A Conceptual Paper: STEM Career Interest and Career Readiness

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ABSTRACT

This conceptual paper examines the role of STEM career interest in predicting career readiness among Malaysian secondary school students in STEM streams. Guided by Social Cognitive Career Theory (SCCT), the paper positions career interest as an affective motivational construct that drives students to engage in exploration, planning and decision-making behaviours associated with readiness for future study and work. Within SCCT, cognitive beliefs such as career self-efficacy and career outcome expectations are recognised as antecedents that shape career interest formation. However, this paper focuses specifically on the direct motivational pathway linking STEM career interest to career readiness. Drawing on theoretical and empirical literature, the discussion explains how sustained career interest in STEM domains enhances persistence, proactive engagement and informed career decision-making, all of which signify readiness to pursue STEM pathways. By synthesising current evidence and highlighting key gaps in Malaysian secondary education research, this paper underscores the importance of prioritising STEM career interest as a central motivational determinant of career readiness and calls for future empirical studies to test this relationship within the Malaysian context.

Keywords: STEM career interest; career readiness; Social Cognitive Career Theory; STEM education; Malaysia

INTRODUCTION

The Fourth Industrial Revolution (IR 4.0) has accelerated technological transformation, driving economic growth and reshaping global labour demands (Freeman et al., 2019). As innovation and automation redefine industries, graduates must acquire diverse, technology-based competencies to remain employable (Zhan & Niu, 2023). In response, many nations have prioritised technological literacy from early education levels, especially among secondary students, to build strong national science, technology, engineering and mathematics (STEM) pipelines (Golegou & Peppas, 2025; Mudaly & Chirikure, 2023). This emphasis aims to prepare students with the readiness required to pursue future opportunities in STEM fields (Sarsale et al., 2024). Similarly, Malaysia, Singapore and Thailand have embedded STEM into national education frameworks through curriculum reform and teacher-led approaches to strengthen scientific literacy and prepare students for STEM related careers (Sarsale et al., 2024; Zhan & Niu, 2023).

Despite these efforts, Malaysia continues to face challenges in strengthening its STEM pipeline. Only 50.83% of upper secondary students were enrolled in STEM streams in 2024 (Amatan et al., 2025), which remains below the national 60:40 STEM to non-STEM policy target (Kementerian Pendidikan Malaysia, 2013). STEM participation continues to decline at higher levels of education, with only 43.5% of tertiary graduates coming from STEM fields (Katharina, 2023). A recent scoping review of STEM education across Asia-Pacific identified that STEM-related challenges are most prevalent at the secondary school level, including issues of teaching practices, learning approaches, career interest and student enrolment (Jamaluddin et al., 2025). These patterns collectively point to a persistent STEM pipeline issue in Malaysia, suggesting that students may not be adequately developing the career readiness needed to sustain engagement and progression into STEM pathways.

However, research on career readiness in Malaysia has predominantly focused on university students and vocational graduates (Mahmud, 2017; Musa & Mat Rashid, 2020; Yeop Kamarudin & Mohd Kosnin, 2022),

with limited attention to the secondary school populations. Existing studies have often examined isolated characteristics of career readiness such as career exploration (Nor Hazwani & Sheerad, 2020) or career choice (Abd. Karim & Mohd Rasdi, 2021; Ashari et al., 2019; Wong et al., 2023), rather than addressing the construct holistically. Furthermore, most Malaysian studies focus on how cognitive factors, such as career self-efficacy (Zakaria et al., 2020) and career outcome expectations (Wong et al., 2023), influence specific aspects of career choice.

A significant gap remains in understanding how motivational factors, particularly career interest, translate cognitive beliefs into actual readiness behaviours among secondary school students. Specifically, the potential mediating role of motivational variables, such as STEM career interest, remains largely unexplored in the Malaysian context. Addressing this gap is urgent, given the rapidly changing skill landscape that requires secondary students to develop readiness for both higher education and employability (Agherdien, 2014; Balfanz & Byrnes, 2019; Villares & Brigman, 2019).

This paper argues that career interest serves as a core motivational mechanism within students' career development. For many students, interest plays a key motivational role that supports continued engagement in STEM activities and increases the likelihood of pursuing STEM-related careers (Blotnicky et al., 2018; Jiang et al., 2024). Accordingly, this paper examines STEM career interest as a direct motivational pathway influencing career readiness among Malaysian secondary students. It explains how clearly defined STEM career interests drive the exploration, planning and decision-making behaviours that form career readiness. While acknowledging the foundational role of cognitive beliefs and contextual factors in shaping interest, this paper deliberately focuses on the direct motivational pathway from established career interest to career readiness.

LITERATURE REVIEW

Career Readiness

Career readiness is rooted in Social Cognitive Theory (Bandura, 1986), which explains human behaviour through the continuous interaction of personal, environmental and behavioural factors. This foundation was extended by the SCCT, which situates these interactions within the career development process and highlights how career self-efficacy, career outcome expectations and career interests, along with contextual supports and barriers, jointly influence individuals' career decisions, planning and performance (Lent et al., 1994).

In educational settings, career readiness is viewed as a multidimensional construct involving cognitive, emotional and behavioural competencies that enable students to plan and pursue career pathways (Mohd Izwan et al., 2016). Similarly, Azhenov et al. (2023) and Mahmud et al. (2020) define career readiness as a combination of motivation, attitudes, abilities and behaviours that support students' growth and transition into the workforce. These internal resources interact with contextual factors such as family background, economic conditions and institutional support to shape overall preparedness.

Hirschi and Lage (2007) note that readiness develops through interrelated elements that influence students' decision-making and long-term employability. Rachmawati et al. (2024) emphasise that these elements are strengthened by internal factors such as attitudes, emotions and self-beliefs, and external supports such as career development opportunities. Together, these findings suggest that readiness emerges from the interaction of competencies and contextual supports guiding students toward informed and sustainable career choices. For secondary students, particularly adolescents, readiness represents a developmental milestone supporting realistic goal formation and transition to adulthood (Porfeli & Bora, 2012; Tang, 2019).

Synthesising these perspectives, this paper defines career readiness as a multidimensional state involving knowledge, skills and attitudes that help students transition effectively from secondary education to higher STEM study or employment. In STEM contexts, readiness equips students with the cognitive, technical and adaptive competencies needed in science and technology-driven economies (Ananthram et al., 2024; Rezayat & Sheu, 2020). Crucially, these competencies are often activated and sustained by career interest.

Career Interests

If career readiness represents the destination, then career interest is the motivational engine driving the journey. This motivational connection between readiness and interest underscores how affective factors convert knowledge and skills into proactive career behaviours. Career interest motivates students to engage with and pursue particular occupational domains. In the STEM context, it reflects students' enthusiasm, curiosity and sustained motivation to participate in STEM learning activities (Wang & Degol, 2017). This internal drive leads students to value STEM subjects, find them meaningful and envision related career pathways as desirable. Students with strong STEM career interests tend to persist longer in STEM learning and aspire toward related occupations (Blotnicky et al., 2018; Harackiewicz et al., 2012; Maltese & Tai, 2011; Sadler et al., 2012).

It is essential to distinguish between general interest in STEM subjects and specific interest in STEM careers. STEM career interest represents students' affective inclination toward specific occupations within the STEM domain. It reflects not only enjoyment of STEM subjects but also the perceived attractiveness of careers such as engineering, biotechnology, robotics or computer science (Rosenzweig & Chen, 2023). Measuring students' preferences for different STEM careers helps capture the intrinsic motivation and perceived desirability underlying career readiness. Rosenzweig and Chen (2023) emphasised that comparing students' preferences for different STEM careers reveals the motivational beliefs behind their choices. Similarly, Blotnicky et al. (2018) showed that students with greater interest in technical and scientific activities are more likely to consider STEM careers, highlighting career interest as a motivational bridge between engagement and preparedness.

The Social Cognitive Career Theory (SCCT) provides a comprehensive framework for understanding how career interest develops. According to SCCT, career interest is shaped by cognitive antecedents such as career self-efficacy and outcome expectations, as well as contextual factors like learning environment, parental support, socioeconomic background, and exposure to STEM opportunities (Amalina et al., 2025; Chen et al., 2024; Lent et al., 1994).

Students who receive encouragement from teachers and parents, encounter engaging instruction and experience real world STEM applications tend to develop stronger interest in STEM careers (Blotnicky et al., 2018). Conversely, limited exposure and lack of role models may hinder the development of STEM career interest among certain groups (Hernández-Pérez et al., 2024; Kessels & Hannover, 2008; Makarova et al., 2019). Thus, fostering STEM career interest involves strengthening students' self-efficacy and outcome expectations while ensuring equitable access to meaningful STEM learning experiences.

This paper therefore focuses on STEM career interest as the key motivational construct influencing readiness. STEM career interest, defined as students' attraction to specific STEM occupations, is conceptualised here as a direct motivational driver of readiness behaviours. In summary, STEM career interest acts as a motivational bridge that transforms engagement into proactive exploration and planning, making it a central driver of career readiness. The next section examines empirical and theoretical evidence on how career interest influences career readiness, particularly in preparing students for STEM careers.

STEM Career Interest as a Predictor of Career Readiness

Career interest and career readiness are closely connected with the former serving as a primary driver of the latter (Quinlan & Corbin, 2023). Within the SCCT framework, career interest represents a motivational construct that fuels the exploration, planning and decision-making behaviours constituting career readiness (Lent et al., 1994).

Students who develop strong interests in specific career domains such as STEM are more likely to engage in career related learning, set realistic goals and pursue opportunities that enhance their readiness for future employment or further education (Blotnicky et al., 2018; Turner et al., 2017). Conversely, limited or unclear career interests may hinder exploration and planning, leading to lower levels of career readiness (Hirschi & Lage, 2007).

Li et al. (2019) found that students with strong STEM career interest were more likely to explore university majors, seek guidance and align their academic efforts with desired career pathways. This progression reflects

readiness behaviours supported by strong self-efficacy and outcome expectations. These behaviours demonstrate that STEM career interest drives exploration, planning and informed decision-making.

Thibodeaux et al. (2025) provide evidence that strengthening students' STEM career interest leads to improvements in key readiness components. Their study showed that participation in hands-on, industry-linked STEM activities not only increased interest in STEM careers but also enhanced students' career awareness, confidence in using college readiness tools and clarity in planning for post-secondary pathways, behaviours that reflect core elements of career readiness. These results suggest that experiential STEM learning nurtures key readiness components, including career self-efficacy, career awareness and proactive planning.

Empirical findings further validate this theoretical relationship. Blotnicky et al. (2018) found that students who expressed stronger interest in technical and scientific skills were 5.4 times more likely to pursue a STEM career ($p < .001$). Although the study focused on career choice intention, it offers indirect evidence of readiness, as developing career intentions involves exploration, planning, self-understanding and decision-making, which are core components of career readiness (Azhenov et al., 2023; Hirschi, 2011). Therefore, a student who intends to pursue a STEM career is likely to have already engaged in foundational readiness behaviours.

Similarly, Hadaria et al. (2022) reported that career interest in Mathematics and Science significantly predicted career planning ($\beta = 0.111$, $p < .01$) while Tey et al. (2020) found that interest in careers using STEM skills strongly predicted career choice intention ($\beta = 0.626$, $p < .001$). Providing more direct evidence for the link to career readiness, Castro-Villarreal et al. (2025) demonstrated that a passion for teaching mathematics or science was a powerful predictor of both stronger career commitment ($\beta = 1.93$, $p < .001$) and a greater likelihood of intending to teach after graduation ($OR = 2.86$, $p < .05$). These findings indicate that strong STEM career interest fosters commitment and planned career behaviour aligned with readiness. Christensen and Knezek (2017) found that students who planned to pursue STEM careers scored significantly higher on STEM interest and career value measures ($p < .001$), confirming that stronger STEM career interest is associated with greater career intent and orientation.

Sustained STEM career interest enhances persistence in challenging STEM subjects, which in turn builds both cognitive and non-cognitive competencies. Students with strong interest engage more actively in exploration, goal setting and skills development (Luo et al., 2021). Conversely, low interest may produce passive engagement and unclear planning (Yeop Kamarudin & Mohd Kosnin, 2022).

In summary, STEM career interest acts as a motivational catalyst sustaining learning, exploration and skill development, thereby reinforcing readiness for STEM pathways. Collectively, research indicates that sustained STEM interest strengthens readiness to pursue future STEM educational and occupational pathways. Thus, STEM career interest serves as a motivational foundation that directly supports students' preparedness to navigate the transition from school to STEM related careers. This synthesis provides the basis for the concluding discussion and future recommendations of this paper.

CONCLUSION AND FUTURE RECOMMENDATION

This conceptual paper emphasizes the motivational role of STEM career interest as a key determinant of career readiness. It demonstrates that students who develop a well-defined interest in specific STEM career paths are more likely to engage in the planning, exploration and commitment that constitute readiness for science and technology fields.

Future research should empirically test the proposed framework, particularly the role of STEM career interest in linking cognitive factors and career readiness. Such studies would strengthen the applicability of SCCT within Malaysian secondary education.

The findings highlight the importance of integrating structured career guidance and early STEM career exploration within secondary schooling. Schools, teachers and counsellors should provide targeted career guidance, meaningful mentorship and authentic STEM learning experiences. By nurturing sustained interest and

expanding equitable access to STEM opportunities, education systems can ensure that students are both motivated and prepared to participate in a rapidly evolving, technology-driven economy.

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