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Strengthening STEM foundations in primary education to reach the 60:40 goal

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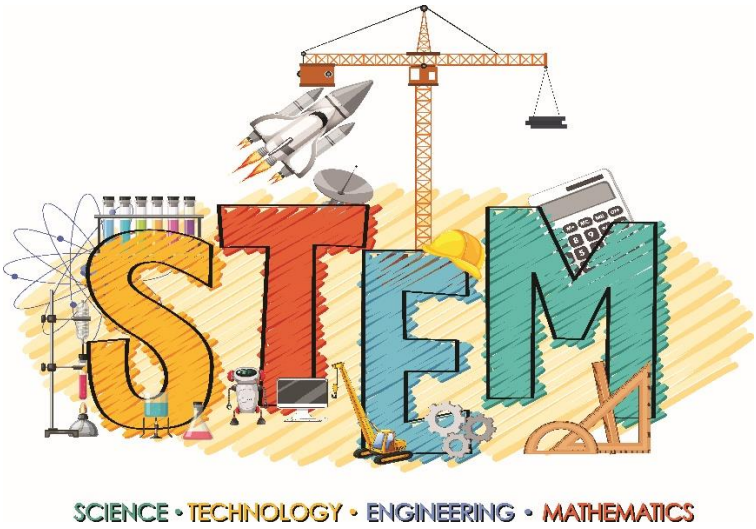

Key takeaways

- STEM participation rate at the upper-secondary level has improved from 45.7% in 2023 to 50.8% this year. However, the progress has been slow despite the 60:40 policy goal implemented in 1970.

- Some key challenges causing Malaysia to fall short of the 60% target are the deficit in student motivation and interest to study STEM, teaching challenges driven by time and capacity constraints, and frequent shifts in the medium of instruction.

- Policy measures should focus on nurturing young talents, beginning in primary schools, through support programmes under public-private partnerships, as well as enhancing teacher capacity through pre-service and in-service training.

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This view was prepared by Nur Sofea Hasmira Azahar, a researcher from the Khazanah Research Institute (KRI). The author is grateful for the valuable comments from Dr. Rachel Gong, Wan Amirah Wan Usamah and Syalin Koh.

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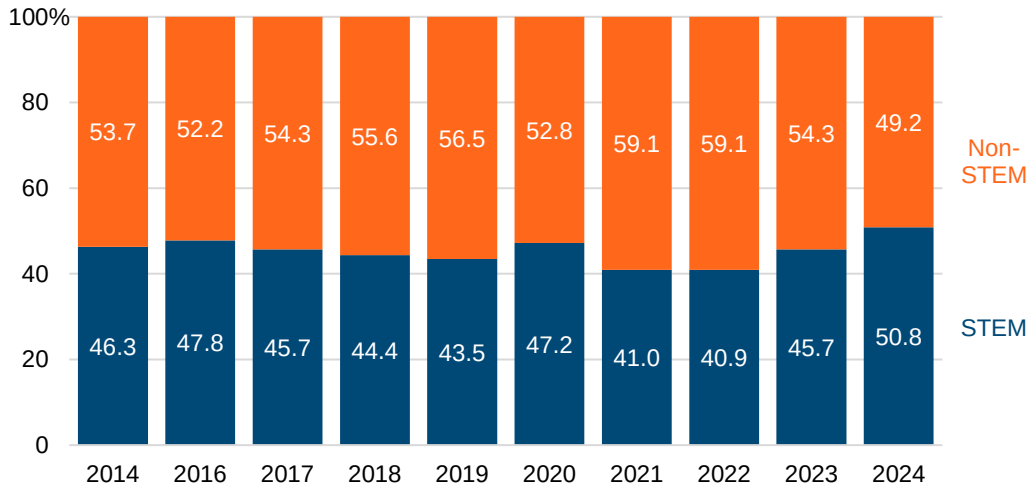
Introduction

It was recently announced that the enrolment of upper-secondary students in Science, Technology, Engineering, and Mathematics (STEM) fields has improved to 50.8% as of this year, up from 45.7% last year[1] (see Figure 1). **While this marks progress, the take-up rate still falls short of the targeted 60%, a goal that has remained unmet for over five decades.**

Figure 1: Participation rate of upper-secondary pupils in STEM and non-STEM



Source: MOE, research papers, news articles

The 60:40 policy was first introduced by the Malaysia Higher Education Planning Committee in 1967 to meet the growing demand for science graduates. This policy stipulated that 60% of students should be in the Science/Technical stream, with the remaining 40% in Arts[2,3]. The implementation of this policy recognised core science and technology as essential to Malaysia's development by fostering critical thinking, problem-solving, and teamwork skills[4].

This vision was reiterated through the Malaysia Education Blueprint 2013-2025 (MEB), introduced as a key initiative to integrate STEM into the education system and meet future workforce needs, particularly in alignment with the Fourth Industrial Revolution. The Blueprint outlines three development phases for enhancing STEM.

1. The first phase focuses on improving the quality of STEM education through multiple ways, including curriculum strengthening and teacher capacity building;

2. The second phase builds on Phase 1 through the upgrades of school equipment and facilities for effective STEM learning and STEM awareness programmes, such as campaigns and collaboration with relevant agencies; and

3. The third and last phase aims to transition STEM to greater heights, above the minimum standards. This will be pursued by scaling up innovations to improve school learning

[1] Gimino, Tan, and Vethasalam (2024)
[2] Ong et al. (2021)
[3] Students in the STEM stream are those who take up an average of five STEM subjects. In contrast, students who prefer non-STEM paths must only take one core Science and one Mathematics subject.
[4] MOHE (2018)

standards, driving a peer-led culture among educators, and improving school management as well as autonomy.

Complementary national policies, such as the National Science, Technology, and Innovation Policy (2021-2030), the National Fourth Industrial Revolution (4IR) Policy, the Shared Prosperity Vision (2030), and the National Biotechnology Policy 2.0 (2022-2030) have also been introduced to support this goal.

Despite this long list of efforts towards developing STEM participation among students, Malaysia has struggled to achieve the 60:40 target. This situation prompts a crucial question: What factors hinder progress, and can Malaysia achieve this goal by the time the Education Blueprint is due next year?

Stumbling blocks

Several longstanding challenges have hampered Malaysia's progress in producing the expected number of STEM-oriented talents needed for a higher developmental trajectory. In this article, I will emphasise key issues related to lack of student interest and motivation, gaps in STEM teaching, and shifts in the medium of instruction.

Deficit in motivation and interest among students

Various studies suggested that students' attitudes play a significant role in determining their interest and curiosity in studying certain subjects. Motivation, in particular, can be crucial in sustaining student engagement and ensuring consistent commitment to learning[5].

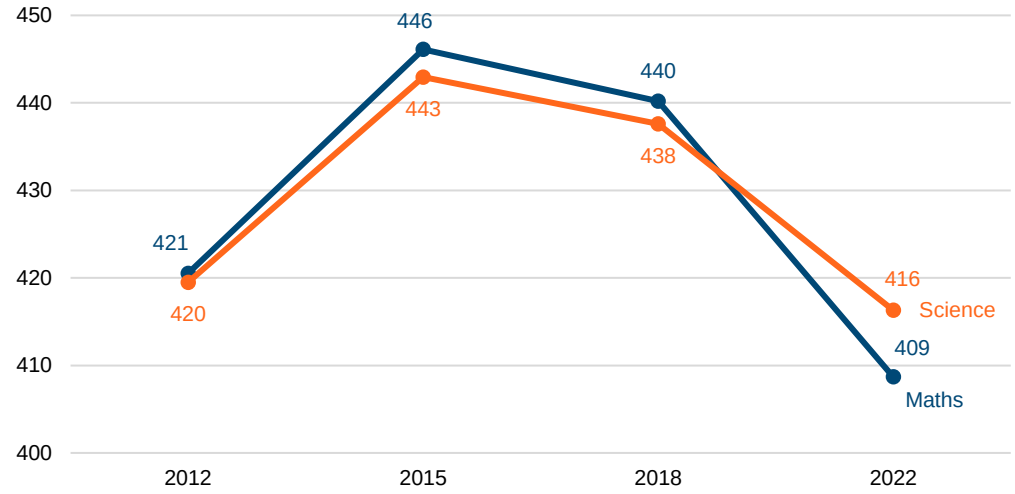
In the context of STEM, especially Science, students' lack of motivation and confidence appears to be one of the root causes of persistently low participation rates over the years[6]. This may be attributed to several reasons including the perception among students that STEM subjects are inherently difficult, which is often reinforced by insufficient encouragement from their environment[7]. Furthermore, research highlighted that students' inadequate foundational knowledge could further affect students' readiness to take on STEM subjects[8].

The impact of students' lack of motivation in STEM subjects is already apparent even before upper secondary, as reflected in Malaysia's Programme for International Student Assessment (PISA) performance. In 2022, the PISA scores of 15-year-old students in Malaysia declined further across subjects—dropping 32 points in Mathematics and 21 points in Science from 2018 scores (see Figure 2)[9]. The chart also reveals that the scores have been on a downward trend for over a decade.

Even student responses to the PISA survey corroborate the abovementioned findings from past literature. While a majority expressed desires to do well in classes, a significant share—65% in Mathematics and 49% in Science—disagreed that these subjects are easy[10].

[5] Haw, Sharif, and Han (2022)
[6] Ismail, Mat Salleh, and Md Nasir (2019)
[7] Zainudin, Halim, and Iksan (2016)
[8] Baskaran and Abdullah (2023)
[9] OECD (2023a)
[10] The numbers are based on the author's calculations using the 2022 PISA database.

Figure 2: Average PISA scores for Mathematics and Science



Source: OECD, PISA database

As such, beyond what such assessments reveal, deeper underlying factors related to interest and motivation warrant attention. For example, studies indicated that underperforming students often have lower interest and motivation levels, primarily due to low self-esteem, lack of confidence in their abilities, and inadequate parental involvement and support[11]. Worse, these challenges could also potentially lead to students dropping out[12].

Changes in the medium of instruction

In relation to students' interest in STEM, frequent shifts in the medium of instruction in schools have also significantly impacted students' engagement with the subjects. For instance, the introduction of the Teaching and Learning of Science and Mathematics in English (PPSMI) policy in 2003 was driven by the emphasis on English proficiency[13]. However, poor mastery of English within certain groups led to the policy being replaced with the Dual Language Programme (DLP) in 2018[14]. DLP, which aims to "*Memartabatkan Bahasa Malaysia, Memperkukuhkan Bahasa Inggeris*", allows teaching and learning in both languages. It is intended to make students more competitive in Science and Mathematics at the international level, thereby widening their future job prospects.

Despite these hopes, research suggests that PPSMI has negatively affected student performance. For example, the World Bank's study indicated that transitioning from learning in Bahasa Melayu to English in the middle of schooling led to poorer academic outcomes among secondary school students[15]. While DLP aimed to reconcile such challenges for students and teachers, there are mixed sentiments about the language policy. Critics argued that DLP seems to resemble PPSMI,

[11] Selvarajoo and Baharudin (2023); Govindarajoo, D. Selvarajoo, and Ali (2022)
[12] Ibid.
[13] Mohd Zulfakhar and Mohamad Nasri (2024)
[14] Ibid.
[15] Soh, Del Carpio, and Wang (2021)

which highly emphasises English proficiency in a way that may be detrimental to students and teachers who are accustomed to learning and teaching in their native languages[16].

Gaps in STEM teaching

Finally, the quality of teaching can also be a critical factor in motivating students to pursue STEM. Based on studies, the primary issue concerns insufficiently trained STEM teachers and time constraints to craft a complete lesson plan and implement effective pedagogies. This challenge is further exacerbated by teacher shortages[17]. For one, some teachers found it challenging to cover the entire syllabus within a limited timeframe, possibly restricting students from experiencing hands-on learning and instead being passive recipients of the knowledge[18]. As a result, rote learning becomes more prevalent, with students primarily focused on exam preparations rather than truly understanding the subject matter.

Moreover, this issue has been compounded by the lack of support from school leadership in facilitating positive changes, particularly in providing resources and time for teachers to pursue in-service training or other professional development pathways[19].

If these primary challenges are not effectively addressed, the long-term consequences could be dire for students, particularly their future job prospects. Khazanah Research Institute (KRI) has found that over the past decade (2010 – 2021), there has been a shortage of working graduates in STEM fields related to Science, Mathematics, and Computing compared to other sectors[20]. This could partly indicate a mismatch in the labour market, where there is an insufficient supply of skilled talent in these critical areas.

Deepen interest in STEM education at the primary level

One possible way to accelerate the progress toward the 60:40 goal in the upper-secondary cohort is by nurturing young talents from primary schools. The rationale is that early exposure to STEM subjects and practicality can provide students with stronger foundational skills and knowledge, facilitating a smoother transition to secondary school. Studies suggest that while children's career aspirations might evolve, exposure to practical STEM experiences around the age of 9 can influence their future career choices[21].

While it can be difficult to gauge or guarantee a long-lasting interest in STEM among primary school students in Malaysia because of the differences between primary and secondary school curricula, early interventions can help identify and address potential gaps before the transition.

Various initiatives are already in place to draw more young people to STEM and improve the quality of STEM teaching. Some of the key ones include the establishment of Pusat STEM Negara, STEM competitions like the National Robotics Competition, the Young STEMist Expo Programme, and the International Mathematical Olympiad, informal learning programmes by Petrosains, Program Duta Guru, and the formation of a cross-ministerial STEM Committee.

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[16] Abdullah and Nordin (2023)
[17] OECD (2023b)
[18] Ramli and Talib (2017); Baskaran and Abdullah (2023)
[19] Baskaran and Abdullah (2023)
[20] KRI (2024)
[21] Caspi et al. (2023)

State-level initiatives are also making strides through public-private partnerships, such as in Penang, where 6 STEM centres—Penang Skills Development Centre, Penang Science Cluster, Tech Dome, @CAT, Penang Math Platform and Penang Digital Library—have collaborated to address declining interest in STEM within schools[22]. More recently, in Melaka, more targeted efforts to boost participation in primary schools have been pursued by a partnership between Universiti Teknikal Melaka (UTeM), ISpace Digital Academy Malaysia, Melaka Education Department, and certain corporations[23]. Under this project, certain schools have been selected to subscribe to the designed programmes, followed by independent evaluation by an international STEM certification body and a boot camp. Perhaps scaling up such productive partnerships nationwide can be key to producing more STEM-centric talents.

Additionally, several initiatives have been put forward to identify 'at-risk' and 'not at-risk' students in primary schools. For instance, Education Minister Fadhlina Sidek's announcement on a pilot early literacy and numeracy screening for Year 1 beginning in July was a positive move[24]. This initiative expands the scope of existing programmes, such as the Primary Literacy and Numeracy Programme (PLaN) for Year 2 and Year 3 students. Subsequently, regular impact assessments are necessary to monitor the progress and effectiveness of such initiatives. Since basic literacy and numeracy skills are crucial for understanding STEM subjects, this added support could significantly improve the foundational knowledge of primary school students before they transition to a higher education level.

Another potential avenue to promote greater interest and strengthen foundational STEM knowledge at the primary level is to focus on building teachers' capacity, regardless of whether they are in pre-service or in-service. This support should include training programmes or workshops on effective STEM pedagogies or other professional development opportunities aimed at improving teaching effectiveness. Subsequently, such initiatives could play an impactful role in instilling more interest and motivation in STEM among students. At the same time, measures to reduce heavy administrative and clerical duties on educators should also be considered, allowing them more time to pursue professional growth and development.

Conclusion

Malaysia is gradually making headway toward the 60:40 goal facilitated by numerous policies and initiatives, but the journey has been long and challenging. Various factors, including deficits in motivation and interest among students, frequent shifts in the medium of instruction, and gaps in teaching, have contributed to the slow progress. Research, despite being limited, suggests that improvements in STEM performance can result in higher innovation and research and development (R&D), and ultimately drive Malaysia's economic growth. As such, we should leverage this notion by investing in STEM foundational skills as early as primary education, which could be a key catalyst in achieving the 60:40 goal.

[22] Malaysiakini (2019)
[23] The Star (2024)
[24] Zalani (2024)

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