BORNEO AKADEMIKA (BA)

Volume 7 (1), June 2023 (9-14)

ISSN: 2462-1641
e-ISSN: 2735-2250

Journal home page:
https://borneoakademika.sabah.uitm.edu.my

FACTORS INFLUENCING SECONDARY STUDENTS' INTENTION TO STUDY STEM

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ABSTRACT

The percentage of Malaysian students in Science, Technology, Engineering, and Mathematics (STEM) is less than 60%, as highlighted by the Ministry of Science, Technology, and Innovation (MOSTI). STEM talent is essential as the catalyst for the development of a country. The vision of the Sustainable Development Goals (SDG) of the United Nations to produce new science and technology that are sustainable, affordable, and safe, could be achieved by encouraging students to take courses in science and technology. One of the universities in Sabah has taken the initiative to conduct a STEM outreach programme at SMK Tongod during the Imbak Canyon Scientific Expedition 2022 to promote STEM. The study was conducted to identify the factors that influence the intention of secondary students to pursue STEM education. The theory underpinning the present study was the Theory of Planned Behaviour (TPB). The dependent variable was students' intention to study STEM, and the independent variables were attitude towards STEM, normative social influences, and self-efficacy. The data were collected using questionnaires, which were distributed to 50 secondary students. The data were analysed using the SmartPLS. The findings have important implications. Parents, educators, and society can influence students' attitudes towards STEM education.

Keywords: STEM, intention, attitude, Theory of Planned Behaviour, SmartPLS

Introduction

STEM fields are critical drivers of economic growth and national development. However, most countries worldwide are facing problems recruiting individuals into STEM industries, and Malaysia is no exception. To ensure the country has an adequate supply of talent in

STEM fields, the percentage of students choosing STEM education needs to be increased to 60 percent, as targeted by the Ministry of Science, Technology, and Innovation (MOSTI) (Bernama, 2021, October 9). The vision of the Sustainable Development Goals (SDGs) of the United Nations, which is to produce new science and technology that are sustainable, affordable, and safe, could be achieved by cultivating science and technology, thus developing a society that supports science and technology (U.N.D.P., 2022).

Researchers from all over the globe have looked into the factors that influence students' decisions to major in STEM fields of study. There are many factors that influence the percentage of students who choose STEM education. The factors can be a lack of interest, background, environmental factors, intrinsic factors of the individual, and so on. (Halim et al., 2018; Ismail et al., 2019). A comprehensive analysis of the UK literature on the variables affecting young people's educational options in STEM fields was conducted by Tripney et al. (2010). They found that Asian students were more likely to continue studying science or mathematics after the age of compulsory education. Additionally, they revealed that the key deterrents to choosing STEM subjects for students were students' aptitude, and their lack of interest. In contrast, the main motivators for choosing STEM subjects for students were usefulness, ability, enjoyment, and complementary subjects. Additionally, they found that girls are more likely than boys to attribute their decision to their interest in or enjoyment of the field of study rather than their level of trust in STEM-related fields. Secondary students show interests in STEM fields (Wiebe et al., 2018). Hence, this might show that secondary students are better suited to respond to research on the connection between attitude and intention to pursue STEM. According to Kurban and Cabrera's research (2019), STEM readiness and students' interest in mathematics and science have a direct impact on their intention to major in STEM. Additionally, socioeconomic position, mathematical aptitude, parental influence, self-efficacy, and interest, have a direct impact on STEM readiness. Therefore, the present research was to determine the variables that affect secondary students' intentions to pursue STEM education.

Objective

The primary objective of this research is to identify the factors influencing secondary students' intentions of pursuing STEM education in Tongod District. We are interested in determining the impacts of three variables—attitude towards STEM, parental support, and confidence in pursuing STEM education—on students' intentions for pursuing STEM education. Additionally, this study seeks to pinpoint the element that has the biggest impact on students' intentions to pursue STEM fields. With our findings, we aim to assist educators, school officials, policymakers, and parents in empowering students to continue their studies in the STEM stream.

The research questions were: What variables affect secondary school students' intention to pursue STEM fields of study? What is the main element influencing secondary students' intention to pursue STEM studies?

Methodology

This study was guided by the Theory of Planned Behaviour or TPB (Jeffries et al.,2019; Malik et al.,c2021). TPB is a conceptual model that aims to describe behaviours (Fishbein and Ajzen, 2010). It offers a helpful and solid conceptual framework to research complicated behaviours. According to the theory, a person's desire to engage in a specific behaviour can be used to anticipate that behaviour (Ajzen, 1991). Hence, based on this theory, there are three main factors that influence intention: attitude towards behaviour, subjective norms, and perceived behavioural control (Ajzen, 1991).

In addition to the existing variables in the theory, more factors might be added if they are shown to be significant. Accordingly, the independent variables used in this study comprised the students' attitude towards STEM, normative social influences, and self-efficacy. In our study, normative social influences were proxied by parental influence on students' motivation to study STEM and their career interests, whereas self-efficacy was proxied by students' confidence to study STEM and understand the career scope. The three independent variables were assumed to have influence on the dependent variable, which was the intention to study STEM. For the purposes of our study, students' STEM career interest was students' intention to study STEM proxy. Figure 1 shows the conceptual framework of our study.

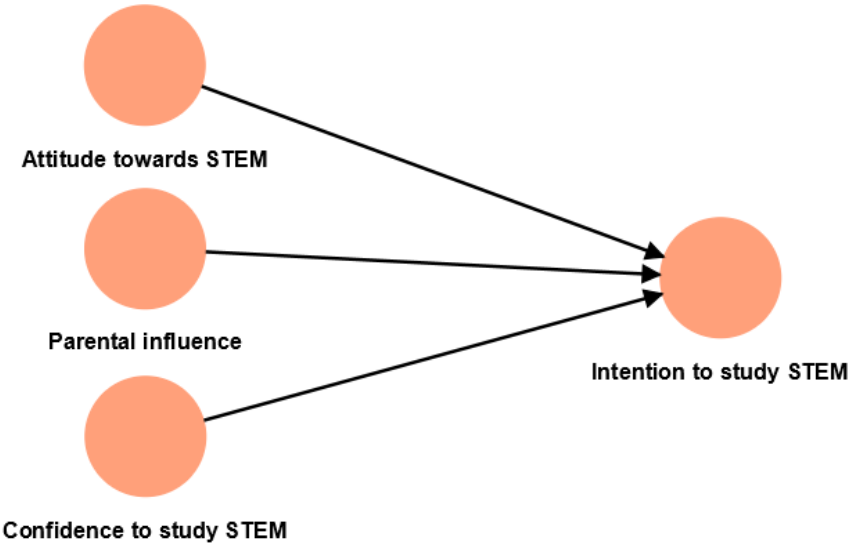

Figure 1: Research Conceptual Framework

Based on the literature reviewed, three hypotheses were developed. The first hypothesis was that students' attitudes towards STEM have a significant relationship with their intention to study STEM. The second hypothesis was that parental influence has a significant relationship with students' intention to study STEM. Finally, the third hypothesis was that students' confidence to study STEM has a significant relationship with their intention to study STEM. To represent the factors in a more current and precise manner, primary data was used, as was done by Ito and McPherson (2018) and Malik et al. (2021).

The intended respondents were secondary school students from several secondary schools in the Tongod District region who took part in the Imbak Canyon Scientific Expedition 2022 organised by the STEM team from the UiTM Sabah Branch. We adapted and modified a questionnaire from Razali et al. (2017) to study both dependent and independent variables. Several questionnaires were combined, including the Student Attitudes towards Science, Technology, Engineering, and Mathematics (S-STEM) and Interest in STEM Careers Questionnaire (Tyler-Wood, 2010), the Science Motivation Questionnaire II (SMQ-II) (Glynn et al., 2011), and the Parental Authority Questionnaire (PAQ) (Buri, J.R., 1991).

The STEM Outreach Program held at SMK Tongod was appropriate since SMK Tongod is a school that is relatively far from the city precinct, and the students there need to be exposed to science and technology to increase their awareness and encourage them to choose this field in the future.

The Statistical Package for Social Science (SPSS) and Partial Least Square (SmartPLS 4) were used to perform the data analysis. The data was first recorded into SPSS to obtain descriptive statistics and check for any missing values. Then, the data were transferred to SmartPLS 4 for partial least squares structural equation modelling (PLS-SEM) analysis. To assess construct validity, two model analyses were carried out: a measurement model and a structural model analysis. In the measurement model analysis, convergent validity analysis was performed This analysis described the degree of agreement between various items used to measure the same notion, by using factor loadings, composite reliability (CR), and average variance extracted (AVE). Factor loadings were used to exclude items with low or no significance to reduce the number of items requiring further analysis. Hair et al. (2018) recommended that factor loading values be greater than 0.5 for our study; thus, items with less than 0.5 values were removed one by one based on their insignificant value. In addition, the recommendations of Hair et al. (2018), whereby the value of AVE should be more than 0.5 and CR should be more than 0.7 to ensure that the construct has adequate internal consistency.

In addition, the discriminant validity was evaluated using the Fornell and Larcker (1981) criterion and cross-loading analysis. For the Fornell and Larcker criterion (1981), it is suggested that the square root of the AVE should be bigger than the values in the rows and columns of all associated constructs to ensure that the constructs are unique. For the cross loadings, the loadings are considered crossed if the values of the matched items and constructs are greater than 0.50; hence, it is vital to ensure that there is no cross loading among the variables to achieve satisfactory discriminant validity (Hair et al., 2018). The second phase of the analysis was the structural model analysis, which is performed to reduce error variance. The analysis included bootstrapping and hypothesis testing. To determine the significance levels of loadings, weights, and path coefficients, 5000 resamples of bootstrapping were used as suggested by Hair et al. (2018). Hypothesis testing was conducted following the guidelines by Hair et al. (2018) i.e., a t-value above 1.64 is significant at the five percent level and a t-value above 2.33 is significant at the one percent level.

Results

What variables affect secondary school students' intention to pursue STEM fields of study?

Our findings reinforce prior research that students' attitude towards STEM and their confidence to study STEM were among the variables that affect secondary school students' intention to pursue STEM.

What is the main element influencing secondary students' intention to pursue STEM studies?

We found that students' attitudes towards STEM were the main element influencing their intention to pursue STEM.

The result indicated that the first hypothesis was supported. The students' attitude towards STEM has a significant relationship with their intention to study STEM. It was reported that the T-value of the hypothesis was 2.520, which was above the recommended value of 2.33 (Hair et al., 2018). This shows that there is a significant relationship between students' attitudes towards STEM and their intention to study STEM at the one percent significance level. Aligned with the findings obtained by Ismail et al. (2019) and Halim et al. (2018), a positive attitude towards STEM improves the students' intention to study STEM, whereas a negative attitude towards STEM decreases the students' intention to study STEM. The second hypothesis of this study was not supported. It was reported that the T-value of the hypothesis was 0.970, which was below the minimum recommended value of 1.64 (Hair et

al., 2018). In contrast to Kurban and Cabrera (2019), this research demonstrated that there is little correlation between parental influence and the intention of pursuing STEM education. The students claimed that their parents had no influence on their intention to study STEM. Although this result may suggest that parents are not always responsible for explicitly encouraging their children to study STEM, parents can still help shape their children's attitudes towards the field. Finally, the third hypothesis was supported. It was reported that the T-value of the hypothesis was 1.715, which was above the minimum recommended value of 1.64 (Hair et al., 2018). Aligned with Kuchynka et al. (2021), this study shows that there is a significant relationship between students' confidence and their intention to study STEM at the five percent significance level. This indicates that higher confidence in learning STEM improves the students' intention to study STEM, whereas lower confidence in learning STEM declines the students' intention to study STEM.

Table 1: Cross measurement of attitude, confidence, and parental influence towards students' intention to study STEM.

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Attitude x Intention	**0.497**	**0.479**	**0.197**	**2.520**	**0.012**
Confidence x Intention	**0.184**	**0.205**	**0.190**	**0.970**	**0.332**
Parental Influence x Intention	**0.202**	**0.217**	**0.118**	**1.715**	**0.086**

Conclusion

As a conclusion, there must be some efforts to instill STEM culture among the younger generation. Nowadays, the younger generation is good at using social media and technology. The belief that STEM is difficult must be dispelled to keep the younger generation interested in the STEM field. Through films and documentaries in Malay, the awareness of the importance of STEM can be elevated among the young generation in various geographical positions in Malaysia. Corporate bodies and interested individuals can promote STEM. The implementation of STEM should be more comprehensive, well-organised, and the results should be observed so that its effectiveness can be seen. As an example, MOSTI Sabah has organised various programmes related to STEM during the STEM Carnival, which is held every year for the community and the younger generation, especially secondary and primary school students. Lastly, it is very important for educators, parents, and the society to do their parts so that students have positive attitudes towards STEM education.

Acknowledgments

First and foremost, we would like to express our special thanks and gratitude to the Ministry of Science, Technology, and Innovation, Sabah (MOSTI Sabah) for their generosity in funding the STEM Outreach Program in Tongod District, without the fund, the programme would not be possible.

Secondly, we also would like to extend our gratitude to PETROSAINS for always supporting the programme conducted by UiTM Sabah, especially for this STEM program, by providing us with STEM goodies for the participants and equipment for STEM activities.

Finally, our special thanks go to the management of UiTM Sabah, the management of Yayasan Sabah Group, and the management of the Imbak Canyon Study Centre for their cooperation in making this scientific expedition a reality.

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