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Charting the Course: STEM Interest Career Survey among Secondary School Students in Malaysia

Rashidin Idris[1], Juppri Bacotang[2], Priyalatha Govindasamy[3], Suppiah Nachiappan[4]

Faculty of Human Development, Universiti Pendidikan Sultan Idris, 35900 Tanjung Malim, Perak, Malaysia[1,3,4], Faculty of Psychology and Education, Universiti Malaysia Sabah, 88400 Kota Kinabalu, Sabah, Malaysia[2]

Corresponding Author Email: crashidin7@gmail.com

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Abstract

STEM (Science, Technology, Engineering, and Mathematics) career interest has expanded in tandem with the rising emphasis on STEM education in schools and universities. Researchers investigated aspects and consequences connected to students' interest in STEM disciplines, which is critical for recognising their potential and inclination towards STEM subjects, particularly in the context of Malaysia's ongoing STEM education implementation. Kier et al. (2013) created the STEM-Career Interest Survey (STEM-CIS) as a theoretical framework for assessing STEM career interest. The STEM-CIS, which is based on the Social Cognitive profession Theory, takes into account factors such as profession choice, self-efficacy, outcome expectations, personal aspirations, and contextual factors. The STEM-CIS theory is made up of four sets of characteristics that describe careers in science, technology, engineering, and mathematics. These dimensions include self-efficacy, personal objectives, outcome expectations, interest in STEM courses, contextual support, and personal input. Understanding STEM career interest and using the STEM-CIS has important consequences for educational institutions, legislators, and career counsellors. This knowledge helps to produce a skilled and diversified workforce, which drives innovation and progress in STEM-related sectors.

Keywords: Career Interest, STEM Education, Secondary School Student, Enrolling

Introduction

STEM education lays the groundwork for individuals to gain the information, skills, and competences needed to succeed in STEM-related employment (Idris et al., 2023f). As Hussain et al (2019) emphasise, higher education institutions play a critical role in promoting innovation, strengthening STEM education, and preparing students for future STEM careers through partnership with schools, commercial partners, and the government.

It is critical to nurture students' excitement, curiosity, and active participation in STEM courses by promoting a favourable perception of STEM education and careers (Idris et al., 2023b). This favourable impression motivates students to investigate and pursue STEM careers, thereby contributing to the formation of a skilled and competitive STEM workforce that promotes innovation, economic growth, and societal advancement. Middle school pupils' opinions of various vocations influence their interest in those occupations (Wyss et al., 2012).

STEM-related occupations in Malaysia span a wide range of businesses and sectors, allowing individuals to put their STEM knowledge and abilities to use in practical and productive ways (Idris et al., 2023a). These occupations include information technology, engineering, biotechnology, and renewable energy. STEM education provides up multiple job options for individuals to drive innovation, influence digital transformation, and address challenging challenges across industries in the era of Industrial Revolution 4.0 and Society 5.0 (Idris & Bacotang, 2023).

However, the trend of secondary school students enrolling in STEM courses has been declining each year Academy of Science Malaysia (2020); Idris et al (2023e), while simultaneously facing limitations in the application of STEM education within schools such as limited resources Markus et al (2021); Chin et al (2019), teacher training Mahmud et al (2018); Khalik et al (2019), lack of interest among students' (Ramli & Awang, 2020), curriculum alignment Mustafa et al (2022) and gender gap (Rahman & Halim, 2022; Goy et al., 2018).

In Malaysia, the relationship between STEM education and STEM-related jobs is mutually reinforcing (Mahmud et al., 2020). STEM education lays the groundwork for individuals to acquire the information and skills required for STEM jobs, whereas STEM careers provide real-world applications and contexts that improve students' understanding and passion for STEM topics. This mutually beneficial relationship enhances the link between education and career paths (Idris et al., 2023c; Kang et al., 2018; Osman & Saat, 2014).

Overall, STEM education in Malaysia is critical for educating students for the demands of the twenty-first century workforce. Students improve critical thinking, problem-solving skills, and creativity by incorporating STEM principles and practises into the curriculum. They also learn scientific inquiry, technological literacy, engineering design, and mathematical reasoning (Fallon et al., 2020; Idris et al., 2023a).

STEM Interest Career

When educational institutions began prioritising science, technology, engineering, and mathematics (STEM) education at the high school and university levels, the hypothesis of STEM career interest became popular and recognised. According to Shahali et al (2016), the value of STEM education in schools is crucial since these children will continue their studies at the university level and maybe seek professions in STEM sectors. Exploring the factors and implications of STEM interest is thus required to assess the potential of secondary school pupils for the introduction of STEM topics, which has now entered the third phase in Malaysia (Mahmud et al., 2022).

Kier et al (2014) created the STEM-Career Interest Survey (STEM-CIS) to test the notion of STEM career interest. The theoretical underpinning for this theory is essentially based on career choice and the Social Cognitive Career Theory given by Lent et al (1994; 2000). Furthermore, Lent et al (1994; 2000) integrate Albert Bandura's theory of self-efficacy, outcome expectations, and goals to contextual factors, personal inputs, and interests in order to explain how people make career selections (see Figure 1).

Personal inputs include socially constructed elements such as gender, background, ethnicity, socioeconomic status, and intra-personal factors such as personality that contribute to high or low levels of self-efficacy in the model. External or individual factors that help or inhibit high self-efficacy or the formation of academic or career goals are referred to as contextual supports and obstacles. This paradigm has been employed in studies that support the operationalization of these essential elements to make them more relevant to the researched population (Gushue et al., 2006; Lent et al., 2008).

Finally, Kier et al (2014)'s STEM-CIS career theory is divided into four sets of variables that incorporate proclivities towards careers in science, technology, engineering, and mathematics. Each dimension set comprises elements of self-efficacy, personal goals, outcome expectations, STEM curiosity, contextual support, and personal input. The following subtopics will go through additional explanations of the STEM-CIS career theory's subdimensions.

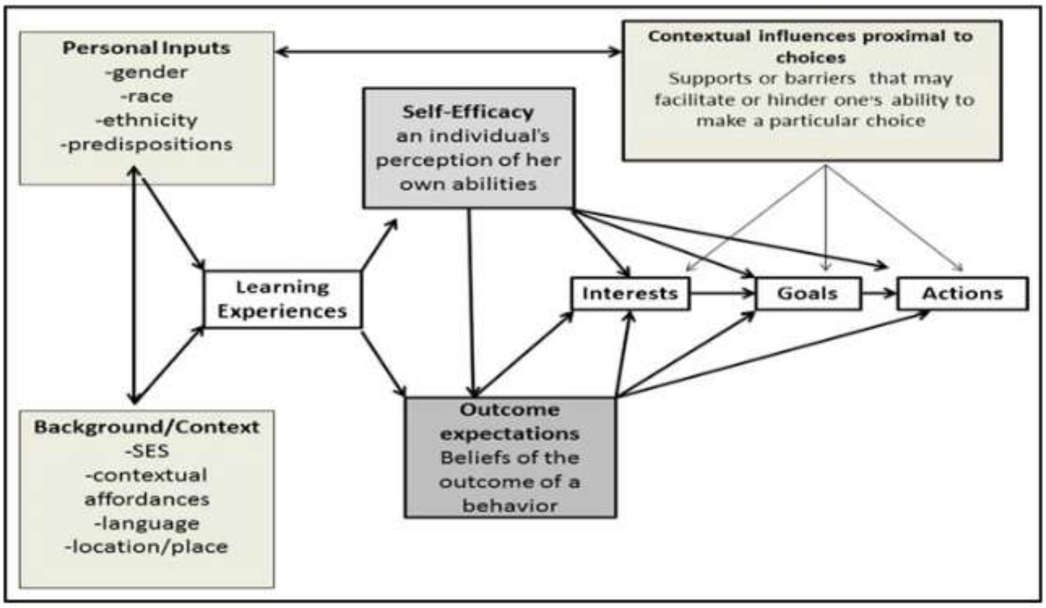

Figure 1. The socio-cognitive career theory (Lent et al., 1994, 2000)

STEM Interest Career Survey Theories

One of numerous variables that contribute to low involvement or participation in STEM topics in schools is a lack of exposure to employment options in the STEM area (Idris et al., 2023f). Interventions focused at promoting and cultivating interest in STEM subjects, on the other hand, have revealed significant variations in students' interest in STEM fields and occupations (Shahali et al., 2016).

According to the findings of a study conducted by Tekbiyik et al (2022), technology-based learning in STEM courses has an effect or influence on students' career interest. The usage of technology in STEM education increases students' interest in the STEM sector and jobs. This finding is backed by Syukri and Ernawati's (2020) research, which shows that students' interest in STEM subjects rises when exposure to learning components is improved through intervention methods to raise STEM interest.

Furthermore, evidence indicates a link between personality qualities and pupils' interest in STEM courses. A study conducted in Malaysia by Ai and Mahmud (2020) discovered that pupils with specific personality qualities had a substantial influence on their interest in STEM jobs. However, respondents' demographic location in rural areas with limited exposure to STEM (Idris et al., 2023a), limited information about STEM careers (Blotnicky et al., 2018), and different demographic areas Tey et al (2019) all influence their interest in the STEM field and careers.

According to Kier et al (2014) claim that additional efforts are needed to empower and develop students' interest in STEM courses, particularly in secondary schools, in order to raise their career interest. As a result, some studies have employed STEM career interest theories in schools to identify pupils' tendencies, offering early rationale and exposure to career sectors that correspond with their interests, particularly in STEM occupations.

Other than that, Kier et al (2014) developed the STEM-CIS instrument, which has 11 items for each pair of dimensions covering vocations in science, technology, engineering, and mathematics. The STEM-CIS assessment provides factors for career inclinations towards STEM areas such as self-efficacy, goals, outcome expectations, interest, and contextual support. Table 1 refers to a single set of dimensions for science jobs, which includes the same characteristics as the other STEM fields.

Table 1
Item Correlations for STEM-CIS(Kier et al., 2014)

Item Number	**STEM-CIS Career Theory Aspect**	**Item**
1	Self-Efficacy	I am able to get a good grade in my science class
2	Self-Efficacy	I am able to complete my science homework
3	Personal goals	I plan to use science in my future career
4	Personal goals	I will work hard in my science classes
5	Outcome expectation	If I do well in science classes, it will help me in my future career
6	Outcome expectation	My parents would like it if I choose a science career
7	Interest in subject (STEM)	I am interested in careers that use science
8	Interest in subject (STEM)	I like my science class
9	Contextual support	I have role model in a science career
10	Personal input	I would feel comfortable talking to people who work in science careers
11	Contextual support	I know of someone in my family who uses science in their career

(Source: Kier et al., 2014)
Several researchers have used the STEM-CIS instrument in their research studies, including those for high school Mau et al (2019); Ardianto et al (2023), middle school Unlu & Dokme (2018), secondary schools (Tekbiyik et al., 2022; Donmez et al., 2020; Yerdelen et al., 2016). This suggests that the STEM-CIS instrument created by Kier et al (2014) can aid in detecting career interests among secondary school student populations and increasing student participation in STEM disciplines within schools. This is especially important in Malaysia, where student interest in STEM courses is declining.

Figure 2 depicts a theoretical conceptual framework for the research aimed at assessing student preferences for STEM education in schools. Furthermore, as shown by Kier et al. (2013), these STEM education inclinations will lead to professional interests in STEM domains.

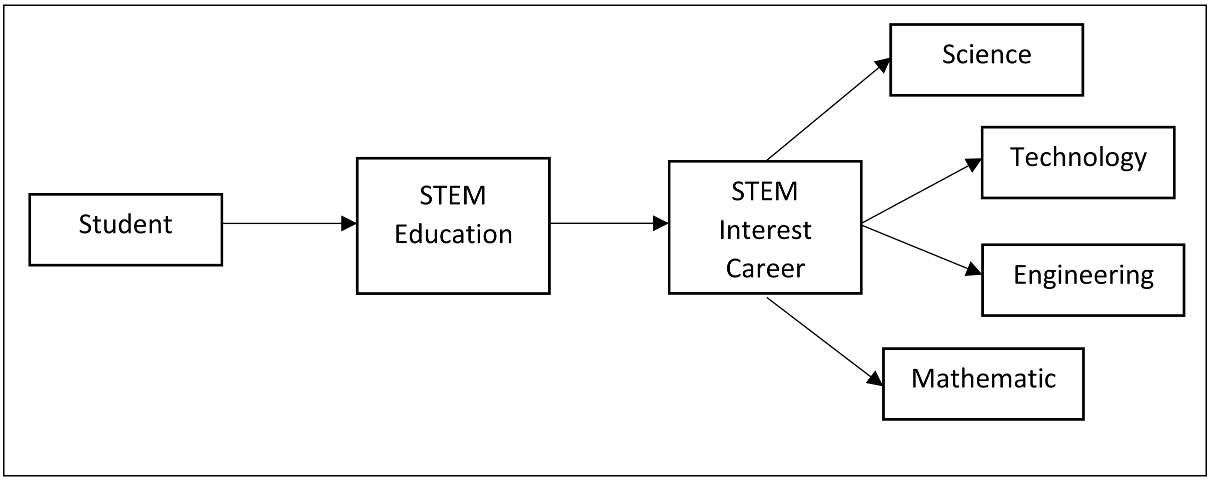

Figure 2. Theoritical Concept Proposed by Researcher

Discussion

Based on the study of past studies, both domestic and foreign, it has been discovered that STEM fields and career interest have a major influence on secondary school students. Shahali et al (2016) discovered an increase in STEM job interest scores among students who participated in intervention-based STEM career exposure in an experimental study. This finding is confirmed by the findings of Tekbiyik et al (2022), who investigated STEM field interest among students in the classroom utilising robots in STEM education. Their research discovered that when students engaged in robotics-based learning, their interest in a career in technology increased.

Furthermore, past research has examined the impact of gender on STEM job choices. Azgin and Senler's (2019) study found substantial disparities in gender-related factors influencing attitudes and career interest in STEM. This finding is corroborated by Ciftci et al.'s (2020) study, which discovered significant gender disparities in career desire. Yerdelen et al (2016) found a strong gender influence on STEM career interest among both males and females in Turkey. Nonetheless, these findings contrast the findings of Ayse et al (2020), who discovered no significant gender differences in STEM interest.

Subsequently, earlier research looked into the demographic characteristics that influence STEM field and career interest. Yerdelen et al (2016) examined how low socioeconomic status limits access to STEM information for students from low-income families. This finding is corroborated by Azgin and Senler's (2019) research, which discovered that family background, parental education level, and computer accessibility at home promote STEM career interest. Furthermore, Tey et al (2019) discovered substantial disparities in STEM interest across three states among respondents from various demographic backgrounds.

Previous research findings also outline measures that can be implemented to increase STEM field and career enthusiasm among kids. Blotnicky et al (2018) discovered that pupils with strong self-efficacy are more likely to be interested in STEM areas. This is due to the fact that when students have a high level of information about STEM occupations, their proclivity to pick STEM disciplines increases (Idris et al., 2023d). This finding is corroborated by Syukri and Ernawati's (2020) research, which found that an experimental study increased students' STEM interest. Their findings revealed that pupils who participated in STEM learning were more likely to pursue STEM careers.

Additionally, studies suggest that, while kids excel in science and mathematics in school, their job interest in STEM disciplines is rather low (Idris et al., 2023e). Despite their passion and excellent academic achievement in science and mathematics, students choose to pursue careers in non-STEM professions (Mohtar et al., 2019). According to Maltese and Tai (2011), despite their good achievement in these courses in school, students have a tendency to overlook STEM employment alternatives. Furthermore, students are observed to drop out of STEM disciplines during their undergraduate education.

Conclusion and Future Agenda

According to a review of several studies, STEM subjects and career interests have a major influence on secondary school students. STEM career exposure and robotics-based learning have been found to increase kids' interest in STEM careers. Gender differences in STEM career ambition have been identified, with gender-related factors playing an important role in shaping attitudes and interests. Demographic factors such as financial level, family background, and computer accessibility have been found to either hinder or increase interest in STEM careers. STEM curiosity is connected with high self-efficacy and exposure to knowledge about STEM careers.

Experiments have shown that active participation in STEM learning programs increases the likelihood of students entering STEM careers. Despite excelling in science and mathematics, students frequently show a lack of interest in STEM professions and may pursue non-STEM career paths, adding to the overall challenge of attracting and retaining students in STEM disciplines, even leading to dropout rates during undergraduate education.

A review of previous studies indicates some major conclusions concerning secondary school students' interest in STEM disciplines and jobs. STEM disciplines clearly have a significant impact on students' career goals, as intervention-based exposure to STEM jobs improves interest scores, as evidenced (Shahali et al., 2016; Tekbiyik et al., 2022). Gender-related factors have a substantial influence on attitudes and career interest in STEM Azgin and Senler (2019); Ciftci et al (2020), while Ayse et al (2020) reported contradictory gender outcomes.

Demographic factors also play a role, as low socioeconomic status restricts access to STEM information Yerdelen et al (2016), whereas family background and parental education promote STEM interest (Azgin & Senler, 2019), and significant disparities exist across demographics (Tey et al., 2019). Self-efficacy and knowledge of STEM occupations increase interest (Blotnicky et al., 2018; Idris et al., 2023d), and experimental research motivate students to seek STEM careers (Syukri & Ernawati, 2020). Despite excelling in science and mathematics, students frequently select non-STEM occupations (Idris et al., 2023e; Mohtar et al., 2019), and STEM dropout rates throughout undergraduate study remain high (Maltese & Tai, 2011).

Finally, in response to the expanding importance of STEM education, the concept of STEM career interest has gained traction. The STEM-Career Interest Survey (STEM-CIS) is a framework for assessing students' interest in STEM disciplines, with variables such as self-efficacy, personal goals, outcome expectations, and contextual factors included. Understanding and utilising STEM career interest has enormous consequences for educational institutions, policymakers, and career counsellors, allowing them to build focused interventions and support systems to cultivate STEM talent among students.

Moving forward, several significant future goals in the field of STEM career interest exist. To begin, more research is needed to investigate the particular elements that influence students' interest in STEM areas, such as the impact of educational experiences, role models, and cultural influences. Understanding these factors can help inform initiatives for increasing STEM career interest and participation.

Efforts should also be made to improve diversity and inclusion in STEM disciplines. This includes increasing STEM enthusiasm among underrepresented groups, such as women and minority students, as well as removing institutional barriers that prevent them from pursuing STEM careers. Furthermore, the STEM-CIS and other assessment instruments must be evaluated and refined on a continuous basis to ensure their validity and reliability. Adapting the survey to unique cultural contexts and validating it with diverse groups are examples of this.

Finally, collaboration among educational institutions, industries, and policymakers is critical for closing the education-to-workforce gap. Students' enthusiasm and readiness for STEM jobs can be increased by aligning school curricula with industry needs and providing meaningful STEM career routes. By addressing these future agendas, we can raise a generation of STEM professionals capable of tackling challenging global challenges and driving innovation across multiple sectors

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