A Preliminary Study on Career Readiness and Career Interest in STEM among STEM-Stream Students in Johor, Malaysia

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ABSTRACT

This study examines career readiness and career interest in STEM among Form Four STEM-stream students in Johor, Malaysia, in response to increasing demand for a technologically skilled workforce. Despite the strategic importance of this group, empirical evidence focusing specifically on students already enrolled in the STEM stream remains limited. This preliminary study aimed to describe the levels and distribution patterns of career readiness and career interest in STEM, and to assess the feasibility of a larger inferential study. A quantitative descriptive survey design was employed involving 350 students from national secondary schools. Data were collected using a questionnaire and analysed using descriptive statistics, including means, standard deviations, frequencies, and percentages. The findings indicate that career readiness was relatively high overall (M = 3.63, SD = .80), with most students classified at the high level (65.7%), followed by moderate (32.0%) and low levels (2.3%). In contrast, career interest in STEM was at a moderate level overall (M = 2.17, SD = .52), with the majority of students classified at the moderate (58.0%) and low levels (37.4%), and only a small proportion at the high level (4.6%). These findings suggest that although students appear generally prepared to plan their future pathways, readiness is not uniformly strong and interest in STEM careers remains limited. The study provides baseline evidence for future research and underscores the importance of strengthening career guidance and expanding exposure to diverse STEM pathways during secondary education.

Keywords: career readiness, STEM career interest, secondary STEM education, career development, Malaysian secondary students

INTRODUCTION

The Fourth Industrial Revolution (IR4.0) has increased global demand for a workforce with strong technological competencies, digital literacy, and advanced skills in science, technology, engineering, and mathematics (STEM) (Freeman et al., 2019; Zhan & Niu, 2023). In response, governments worldwide have strengthened STEM education to support competitiveness in innovation-driven economies. Malaysia has similarly identified STEM education as a strategic priority (Kementerian Pendidikan Malaysia, 2013). However, the long-standing goal of achieving a 60:40 ratio of science to non-science enrolments remains unmet, raising concerns about the country's ability to sustain the STEM talent pipeline needed for future economic and industry demands (Idris et al., 2023a; Kementerian Pendidikan Malaysia, 2026).

STEM education equips students with essential skills such as problem solving, analytical thinking, and adaptability, which are increasingly demanded in the IR4.0 landscape (Idris & Bacotang, 2023). Form Four represents a critical juncture in the Malaysian education system, as students enter specialised academic pathways at around age 16 (Kementerian Pendidikan Malaysia, 2013) and are expected to develop deeper career awareness, refine their academic choices, and engage in more active career exploration (Halim et al., 2018; Razali, 2021). This phase plays a key role in shaping their long-term academic and occupational trajectories.

Although career readiness has been investigated among secondary school students in Johor (Sulong & Mahfar, 2025b), existing studies have not specifically examined STEM-stream students, despite their strategic relevance to Malaysia's future workforce (Idris et al., 2023). This represents a critical gap, as students in the STEM stream are already positioned within academic pathways that allow them to focus on specific STEM disciplines (Jamaluddin et al., 2025). Understanding this subgroup is particularly important in Johor, one of Malaysia's fastest-growing industrial states (MIDF Team, 2024), where indicators such as a high proportion of undereducated youth (13.3%) (Abu Rahim et al., 2023) and a large share of adolescents aged 15 to 19 already in employment (15.6%) (Department of Statistics Malaysia, 2024) suggest potential gaps in career preparation.

Weak readiness during secondary school carries significant long-term implications. Inadequate readiness may place youth at risk of underemployment and more difficult school-to-work transitions, particularly among those without tertiary education, who are more likely to experience job mismatch and less stable employment outcomes (Abu Rahim et al., 2023). Given these concerns, it is critical to examine the career readiness and career interest in STEM of Form Four STEM-stream students in Johor. To address this gap, the present preliminary study provides an initial descriptive overview of career readiness and career interest in STEM among Form Four STEM-stream students in Johor. Specifically, the study aims to establish baseline levels of both constructs, examine their distribution patterns, and determine the feasibility of conducting a larger inferential study involving this population.

RESEARCH BACKGROUND

Career readiness is recognised as encompassing the knowledge, skills, and attitudes that enable young people to prepare for and navigate educational and occupational transitions (Dodd et al., 2022). According to Organisation for Economic Co-operation and Development (OECD) (2024b, 2024a), career-ready students demonstrate early engagement in career exploration, develop informed expectations about future work, and acquire skills that support long-term labour market success. In the Malaysian context, career readiness involves students' capacity for systematic career planning, self-exploration, decision making, and problem solving, all of which influence their transition to further education and employment (Mahmud et al., 2018).

In line with this, career development research further specifies that readiness includes career decisiveness, planning, research, and vocational identity (Azhenov et al., 2023; Tang, 2019), all of which support young people in making informed and adaptive academic and career choices (Hirschi, 2012), particularly during Form Four when students first enter specialised academic tracks (Kementerian Pendidikan Malaysia, 2013).

When career readiness is insufficient, students may face difficulties navigating the transition from education to employment (Hirschi, 2012). Career development research emphasises that early career exploration and informed expectations about work play an important role in supporting successful labour market outcomes (Dodd et al., 2022; OECD, 2024a). Labour market research in Malaysia indicates that mismatches between education and occupation can lead to unstable employment outcomes and difficulties in securing satisfactory jobs among young workers (Abu Rahim et al., 2023). Such concerns are increasingly evident in Johor (Department of Statistics Malaysia, 2024) and the wider Southern Region (Abu Rahim et al., 2023).

Complementing this, career interest in STEM refers to students' motivation, curiosity, and sustained intention to pursue STEM-related fields (Blotnicky et al., 2018; Sulong & Mahfar, 2025a). This study is conceptually informed by Social Cognitive Career Theory (SCCT), which explains how students develop career interests through the interaction of self-efficacy beliefs, outcome expectations, and learning experiences (Lent et al., 1994). In Malaysia, where demand for STEM talent continues to accelerate under IR4.0, nurturing career interest in STEM among secondary school students, particularly those in the STEM-stream, is essential for building a resilient talent pipeline (Idris et al., 2023b). Previous studies have shown that career interest in STEM plays a key role in shaping STEM aspirations (Chen et al., 2024; Jiang et al., 2023), course-taking behaviour (Maltese & Tai, 2011), persistence (Sevilla et al., 2023), and long-term career trajectories (Maltese & Tai, 2011). However, limited evidence exists regarding how these processes operate among Form Four STEM-stream students in Johor.

Taken together, career readiness and career interest in STEM represent two complementary indicators of students' preparedness to navigate future educational and occupational pathways. Career readiness reflects students' ability to plan and make informed decisions about their future careers, whereas career interest in STEM indicates their motivation to pursue careers within STEM-related fields. Examining both constructs among Form Four STEM-stream students is therefore essential for evaluating whether this group is adequately prepared and motivated to contribute to Malaysia's future STEM workforce (Blotnicky et al., 2018; Dodd et al., 2022; Idris et al., 2023a, 2023b; Sulong & Mahfar, 2025a).

However, existing studies in Johor have largely examined career-related variables among general student populations without differentiating between academic streams (Sulong & Mahfar, 2025b). In addition, empirical evidence specifically focusing on students already enrolled in the STEM stream remains limited. This gap is significant because Form Four STEM-stream students represent an important segment of the future STEM talent pipeline. Hence, understanding their readiness and interest levels is crucial for informing educational planning, counselling practices, and STEM workforce development strategies.

METHODOLOGY

This section outlines the research design, participants, data collection procedures, instruments, and data analysis employed in the study.

Research Design and Participants

This study employed a quantitative descriptive survey design to examine the levels of career readiness and career interest in STEM among secondary school students. The sample consisted of 350 Form Four STEM-stream students from national secondary schools in Johor who were enrolled in Physics, Chemistry, Biology, and Additional Mathematics. In earlier Malaysian studies, students enrolled in Biology, Physics, Chemistry, and Additional Mathematics were commonly referred to as science-stream students (Fazilah, 2019). However, in the present study, this group is referred to as STEM-stream students to reflect current terminology (Aspin et al., 2021; Jamaluddin et al., 2025).

The respondents were selected using convenience sampling, as they were recruited based on accessibility and availability from schools that granted administrative approval and were feasible for the researcher to access during the data-collection period (Creswell & Creswell, 2018). This approach was necessary given that the participants were minors, and access to student data was restricted by institutional and ethical requirements, limiting the feasibility of probability-based sampling. In such contexts, convenience sampling is considered an appropriate and practical method when access is constrained by administrative procedures, time limitations, and the absence of a comprehensive sampling frame (Memon et al., 2025).

Data Collection Procedures

Data were collected using a questionnaire administered via Google Form from 6 October 2025 to 11 November 2025. Prior approval to administer the questionnaire was obtained from the Ministry of Education Malaysia, the Johor State Education Department, and the respective schools. With the cooperation of STEM senior subject teachers and school counsellors, the survey link was distributed through designated WhatsApp and Telegram groups for STEM classes to ensure that only eligible students had access to the questionnaire.

Instruments

The instrument comprised three sections, namely demographic information, Career Readiness, and Career Interest in STEM.

Career Readiness

Career Readiness was measured using the Student Career Readiness Index (SCRI), which consists of 9 items rated on a 6-point Likert scale ranging from 0 (I don't know) to 5 (I completely agree). Developed by Dodd et al. (2022), the SCRI has demonstrated satisfactory validity and reliability in previous studies. It has also been used in a local study involving Form Four students in Johor, where it showed high reliability (α = .810) (Sulong & Mahfar, 2025b).

Career Interest in STEM

Career Interest in STEM was measured using the Your Future scale from the Attitudes toward STEM Survey (S-STEM), developed by the Friday Institute for Educational Innovation. The scale comprises 12 items assessing interest in STEM-related careers and uses a 4-point Likert scale ranging from 1 (Not at all interested) to 4 (Very interested). It has previously been used in a local study involving Form Four science-stream students and demonstrated acceptable reliability (α = .752) (Razali et al., 2018). Additional international evidence also supports its reliability (α = .89) (Yamani & Almazroa, 2024). These reliability findings suggest that both scales are suitable for use in this study, including within the local secondary school context.

Data Analysis

Descriptive analyses were conducted using the Statistical Package for the Social Sciences (SPSS) version 30.0. The analyses involved calculating means, standard deviations, frequencies, and percentages at both the item-level and the composite construct level. In addition to reporting mean scores, composite scores for Career Readiness and Career Interest in STEM were categorised into three levels using an equal-interval classification method derived by dividing the scale range by the number of classification levels (Alkharusi, 2022; Pimentel, 2010), as presented in Table 1. The same cut-off criteria were further applied at the item level as a supplementary descriptive analysis to identify specific dimensions contributing to the overall construct level, following the item-level weighted mean interpretation approach demonstrated by Pimentel (2010).

Table 1 Score Category Classification for Career Readiness and Career Interest in STEM

Score Category	Career Readiness	Career Interest in STEM
Low	0.00 – 1.66	1.00 – 2.00
Moderate	1.67 – 3.33	2.01 – 3.00
High	3.34 – 5.00	3.01 – 4.00

RESULTS

This section presents the results of the descriptive analyses, including the distribution and item-level statistics for career readiness and career interest in STEM among Form Four STEM-stream students.

Career Readiness

Table 2 presents the distribution of career readiness levels among students. The majority were classified at the high career readiness level, with 230 students (65.7%), followed by a moderate level, with 112 students (32.0%), and a low level, with 8 students (2.3%). Overall, the mean score for Career Readiness was 3.63 (SD = .80).

Table 2 Career Readiness Level

Level	Frequency (n)	Percentage (%)
Low	8	2.3
Moderate	112	32.0
High	230	65.7
Total	350	100.0

Note. Mean (M) = 3.63; standard deviation (SD) = .80

In addition, Table 3 presents the item-level descriptive statistics for career readiness. The mean scores ranged from 2.74 to 4.18, indicating variation in students' responses across the items. CR8 recorded the highest mean score (M = 4.18, SD = .90), followed by CR5 (M = 4.05, SD = .98), while CR1 recorded the lowest mean score (M = 2.74, SD = 1.34).

Table 3 Item-Level Descriptive Statistics for Career Readiness (CR)

Item	Description	Mean (M)	Standard Deviation (SD)	Level
CR1	Career information seeking	2.74	1.34	Moderate
CR2	Future career awareness	3.46	1.28	High
CR3	Career-life goal alignment	3.79	1.18	High
CR4	Self-assessment ability	3.77	1.07	High
CR5	Career persistence	4.05	.98	High
CR6	Work values awareness	3.73	1.17	High
CR7	Employer awareness	3.15	1.30	Moderate
CR8	Study persistence	4.18	.90	High
CR9	Career-ability fit	3.77	1.16	High

Career Interest in STEM

Table 4 presents the distribution of career interest in STEM levels among students. The majority of students were classified at the moderate level, with 203 students (58.0%), followed by the low level, with 131 students (37.4%), and the high level, with 16 students (4.6%). Overall, the mean score for Career Interest in STEM was 2.17 (SD = .52).

Table 4 Career Interest in STEM Level

Level	Frequency (n)	Percentage (%)
Low	131	37.4
Moderate	203	58.0
High	16	4.6
Total	350	100.0

Note. Mean (M) = 2.17; standard deviation (SD) = .52

In addition, Table 5 presents the item-level descriptive statistics for the career interest in STEM. The mean scores ranged from 1.74 to 2.61, indicating variation in students' career interest across the items. CI6 recorded the highest mean score (M = 2.61, SD = 1.12), followed by CI9 (M = 2.44, SD = 1.05) and CI10 (M = 2.36, SD = .97). In contrast, CI11 recorded the lowest mean score (M = 1.74, SD = .86), followed by CI2 (M = 1.85, SD = .82).

Table 5 Item-Level Descriptive Statistics for Career Interest (CI) in STEM

Item	Description	Mean (M)	Standard Deviation (SD)	Level
CI1	Physics	2.23	.88	Moderate
CI2	Environmental Work	1.85	.82	Low
CI3	Biology and Zoology	2.27	.98	Moderate
CI4	Veterinary Work	2.01	.96	Moderate
CI5	Mathematics	2.31	1.01	Moderate
CI6	Medicine	2.61	1.12	Moderate
CI7	Earth Science	2.01	.95	Moderate
CI8	Computer Science	2.10	1.05	Moderate
CI9	Medical Science	2.44	1.05	Moderate
CI10	Chemistry	2.36	.97	Moderate
CI11	Energy	1.74	.86	Low
CI12	Engineering	2.17	1.05	Moderate

DISCUSSION

This preliminary study provides a descriptive overview of career readiness and career interest in STEM among Form Four STEM-stream students in Johor. The findings reveal two key patterns. First, most students demonstrated relatively high levels of career readiness. Second, despite this readiness, students' interest in STEM careers remained largely concentrated at moderate and low levels.

The findings indicate that although most students demonstrated high levels of career readiness (Table 2), this pattern reflects generally positive preparedness rather than uniformly strong readiness across all students. While students appear to show a degree of preparedness for planning their future pathways, this does not necessarily imply that all aspects of career readiness are equally developed. At the Form Four level, students are expected to begin refining their career direction (Halim et al., 2018; Razali, 2021). However, the results suggest that this development is still incomplete.

This interpretation is further supported by the item-level findings (Table 3), where lower mean scores were observed for career information seeking (CR1) and employer awareness (CR7). These patterns suggest that students may have limited exposure to detailed career information and real-world occupational contexts. These findings are consistent with previous research indicating that career exploration, particularly the environmental or occupational dimension involving active information seeking, remains a challenge among secondary school students, with many not meaningfully engaging in information gathering about real-world occupational contexts (Chen et al., 2021). Although students demonstrated strong persistence and general awareness of their future, they may not be actively engaging in exploring specific career pathways or understanding workplace expectations. This gap highlights a potential limitation in students' career development, where motivational aspects are present, but informational and exploratory components remain underdeveloped.

In contrast to the relatively positive readiness levels, career interest in STEM was generally concentrated at the moderate and low levels, with only a small proportion of students demonstrating high interest (Table 4). This pattern is broadly consistent with findings by Blotnicky et al. (2018), who reported limited STEM career knowledge and relatively weak career interest in STEM among school students, suggesting that modest career interest in STEM may be a persistent concern across contexts. Academic placement in the STEM-stream alone may therefore not be sufficient to foster strong career motivation. From a SCCT perspective (Lent et al., 1994), this suggests that key SCCT factors, including learning experiences, self-efficacy, and outcome expectations, may not be sufficiently developed. Without adequate exposure to diverse STEM careers and a clear understanding of their relevance, students may struggle to form strong intentions to pursue STEM-related occupations.

Item-level analysis further highlights variations in students' interest across different STEM career areas (Table 5). Although all items were classified within the low to moderate levels, relatively higher mean scores were observed in medicine (CI6) and medical science-related careers (CI9), whereas lower interest was reported in areas such as environmental work (CI2) and energy (CI11). This pattern may reflect differences in students' familiarity and exposure to these fields. Health-related careers, particularly medicine and life sciences, tend to attract considerable interest among students, as reflected in reports indicating that a substantial proportion of secondary students express interest in fields such as biotechnology, biomedicine, and medicine (Wooi Leng et al., 2020). At the same time, students' level of exposure to STEM career information plays a critical role in shaping their career preferences, with better-informed students more likely to develop stronger interest in specific fields. These findings suggest that being placed in a STEM academic stream does not automatically translate into broad interest across all STEM domains. Instead, students' career preferences may be shaped by selective exposure, perceived prestige, and limited awareness of the diversity of STEM career pathways.

The relatively low proportion of students demonstrating high career interest in STEM (Table 4) raises important concerns about the sustainability of the STEM talent pipeline. Although students are enrolled in STEM pathways, the lack of strong interest indicates that many may not pursue STEM-related fields in higher education or future careers. This misalignment between academic preparation and career motivation may reduce the effectiveness of efforts to strengthen STEM participation, particularly in regions such as Johor where demand for a skilled workforce continues to grow (MIDF Team, 2024).

Although career readiness appeared relatively strong overall, a considerable proportion of students remained at the moderate readiness level, while career interest in STEM was concentrated mainly at the moderate and low levels. These patterns support the need for a larger inferential study focusing on STEM-stream students to examine factors associated with career readiness, particularly the role of career interest in STEM. Such research may provide deeper insight into whether students with stronger interest in STEM careers are also more prepared

to plan and pursue STEM-related educational and career pathways. Overall, the findings indicate that enrolment in the STEM stream alone is insufficient to ensure that students are both fully prepared and strongly motivated to pursue STEM careers.

From a policy and practice perspective, these findings highlight the need for structured career guidance interventions that not only support career planning but also actively enhance students' exposure to diverse STEM career pathways. Schools and policymakers should consider integrating career exploration activities, industry engagement, and experiential learning opportunities to strengthen both readiness and interest among STEM-stream students.

Limitations

This study has several limitations that should be considered when interpreting the findings. First, the study employed convenience sampling and involved only Form Four STEM-stream students from national secondary schools in Johor, which limits the generalisability of the findings to other student populations and contexts, as commonly associated with non-probability sampling approaches (Memon et al., 2025). Second, the study was descriptive in nature and therefore does not explain the factors influencing career readiness or career interest in STEM. Third, the data were collected through self-reported questionnaires, which may be influenced by respondents' personal perceptions and response tendencies. Nevertheless, this study provides useful preliminary evidence and a foundation for future larger-scale inferential research.

CONCLUSION

This preliminary study provides an initial empirical overview of career readiness and career interest in STEM among Form Four STEM-stream students in Johor. The findings indicate that although most students demonstrated relatively high career readiness, a substantial proportion remained at the moderate level, indicating uneven development across students. Item-level patterns further suggest that while students exhibit general preparedness, specific aspects such as career information seeking and employer awareness remain less developed.

In contrast, career interest in STEM was largely concentrated at the moderate and low levels, with only a small proportion of students demonstrating high interest. This pattern highlights a potential misalignment between students' readiness to make career decisions and their motivation to pursue STEM-related careers. The findings suggest that enrolment in the STEM stream alone does not necessarily translate into strong interest across STEM career pathways.

Given that these students represent a critical segment of Malaysia's future STEM workforce, the presence of moderate readiness and limited career interest raises important concerns about the sustainability of the STEM talent pipeline. These findings underscore the need for more targeted career guidance and greater exposure to diverse STEM careers during secondary school to strengthen both preparedness and motivation.

As a preliminary study, this research provides baseline evidence to support the feasibility of a larger inferential investigation. Future research should examine factors influencing career readiness, particularly the role of career interest in STEM and other career development variables, to better understand how students can be supported in translating readiness into meaningful STEM career pathways.

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ETHICAL CONSIDERATIONS

Ethical Approval

Ethical approval for this study was obtained from the Universiti Teknologi Malaysia Research Ethics Committee. Permission to conduct the study was also granted by the Ministry of Education Malaysia, the Johor State Education Department, and the participating schools. Participation was voluntary, and informed consent was obtained from all participants. All responses were anonymised and treated confidentially.

Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

Data Availability

The data that support the findings of this study are not publicly available and will not be shared due to ethical, confidentiality, and privacy considerations involving student participants.

REFERENCES

1. Abu Rahim, M. A. R., Abdul Wahab, D., & Jani, R. (2023). School-To-Work Transition and Job Mismatch Among the Young Workers in Malaysia. International Journal of Business and Economy (IJBEC), 5(1), 84–101. http://myjms.mohe.gov.my/index.php/ijbec
2. Alkharusi, H. (2022). A Descriptive Analysis and Interpretation of Data from Likert Scales in Educational and Psychological Research. Indian Journal of Psychology and Education, 12(2), 13–16.
3. Aspin, S. H., Ali, M., & Bunyamin, M. A. H. (2021). STEM education in Malaysia. STEM Education from Asia, 0832(15), 33–48.
4. Azhenov, A., Kudysheva, A., Fominykh, N., & Tulekova, G. (2023). Career decision-making readiness among students' in the system of higher education: career course intervention. Frontiers in Education, 8(August), 1–12. https://doi.org/10.3389/feduc.2023.1097993
5. Blotnicky, K. A., Franz-Odendaal, T., French, F., & Joy, P. (2018). A study of the correlation between STEM career knowledge, mathematics self-efficacy, career interests, and career activities on the likelihood of pursuing a STEM career among middle school students. International Journal of STEM Education, 5(1). https://doi.org/10.1186/s40594-018-0118-3
6. Chen, H., Liu, F., Wen, Y., Ling, L., Chen, S., Ling, H., & Gu, X. (2021). Career Exploration of High School Students: Status Quo, Challenges, and Coping Model. Frontiers in Psychology, 12(September), 1–8. https://doi.org/10.3389/fpsyg.2021.672303
7. Chen, Y., So, W. W. M., Zhu, J., & Chiu, S. W. K. (2024). STEM learning opportunities and career aspirations: the interactive effect of students' self-concept and perceptions of STEM professionals. International Journal of STEM Education, 11(1), 1–21. https://doi.org/10.1186/s40594-024-00466-7
8. Creswell, J. W., & Creswell, J. D. (2018). Research design: Qualitative, quantitative, and mixed methods approaches (5th ed.). Sage Publications.
9. Department of Statistics Malaysia. (2024). Laporan Survei Tenaga Buruh Malaysia 2023. https://storage.dosm.gov.my/labour/lfs_annual_2023.pdf
10. Dodd, V., Hanson, J., & Hooley, T. (2022). Increasing students' career readiness through career guidance: measuring the impact with a validated measure. British Journal of Guidance & Counselling, 50(2), 260–272. https://doi.org/10.1080/03069885.2021.1937515
11. Fazilah Razali. (2019). Model Pembentukan Minat Kerjaya Sains, Teknologi, Kejuruteraan dan Matematik dalam Kalangan Pelajar Aliran Sains Tingkatan Empat di Selangor, Malaysia. Universiti Putra Malaysia.
12. Freeman, B., Marginson, S., & Tytler, R. (2019). An International View of STEM Education. In A. Sahin & M. J. Mohr-Schroeder (Eds.), STEM Education 2.0: Myths and Truths: What Has Years of K-12 STEM Education Research Taught Us? (Issue August, pp. 350–363). Brill. https://doi.org/10.1163/9789004405400_019

13. Halim, L., Rahman, N. A., Ramli, N. A. M., & Mohtar, L. E. (2018). Influence of students' STEM self-efficacy on STEM and physics career choice. AIP Conference Proceedings, 1923(January). https://doi.org/10.1063/1.5019490
14. Hirschi, A. (2012). Vocational Identity Trajectories: Differences in Personality and Development of Well-being. European Journal of Personality, 26, 2–12. https://doi.org/10.1002/per.812
15. Idris, R., & Bacotang, J. (2023). Exploring STEM Education Trends in Malaysia: Building a Talent Pool for Industrial Revolution 4.0 and Society 5.0. International Journal of Academic Research in Progressive Education and Development, 12(2). https://doi.org/10.6007/ijarped/v12-i2/16825
16. Idris, R., Govindasamy, P., & Nachiappan, S. (2023a). Challenge and Obstacles of STEM Education in Malaysia. International Journal of Academic Research in Business and Social Sciences, 13(4), 773–780. https://doi.org/10.6007/ijarbss/v13-i4/16676
17. Idris, R., Govindasamy, P., & Nachiappan, S. (2023b). Fueling Ambitions: The Dynamic Interplay of Personality, Cognitive, and Self-Efficacy in Fostering STEM Interest among Malaysian Secondary School Students. International Journal of Advanced Research in Education and Society, 5(3), 276–287. https://doi.org/10.55057/ijares.2023.5.3.27
18. Idris, R., Govindasamy, P., Nachiappan, S., & Bacotang, J. (2023). Revolutionizing STEM Education: Unleashing the Potential of STEM Interest Careers in Malaysia. International Journal of Academic Research in Business and Social Sciences, 13(7), 1741–1752. https://doi.org/10.6007/ijarbss/v13-i7/17608
19. Jamaluddin, F., Razak, A. Z. A., & Rahim, S. S. A. (2025). Navigating the challenges and future pathways of STEM education in Asia-Pacific region: A comprehensive scoping review. STEM Education, 5(1), 53–88. https://doi.org/10.3934/steme.2025004
20. Jiang, H., Chugh, R., Turnbull, D., Wang, X., & Chen, S. (2023). Modeling the impact of intrinsic coding interest on STEM career interest: evidence from senior high school students in two large Chinese cities. Education and Information Technologies, 28(3), 2639–2659. https://doi.org/10.1007/s10639-022-11277-0
21. Kementerian Pendidikan Malaysia. (2013). Pelan Pembangunan Pendidikan Malaysia 2013-2025. https://www.moe.gov.my/pppm-2013-2025
22. Kementerian Pendidikan Malaysia. (2026). Rancangan Pendidikan Malaysia 2026-2035. https://www.moe.gov.my/dokumen-penuh-rancangan-pendidikan-malaysia-rpm-2026-2035
23. Lent, R. W., Brown, S. D., & Hackett, G. (1994). Toward a Unifying Social Cognitive Theory of Career and Academic Interest, Choice, and Performance. Journal of Vocational Behavior, 45(1), 79–122. https://doi.org/10.1006/jvbe.1994.1027
24. Mahmud, M. I., Noah, S. M., Marzuki, W. A. N., Jaafar, W. A. N., Amat, S., Yazid, A. B. U., & Bakar, A. B. U. (2018). Need Analysis of Development on Career Readiness. 9–16.
25. Maltese, A. V., & Tai, R. H. (2011). Pipeline persistence: Examining the association of educational experiences with earned degrees in STEM among U.S. students. Science Education, 95(5), 877–907. https://doi.org/10.1002/sce.20441
26. Memon, M. A., Thurasamy, R., Ting, H., & Cheah, J. H. (2025). Convenience Sampling: a Review and Guidelines for Quantitative Research. Journal of Applied Structural Equation Modeling, 9(2), 1–15. https://doi.org/10.47263/JASEM.9(2)01
27. MIDF Team. (2024). Heralding A New Growth Era for Johor (Issue January 2024). https://share.google/tijmuuw6GGu3XfGqC
28. OECD. (2024a). Challenging Social Inequality Through Career Guidance: Insights from International Data and Practice. In Challenging Social Inequality Through Career Guidance. https://doi.org/10.1787/619667e2-en
29. OECD. (2024b). Teenage career uncertainty : why it matters and how to reduce it. 16, 1–14.
30. Pimentel, J. L. (2010). A Note on the Usage of Likert Scaling for Research Data Analysis. USM R&D Journal, 18(2), 109–112.
31. Razali, F. (2021). Exploring Crucial Factors of an Interest in STEM Career Model among Secondary School Students. International Journal of Instruction, 14(2), 385–404. https://doi.org/10.29333/iji.2021.14222a
32. Razali, F., Talib, O., Manaf, U. K. A., & Hassan, S. A. (2018). A Measure of Students Motivation, Attitude and Parental Influence towards Interest in STEM Career among Malaysian Form Four Science

Stream Student. International Journal of Academic Research in Business and Social Sciences, 7(14), 245–264. https://doi.org/10.6007/ijarbss/v7-i14/3665

33. Sevilla, M. P., Luengo-Aravena, D., & Farías, M. (2023). Gender gap in STEM pathways: the role of secondary curricula in a highly differentiated school system—the case of Chile. International Journal of STEM Education, 10(1). https://doi.org/10.1186/s40594-023-00450-7
34. Sulong, N., & Mahfar, M. (2025a). A Conceptual Paper: STEM Career Interest and Career Readiness. International Journal of Research and Innovation in Social Science (IJRISS), 9(11), 5864–5871. https://doi.org/https://dx.doi.org/10.47772/IJRISS.2025.91100461
35. Sulong, N., & Mahfar, M. (2025b). The Influence of Career Outcome Expectations and Career Interests on Career Readiness among Secondary School Students in Johor, Malaysia. International Journal of Research and Innovation in Social Science (IJRISS), 9(10), 9993–10005. https://doi.org/https://doi.org/10.47772/IJRISS.2025.910000815
36. Tang, M. (2019). Career Development and Counseling: Theory and Practice in a Multicultural World. Sage Publications. https://doi.org/10.4135/9781071801321
37. Wooi Leng, O., Vaghefi, N., Kar Yong, N., & Jo-Yee, Y. (2020). Student's Choice of STEM Study in Secondary and Tertiary Education in Penang. In Penang Institute. https://penanginstitute.org/publications/books-and-reports/students-choice-of-stem-study-in-secondary-and-tertiary-education-in-penang/
38. Yamani, N., & Almazroa, H. (2024). Exploring career interest and STEM self-efficacy: implications for promoting gender equity. Frontiers in Psychology, 15(October). https://doi.org/10.3389/fpsyg.2024.1402933
39. Zhan, Z., & Niu, S. (2023). Subject integration and theme evolution of STEM education in K-12 and higher education research. Humanities and Social Sciences Communications, 10(1), 1–13. https://doi.org/10.1057/s41599-023-02303-8