lot of attention in Malaysia as the country tries to maximise the potential of its trained people and promote technological breakthroughs (Idris & Bacotang, 2023). STEM interest career can

be reasonably well predicted from a linear combination of four measures of STEM dispositions (Christensen et al., 2015). STEM interest career include a wide range of sectors such as information technology, engineering, biotechnology, renewable energy, and others.

Determining middle school students' STEM career interests is an important step in fostering their passion and motivation for STEM education, as it helps align their academic pursuits with their future aspirations, allowing them to make informed choices, develop relevant skills, and lay a strong foundation for their future STEM careers. STEM career interest has be found to be disproportionate to gender (Donmez et al., 2020). Student's attitudes towards STEM career are not static over their primary and secondary grades (Wiebe et al., 2018).

From 2012 to 2022, the level of STEM interest among Malaysian secondary school students has been observed to be unstable, with the 60 percent target still elusive, indicating the need for additional interventions and strategies to effectively cultivate and sustain students' enthusiasm and engagement in STEM subjects and potential careers. According to Wyss et al (2012), when students have negative perceptions of STEM occupations, they may be excluded from gaining enthusiasm for the field during formal education.

Figure 3 depicts the trend of secondary school students enrolling in STEM programmes in Malaysia. Figure 4 illustrates student enrolment in vocational education in Malaysian schools from 2016 to 2021, demonstrating a significant lack of involvement in this sector.



*Data 2015 not included

Figure 3. STEM education enrolment in Malaysia

Figure 4. The enrolment of student in Vocational Education in Malaysian School (Source: Minister of Education, 2022)

To overcome the hurdles connected with STEM-related occupations, it is critical to execute targeted measures to improve STEM education awareness among instructors and students. STEM education integration is critical because it allows students to develop a holistic understanding of the interconnectedness of science, technology, engineering, and mathematics, fostering critical thinking, problem-solving, and creativity while preparing them for the modern world's interdisciplinary challenges. The main thing to keep in mind to implemented STEM education is to increase the interest of student and teacher's awareness of the STEM education (Bahrum et al., 2017).

Individuals with a strong belief in their own abilities are more likely to persist, overcome challenges, and actively pursue STEM subjects and careers, emphasising the importance of fostering self-efficacy through supportive learning environments, mentorship, and exposure to real-world STEM experiences. The need to improve student's self-efficacy through STEM learning experience is imperative to ensure continued interest in STEM careers (Mohtar et al., 2019). The self-efficacy of current STEM education among student in Malaysia need to be questioned by research (Idris et al., 2023e).

Individuals' cognitive abilities, such as critical thinking, problem-solving, and creativity, are essential for success in STEM fields, emphasising the importance of developing and enhancing cognitive skills through effective instructional strategies, hands-on learning experiences, and stimulating environments that foster curiosity and intellectual growth. According to Idris et al. (2023c) Individuals can overcome cognitive barriers and achieve success in STEM education and careers by establishing a growth mindset, cultivating intrinsic drive, and supporting effective learning practises.

The stability and volatility of STEM career interest among high school students has significant implications for STEM education, emphasising the importance of ongoing efforts to cultivate and nurture student interest, expose students to a variety of STEM opportunities, and address potential barriers and misconceptions that may contribute to fluctuations in their career

aspirations. The percentage of males interested in a STEM career remained stable during the high school years (Sadler et al., 2012). At the same time, Female student's science interest was positively correlated with personal time and innovation oriented career perspectives (Kang et al., 2018).

Finally, STEM-related occupations are critical to Malaysia's economic development and technical improvement. Malaysia can establish a diverse and talented STEM workforce capable of driving innovation and contributing to the nation's progress through stimulating interest, offering support, and promoting inclusivity.

Discussion

In Malaysia's goal of economic growth, technical improvement, and talent development, the relationship between STEM (Science, Technology, Engineering, and Mathematics) education and STEM focused careers is critical (Academy of Science Malaysia, 2020). STEM education lays the groundwork for developing the knowledge, skills, and competences required for individuals to flourish in STEM-related occupations. This study investigates the symbiotic relationship between STEM education and STEM interest careers in Malaysia, focusing on the tactics, problems, and opportunities for aligning these two areas in order to promote a vibrant STEM ecosystem.

The direct involvement of higher education institutions has been identified as a significant factor contributing to the development of STEM in Malaysia, as highlighted by Hussain et al. (2019). Their active participation and collaboration with schools, business partners, and the government may give important resources, expertise, and research opportunities, fostering innovation, improving STEM education, and preparing students for future STEM professions.

It is critical to cultivate a positive perception of STEM education and STEM careers among students because this fosters enthusiasm, interest, and active participation in STEM subjects, encouraging them to explore and pursue STEM pathways, and contributing to the development of a skilled and competitive STEM workforce that drives innovation, economic growth, and societal advancement. Wyss et al. (2012) discovered that middle school students' interests in specific occupations was related to what they thought of the occupation.

STEM oriented careers in Malaysia cover a wide number of industries and sectors, allowing individuals to utilise their STEM knowledge and abilities in practical and effective ways. These vocations include information technology, engineering, biotechnology, renewable energy, and others. Idris and Bacotang (2023) STEM education opens up a plethora of career opportunities as professional workers in the era of Industrial Revolution 4.0 and Society 5.0, where the integration of advanced technologies and the emphasis on human-centered solutions require individuals with strong STEM competencies to drive innovation, shape digital transformation, and tackle complex challenges across various sectors for the betterment of society.

The relationship between STEM education and STEM interest careers in Malaysia is mutually reinforcing. STEM education serves as the foundation for developing the necessary knowledge and skills that individuals require to succeed in STEM interest careers. Concurrently, STEM interest careers provide real-world applications and contexts that

reinforce and deepen students' understanding and passion for STEM disciplines (Idris et al., 2023c; Kang et al., 2018; Osman & Saat, 2014).

STEM education in Malaysia plays a crucial role in preparing students for the challenges and opportunities of the 21st-century workforce. By integrating STEM principles and practices into the curriculum, students are equipped with critical thinking, problem-solving abilities, and creativity. They develop a strong foundation in scientific inquiry, technological literacy, engineering design, and mathematical reasoning (Fallon et al., 2020; Idris et al., 2023a).

Finally, the relationship between STEM education and STEM-related employment in Malaysia is critical to the country's success in the digital age. Malaysia can build a competent and dynamic workforce capable of generating innovation, economic growth, and societal impact by connecting STEM education with the needs and demands of STEM interest careers.

Conclusion and Future Agenda

STEM (Science, Technology, Engineering, and Mathematics) education and STEM focused occupations in Malaysia have enormous potential to shape the country's economy, technological landscape, and talent pool in the future. As Malaysia aims to establish itself as a worldwide player in innovation and technology, it is critical to recognise the symbiotic relationship between STEM education and STEM interest careers and develop a forward-thinking strategy to fully realise their potential.

The theoretical contribution is in offering a holistic framework that combines cutting-edge instructional strategies, curriculum upgrades, and effective mentorship programmes to develop a lifelong interest in STEM subjects. Furthermore, the contextual contribution entails identifying the specific difficulties and possibilities confronting the Malaysian education system while taking cultural and socioeconomic aspects into account in order to personalise the recommended solutions for optimum impact. Finally, the goal of this research is to develop a blueprint for transforming STEM education in Malaysia, unlocking the full potential of students' STEM interests and equipping them with the skills and knowledge needed to thrive in STEM careers, thereby contributing to the nation's scientific and technological advancements.

Malaysia must prioritise many critical areas in the future to ensure the continuing expansion and success of STEM education and STEM-related employment. For starters, there is an ongoing need for investment in infrastructure, resources, and professional development opportunities for educators. Giving teachers the resources, training, and support they need will allow them to deliver high-quality STEM instruction and inspire students to pursue STEM-related occupations.

Second, efforts should be directed towards increasing inclusivity and diversity in STEM professions. Encouraging underrepresented groups, particularly women, to pursue STEM education and careers is critical for tapping into a larger talent pool and encouraging innovation. Policies and programmes should be put in place to ensure equitable opportunities and assistance to all individuals interested in STEM careers.

Third, collaboration among academics, industry, and government is critical for closing the education-industrial gap. Strengthening relationships and encouraging information exchange will help to guarantee that STEM education keeps up with the changing demands of STEM-related careers. Internships, apprenticeships, and mentorship programmes in the industry can give students with real-world experience and improve their employability in STEM subjects.

Finally, ongoing monitoring, evaluation, and research are essential for informing evidence-based decision-making and policy development in STEM education and STEM-related jobs. Ongoing research and evaluations will aid in the identification of emerging trends, difficulties, and opportunities, allowing for timely interventions and improvements. Furthermore, research should focus on understanding the changing job market and future workforce demands in order to link STEM education programmes with industry needs.

By embracing these future agendas, Malaysia can pave the road for a healthy STEM environment that stimulates innovation, empowers its workforce, and contributes to national development by embracing these future goals. Integrating STEM education and promoting STEM-related vocations would position Malaysia as a global leader in science, technology, engineering, and mathematics, driving economic growth, societal improvement, and technical advancement.

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