

Cracking the Code: Investigating the Relationship Between Big Five Personality Traits and STEM Education

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Abstract

The ultimate objective of this research is to provide light on the complex relationship between Big Five personality traits and jobs in science, technology, engineering, and mathematics (STEM). This study examines the role of personality traits, notably openness, conscientiousness, extraversion, agreeableness, and neuroticism, in growing one's interest and proclivity for STEM careers by examining data from a large sample of studies. The study's findings have far-reaching implications for both individuals and society as a whole. Understanding the influence of personality traits on STEM career pursuits can assist educational institutions, career counsellors, and policymakers in creating environments that encourage and support persons with specific personality profiles to pursue STEM jobs. Individuals can also gain substantial insights into their own predispositions and aptitudes, allowing them to make informed career decisions that are aligned with their own personality traits. By cracking the code and unravelling the deep relationship between Big Five personality traits and STEM career choices, this research hopes to contribute to the greater goal of broadening and strengthening the STEM workforce, ultimately paving the way for a more inclusive and innovative future.

Keywords: STEM Education, Personality, STEM Career, Big Five

Introduction

Personality traits are associated to both students' liking for STEM and their desire to specialize in STEM subjects (Coenen et al., 2021). According to the findings, personality is a crucial determinant in students' academic achievement in schools and institutions (Idris et al., 2023b). Compared to higher levels, Mamadov (2021) finds a larger association between academic success and personality qualities such as openness, extraversion, and

agreeableness in elementary/middle school. Personality influences students' behavior, relationships, and interests in specific areas, in addition to academics (Vedel, 2016).

Other than that, numerous research have been conducted to investigate the relationship between personality and STEM education. Personality characteristics, according to Baruth and Cohen (2023), play a critical role in empowering STEM education and increasing learning pleasure. Meyer et al (2023) emphasise the significance of taking topic domain and achievement metrics into account when investigating student achievement in STEM.

Nieben et al (2020) identify an incremental relationship between Big Five personality traits, socio-demographic variables, cognitive capacity, and STEM education transition success. According to Coenen et al (2021), personality traits have a substantial impact on individuals' interest, motivation, and performance in STEM, especially for underrepresented groups such as female students, providing challenges for educators and policymakers.

Furthermore, Roth et al (2022) find substantial links between personality qualities (conscientiousness, openness, agreeableness, extraversion, and neuroticism) and STEM creativity. Patitsa et al (2021) emphasise the impact of personality on learning methodologies, attitudes, engagement, and motivation, which can all affect learning satisfaction.

Personality traits have also been discovered to influence flipped learning methods in students (Arslan et al., 2023). Asselmann and Specht's (2021) study looked at differences in personality traits between people at the beginning and conclusion of their working life. The most essential approaches used by CIT students, according to Al-Qirim et al (2018), were agreeableness, extraversion, openness, and conscientiousness.

Finally, the study emphasises the importance of personality traits in boosting students' enthusiasm in STEM education. Previous study has shown that personality traits can be used as variables to understand and develop students' preferences for STEM topics. STEM education in Malaysia can be considerably enhanced by strengthening skills such as creativity, critical thinking, and tenacity with technical knowledge, allowing students to face the challenges of a fast changing labour market and contribute meaningfully to society. Personality qualities must be recognised and actively incorporated into STEM programmes by educators and policymakers.

STEM Interest Career

STEM (Science, Technology, Engineering, and Mathematics) career interests have gotten a lot of attention in Malaysia as the country attempts to maximise the potential of its trained people and promote technical advancements (Idris & Bacotang, 2023). A linear combination of four measures of STEM dispositions can reasonably predict STEM interest career (Christensen et al., 2015). STEM careers span a wide range of industries, including computer technology, engineering, biotechnology, renewable energy, and others (Idris et al., 2023e).

STEM education in Malaysia faces numerous challenges and impediments that must be overcome in order to attain its objectives (Idris et al., 2023a). Simultaneously, there is a challenge and an impediment to empowering kids in STEM education. It is critical to analyse and address the influence of demographic landscape, family history, and gender, guaranteeing equitable opportunities and support for all persons (Idris et al., 2023f).

Determining middle school students' STEM career interests is an important step in fostering their passion and motivation for STEM education because 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. Students' attitudes

towards STEM careers change throughout their primary and secondary school years (Wiebe et al., 2018).

From 2012 to 2022, the level of STEM interest among Malaysian secondary school students was observed to be unstable, with the 60% target remaining elusive, indicating the need for additional interventions and strategies to effectively cultivate and sustain students' enthusiasm and engagement in STEM subjects and potential careers (Fadzil et al., 2019; Idris & Bacotang, 2023). When students have negative impressions of STEM careers, they may be precluded or low self-efficacy from generating excitement for the field during formal study (Idris et al., 2023d).

Through student interest or enrolment in STEM at school, this issue has an impact on STEM education implementation (Idris et al., 2023e). According to the Malaysian Ministry of Education (2021), the trajectory of student involvement in STEM is quite alarming, with the highest level at 47.82% in 2016 and the lowest level at 40.95% in 2021, with only 152,568 secondary school students enrolled in STEM courses (Idris et al., 2023b).

Personality Big Five

Personality is one of the most essential factors or elements influencing students' academic success in high school or college. Personality also influences students' behavior in several facets of their lives, such as the relationship between a subject or topic of interest in school (Vedel, 2016). Many research used the 'Big Five' model to investigate the association between personality traits and student academic accomplishment, and this study successfully found the 'Big Five' personality's strength in assessing student academic achievement (Zali & Surat, 2022).

Personality is the arrangement of factors such as biology, psychology, and sociology, and it is this element that enables a person to have a personality or character. Students with agreeableness (Fagan et al., 2019), conscientiousness (Brandt et al., 2019; Sanchez-Ruiz & El Khour, 2019; Mammadov, 2021; Fagan et al., 2019), and extraversion Brandt et al (2019) are more likely to achieve academic results in STEM subjects.

Despite recent findings that there are major determinants for STEM learning in school among high school students, student personality remains a priority in identifying trends towards STEM career preferences among high school students, particularly in Malaysia (Idris et al., 2023b). Furthermore, the trajectory of student engagement in STEM remains static, with participation never exceeding 50% compared to the targeted 60% (Idris et al., 2023a).

According to Zali and Surat (2022), openness to cognitive and non-cognitive experiences manifests itself in a variety of interests, a desire to discover new and unexpected life events, and a sense of pleasure. Conscientiousness is a personality trait that focuses on concerns including orientation, habitual behavior, and impulse control. Individuals that are responsible, careful, methodical, organize, dependable, industrious, disciplined, punctual, neat, ambitious, and intuitive are referred to be responsible.

Individuals with strong extraversion are forceful, ambitious, gregarious, active, chatty, people-oriented, optimistic, and loving. Aside from that, people who are pleasant are defined as tolerant, trustworthy, flexible, forgiving, cooperative, polite, gentle, kind, helpful, gullible, and straightforward. Finally, neuroticism is defined as emotional instability, including feelings of wrath, embarrassment, anxiety, hostility, melancholy, self-consciousness, impulsiveness, worry, restlessness, emotionality, insecurity, and inadequacy (John & Strivastava, 1999; Zali & Surat, 2022).

Table 1

Dimension of the Big Five Personality

Big Five Dimension	Explanation
Extraversion	Sociable, assertive, energetic, adventurous, positive emotions, easy to get along with.
Agreeableness	Trusting, straightforward, undemanding, altruistic, obedient, simple, and sympathetic.
Conscientiousness	Efficient, organized, dedicated, trying to achieve success, self-disciplined, earnest.
Neuroticism	Anxious, angry, hostile, depressed, self-conscious, impulsive, vulnerable.
Openness	Curious, imaginative, artistic, broad interests, excited, unconventional.

(Adapted from the Big Five Trait Taxonomy, John & Srivastava, 1999)

The research and studies given demonstrate the importance of personality in academic performance and its impact on numerous aspects of students' lives. In elementary/middle school, Mamadov (2021) emphasises a higher association between academic success with openness, extraversion, and agreeableness. Vedel (2016) add to the evidence that personality influences academic success and influences students' behaviour and interests.

Moving on to STEM education, show the significance of personality characteristics in STEM education empowerment and achievement (Baruth & Cohen, 2023; Meyer et al., 2023). Nieben et al (2020) demonstrate the incremental relationship between the Big Five personality qualities and STEM transfer success, whereas Coenen et al. (2021) examine the impact of personality determinants on interest, motivation, and performance, particularly for underrepresented groups. Roth et al (2022) identify conscientiousness, openness, agreeableness, extraversion, and neuroticism as personality qualities that are substantially connected to creativity in STEM education.

Furthermore, personality variables influence learning methodologies, engagement, and motivation. Patitsa et al (2021) emphasise the impact of personality on a person's approach to learning and attitudes towards learning, which affects total learning satisfaction. Arslan et al (2023) investigate the impact of personality traits on flipped learning styles, whereas Asselmann and Specht (2021) investigate personality variations between persons at various periods of their working careers. According to Al-Qirim et al (2018), the most important approaches used by CIT students are agreeableness, extraversion, openness, and conscientiousness.

The findings also imply that distinct personality qualities are connected with academic performance. Conscientiousness, according to Andersen et al (2020), is equally connected with academic success at all grade levels, with agreeableness and emotional stability being strongly related to conscientiousness. Avram et al (2020) emphasise the importance of personality traits in an individual's ability to adapt to changing work situations and expectations. Gatzka (2021) emphasises the favourable relationship between openness and

academic achievement, focusing on two unique aspects: intellectual and senso-aesthetic openness.

In addition to these findings, show that higher conscientiousness is connected with higher study satisfaction and has a greater influence on academic achievement than other qualities (Smidt, 2015; Soric et al., 2017). According to Muhid et al (2021), openness to experience is the most important predictor of student accomplishment, but Purwana et al (2018) emphasise the importance of neuroticism on entrepreneurial intention. Furthermore, Naqshbandi et al (2017) show that neuroticism has an impact on academic achievement, notably in mathematics and scientific areas.

According to the findings, recognising and incorporating personality qualities such as conscientiousness, openness, and neuroticism in educational environments is critical for increasing academic performance, student satisfaction, and success. Understanding the complicated relationship between personality and academic achievement can aid in the development of personalised interventions and strategies to enhance students' educational journeys and assist them in thriving in a fast changing labour market. Figure 2 depicts the theoretical framework personality big five in STEM education and career interest.

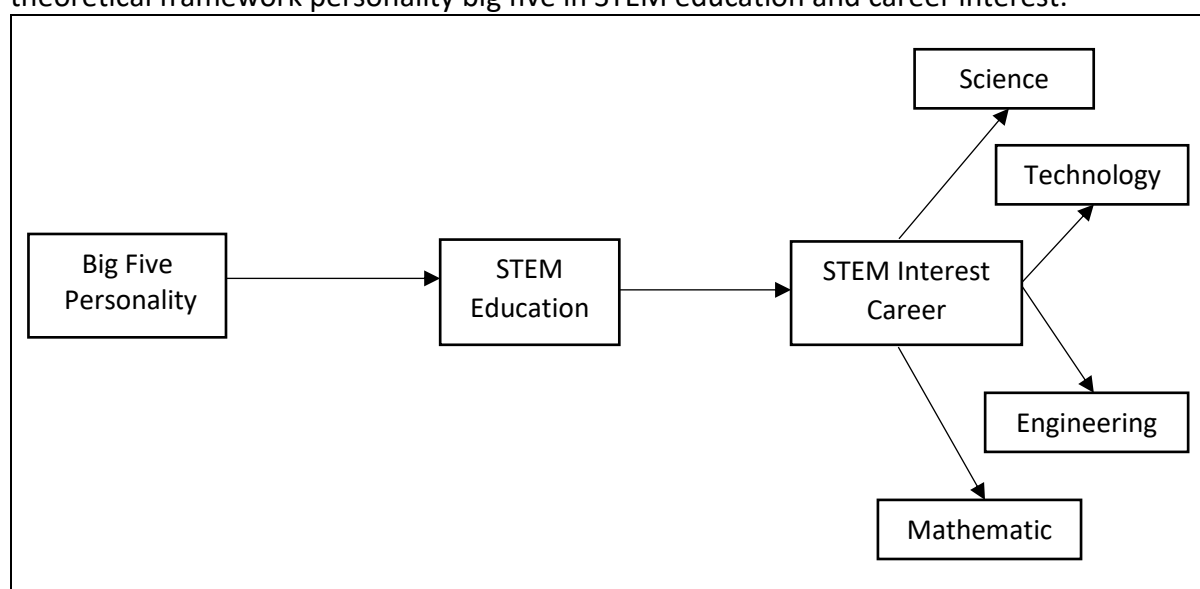


Figure 1. Theoretical Framework Proposed by Researcher

Based on figure 2, schools may establish an environment that promotes students' unique talents, strengths, and interests by focusing on empowering their personalities, thereby increasing their engagement and enthusiasm in STEM education and career paths (Idris et al., 2023b). Students are more likely to acquire a strong sense of self-confidence, curiosity, and love for discovering the wonders of science, technology, engineering, and mathematics when they feel supported, encouraged, and respected for their uniqueness (Idris et al., 2023d). Individuals with different personality traits may have different preferences in how they approach and engage in learning activities, influencing their level of motivation and overall learning outcomes (Idris et al., 2023c).

Conclusion and Future Agenda

The 'Big Five' personality model is commonly employed to investigate this relationship, with agreeableness, conscientiousness, and extraversion associated with higher academic accomplishment in STEM disciplines (Fagan et al., 2019; Brandt et al., 2019; Sanchez-Ruiz &

El Khour, 2019; Mammadov, 2021). This influence goes beyond academic achievement, influencing students' interests, conduct, engagement, and learning approaches. Openness, conscientiousness, agreeableness, extraversion, and neuroticism are personality traits that have been connected to creativity, learning styles, motivation, and study satisfaction (Zali & Surat, 2022; Patitsa et al., 2021; Arslan et al., 2023; Asselmann & Specht, 2021).

Furthermore, personality traits are linked to academic success, adaptability, and even entrepreneurial intent (Andersen et al., 2020; Avram et al., 2020; Gatzka, 2021; Muhid et al., 2021; Purwana et al., 2018; Naqshbandi et al., 2017). Recognizing and implementing these personality qualities in educational environments can improve academic achievement, student satisfaction, and success, allowing students to succeed in their academic journeys as well as the ever-changing job market.

The 'Big Five' personality model is commonly used to investigate the relationship between personality traits and academic achievement, with agreeableness, conscientiousness, and extraversion being connected to higher academic achievement in STEM courses. Furthermore, personality features influence students' involvement, learning approaches, motivation, and learning attitudes. The study emphasizes the significance of understanding and implementing personality traits in educational settings to improve academic performance, enjoyment, and success, particularly in the context of STEM education and the changing labor market.

Finally, fostering a vibrant STEM education environment within schools requires empowering students' personalities. We can kindle a passion for STEM subjects and jobs by recognising and recognising their unique traits and interests. This empowerment leads to increased comprehension, interest, and participation in STEM education.

Looking ahead, it is critical to prioritise and incorporate personality empowerment programmes within educational institutions. This can be accomplished through customised teaching methods, inclusive learning settings, and mentorship programmes that encourage students to pursue their talents and interests in STEM subjects. Collaboration across schools, industries, and communities can also provide kids with real-world exposure, internships, and hands-on experiences, strengthening their interest in STEM vocations.

Additionally, fostering diversity and inclusiveness in STEM education and jobs should be a priority. Accepting people of diverse origins, genders, and nationalities fosters innovation, creativity, and a broader spectrum of problem-solving views. We can build a diverse STEM workforce that represents the world's numerous demands and challenges by ensuring fair access and opportunities for all students.

To summarise, by emphasising student empowerment, we can cultivate a generation of eager learners, problem solvers, and future STEM professionals who will drive innovation and contribute to societal growth. It is our collective responsibility to offer students with the necessary support, resources, and opportunities in order to empower them and construct a brighter future for STEM education and professions.

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