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STEM and Non-STEM Students' Perception towards Work Environment and Career Prospect

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Abstract: The Malaysian education system has undergone transformation to reinstate the significance of science, technology, engineering, and mathematics (STEM). All students at the upper secondary schools are given the chance to learn STEM subjects so that they are equipped with the knowledge and skills needed for STEM careers despite streams of study at schools. Considering the importance of the new streaming system that divides students into STEM and non-STEM stream, it is not clear how students from both streams of studies perceive work environment and prospect of STEM careers. Hence, the purpose of this study was to examine if there is a significant difference between STEM and non-STEM stream secondary school students' perceptions towards STEM work environment and career prospect. Independent-samples t-tests was used to analyse data collected from 157 students from the East Coast of Malaysia. Though the effects of the results were small, this study found that students from different streams of study perceive working environment and career prospect in STEM differently. This research finding would offer insights to the authorities and policy makers to improve the new streaming system in the Malaysia to better prepare students for STEM careers.

Keywords: STEM, non-STEM, perceived work environment, career prospect

1. Introduction

The current demand for STEM talents surpasses its supply in STEM education (Shahali et al., 2017). Numerous vacancies in STEM jobs have created a worldwide concern because lacking STEM human capital for the workforce will threaten a country's development and the global economy at large (Ali et al., 2021). In view of this issue, the Malaysian government has initiated a national STEM action plan to inform the public, schools, and particularly the students about awareness, importance, and career opportunities in STEM.

Many activities, complementary programmes, and out-of-school activities have been implemented to offer students the necessary exposure to STEM beyond academic (Shahali et al., 2017). Through these initiatives, students are expected to be more motivated and are more likely to develop interest to pursue STEM in future (Shahali et al., 2017). Outreach programmes and collaborations with STEM agencies and organisations are among the most popular activities that allow students to have a glance at the actual work environment and foresee the prospects of STEM careers (Shahali et al., 2017).

According to Zhang et al. (2020), a supportive work environment such as having an appropriate reward system can generate positive job performance at the workplace, whereas an unfavourable work environment such as having heavy workload and unrealistic expectations would intimidate the driving force for work dynamic. Besides, Wan et al. (2014) noted that individuals who have possess high value over a career indicate high likeliness to pursue and commit to the targeted industry for its better career prospects. Given the importance of work environment and career prospect in career decision, having understood students' perceived work environment and career prospect in STEM would be able to offer better insights on how to inculcate a desirable and competitive STEM workforce. However, currently it is not clear how STEM and non-STEM students perceive work environment and prospect of STEM careers. Therefore, this study is an initial attempt to test whether there is a significant difference

between STEM and non-STEM stream secondary school students' perceptions towards work environment and career prospect in STEM careers.

2. Literature Review

2.1 STEM and Non-STEM Stream

In tandem with the STEM action plan, STEM has been given great emphasis in the Malaysian education system by reforming its curriculum to prepare students for future STEM academic pursuits or careers. According to Mokhtar (2019), a "streamless" curriculum would replace the traditional science and arts stream through the latest national curriculum. Nevertheless, students are still divided into STEM and Non-STEM stream to establish a STEM-oriented education system so that all students in the upper secondary schools (equivalent to high school) can learn at least one STEM subject based on their preferences (Curriculum Development Division, 2016). In other words, STEM stream students learn more advanced STEM knowledge and skills, while non-STEM students are also given the option to register one STEM subject upon their enrolment at the upper secondary school (Ali et al., 2021; Curriculum Development Division, 2016). STEM subjects introduced to the students were designed based on industrial demand to train adequate talents for STEM workforce (Mokhtar, 2019). However, the implementation of the STEM-oriented streaming system is still at its infancy that it has been officially implemented nationwide since 2020 (Mokhtar, 2019), thus it is not clear if the new streaming system would result in differences between the two streams of students.

Xu (2013) is one of the very rare past research that examined the difference between STEM and non-STEM students. It was reported by Xu (2013) that there were differences in the factors that affected STEM and non-STEM graduates' career. Specifically, students were split into different streams, thus it can be expected that students from each respective field of study would choose a career that is align with their academic training (Xu, 2013). There are very limited career studies that examined students' differences in across streams of study, particularly in STEM and non-STEM. This raised the researchers' curiosity whether students from both the streams share similar perception towards work environment and prospect for STEM careers or not. For this reason, the present study investigated whether perceived work environment and career prospect in STEM would vary between STEM and non-STEM stream students.

2.2 Perceived Work Environment

In the review of literature, it was found that work environment could refer to various aspects such as safety to employees, job security, good relations with colleagues, and working hours (Raziq & Maulabakhsh, 2015). According to Raziq and Maulabakhsh (2015), work environment is a combination of work and context which includes various characteristics of an occupation is carried out and completed. Among the characteristics included in their research were working hours, job security and safety, relationships with colleagues, esteem needs, and the role of top management (Raziq & Maulabakhsh, 2015).

On the other hand, Crilly et al. (2017) suggested that work environment included four attributes, namely self-realisation, nervousness, workload, and conflict. In Sugahara and Boland's (2009) study that compared accounting and non-accounting students, they reported that there was a slight difference in terms of how the work environment influenced their career choice. Based on their research, sufficiency of social life, length of work hours and physical work conditions were the main aspects of work environment. As students are yet to experience an actual work experience, this study selected the aspects that would better relate to students' expectations to examine their perceived work environment. Therefore, perceived work environment in this study refers to a secondary school student's expected combination of work contexts in STEM careers that include sufficiency of social life, relationships with colleagues, length of work hours, application of knowledge and skills, and physical work conditions. Given the discussions, the following hypothesis was proposed:

H1: There is a significant difference between STEM and non-STEM students' perceptions towards work environment in STEM.

2.3 Career Prospect

Career prospect is defined as an individual's perception of the promotion opportunities offered at workplace, advantages working in the industry, and academic qualification as a worthwhile investment in career development (Wan et al., 2014). Based on Liaw et al. (2017), career opportunity, career stability, and good income are the three important attributes of career prospect. Hence, when a person has a positive prospect for a career, it is expected that the career would ensure a desirable income and living standard, provide opportunities to work overseas and career advancement, as well as to attain higher academic qualification (Liaw et al., 2017).

Wan et al. (2014) reported that career prospect is a crucial factor that influences students' commitment in their targeted career. Quansah et al. (2020) explained that when an individual places more optimistic prospect on the targeted career, the individual is more likely to choose a career in the targeted field. In Sugahara and Boland (2009), it was found that there was a slight difference in accounting and non-accounting students' career prospect for accounting career choice. Although these students perceived career prospect as an important key that led to their career decision in accounting, career prospect was only significant for non-accounting students when the career is expected to generate good long-term income. In this study, career prospect refers to a secondary school student's perception towards a STEM career in terms of aspects such as career stability, promotion opportunities, academic advancement, and social prestige. In view of the above discussions, the following hypothesis was formulated:

H2: There is a significant difference between STEM and non-STEM students' perceptions towards career prospect in STEM.

3. Research Methods

This study employed a survey design using a bilingual questionnaire to test the proposed hypotheses. It was a bilingual questionnaire in English and Malay language (the national language of Malaysia). The first section of the questionnaire included the respondents' demographic information such as the location of schools and stream of study. Perceived work environment and career prospect were measured in the subsequent section with six and eight items, respectively. Each item in the constructs were measured using a five-point Likert scale ranging from 1 = Strongly Disagree to 5 = Strongly Agree. The Cronbach's Alpha values for perceived work environment was 0.87 and career prospect was 0.91, which were above the recommended value of 0.70 (Pallant, 2013). In this study, the scales of both constructs consisted of existing items adapted from the existing literature (Crilly et al., 2017; Liaw et al., 2017; Sugahara & Boland, 2009; Wan et al., 2014), as well as self-developed items based on the need of the study.

Prior to data collection, the researchers had been granted the permissions from the Malaysian Ministry of Education, state offices of education, and the researchers' affiliation Scientific and Ethical Review Committee to conduct research. The purpose of the study was explained in the consent forms for the participants and their parents. Parental consent was sought because the respondents were 16-year-old adolescents who were considered under parents' care in Malaysia. Consequently, the respondents of this study were 157 students from the three states (Kelantan, Pahang, and Terengganu) in the East Coast of Malaysia. There were 60 students from Kelantan, 50 of them from Pahang, and 47 of them from Terengganu. More than half of the sample of this study were female students (64.3%, n = 101), whereas the remaining 35.7% (n = 56) of them were male. Among the respondents, 60 students indicated that they were from STEM stream, while the other 97 were non-STEM stream students. All the respondents in this study were 16-year-old, Form Four secondary school students (equivalent to Grade 10).

4. Results

4.1 Independent-Samples t-Tests

The collected data were analysed using independent-samples t-tests with IBM SPSS 23. Skewness and kurtosis were assessed, and the values were within the accepted range of ±1.00 (Hair et al., 2017). According to Pallant (2013), an independent-samples t-test is used to compare the mean scores of two distinct groups of continuous variables. Besides, Pallant (2013) noted that the effect size offers an indication of the magnitude of the differences between the compared groups. In this study, eta squared was used to represent the proportion of variance in the dependent variables that can be explained by the independent variable. Eta squared was calculated using the formula $t^2/ (t^2 + df)$. Eta squared < .06 indicates small effect, eta squared < .14 indicates moderate effect, while eta squared ≥ .14 indicates large effect (Pallant, 2013).

Align with the H1, an independent-samples t-test was conducted to compare the perceived work environment scores for STEM and non-STEM students. Based on the results as shown in Table 1, the significance level of Levene's test for equality of variances was larger than .05. Hence, it was assumed that there were equal variances between STEM and non-STEM stream (Pallant, 2013). The results generated from the analysis showed that there was a significant difference in scores for STEM (M = 3.89, SD = 0.74) and non-STEM (M = 3.49, SD = 0.75) students, with t (155) = 3.30, p < .05. The magnitude of the differences in the means (mean difference = .41, 95% confidence interval: .16 to .65) was very small (eta squared = .006), suggesting that only 0.6% of the variance in perceived work environment was explained by stream of study.

Table 1. *Independent Samples Test for Perceived Work environment*

Levene's Test for Equality of Variances		t-test for Equality of Means						
							95% Confidence Interval of the Difference	
F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
.003	.955	3.297	155	.001	.40475	.12277	.16224	.64726

Besides, an independent-samples t-test was also carried out to test H2, whether there was any significant difference between STEM and non-STEM students' perceived career prospect. Table 2 shows that the significance level of Levene's test for equality of variances was .629 which was above .05, indicating there were equal variances between the two groups (STEM and non-STEM stream). From the results, it was shown that there was a statistically significant difference in STEM (M = 3.97, SD = .73) and non-STEM (M = 3.69, SD = .76) students' perceived career prospect in terms of their stream of study, with t (155) = 2.30, p < .05. The magnitude of the differences in the means had small effect (mean difference = .28, 95% confidence interval: .04 to .52, eta squared = .03). This means that 3.0% of the variance in perceived career prospect was explained students' stream of study.

Table 2. *Independent Samples Test for Perceived Career Prospect*

Levene's Test for Equality of Variances		t-test for Equality of Means						
							95% Confidence Interval of the Difference	
F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
.235	.629	2.304	155	.023	.28269	.12271	.04030	.52508

5. Discussion and Conclusion

5.1 Discussion

In Malaysia, the reformation of the education system was enacted to reinstate the importance of STEM components in its curriculum by offering STEM subjects to all students at the upper secondary level. The goal of this initiative is to better prepare students from all streams of study for careers in STEM. However, the findings indicated that despite having made "STEM for all" in the latest curriculum, students from both streams of study perceive the work environment and career prospect in STEM differently. Though the effects of the results were small, this finding would offer insights on research implications and future studies.

Based on the findings, this study found a need to view students' career perception towards work environment and career prospect in career decision separately despite the "streamless" system. Xu (2013) mentioned that since students are separated into STEM and non-STEM majors, the system per se has isolated the given exposure and training that qualify a student for a STEM career. The unequal exposure and training that STEM and non-STEM students obtain also add to the difficulties for non-STEM candidates to seek a career in STEM fields when the competitors are well-equipped with the qualifications needed for a STEM career. As such, students are more likely to choose careers that are related to their major (Xu, 2013).

Although the curriculum was reformed to emphasise STEM subjects, and has made STEM available to non-STEM students, there is still a gap in terms of the amount of STEM knowledge they learn at schools that equip them for STEM careers. STEM stream students are prepared to pursue STEM professionals, whereas the non-STEM students are expected to pursue careers in humanities and arts, with the alternate option to seek jobs as STEM associates if they choose to learn STEM subject in school. As such, the amount of STEM components and exposure in both streams of studies has naturally segregated non-STEM students from STEM. This could be a reason that has led to the difference in students' perception towards work environment and career prospect in STEM in which STEM students are given more opportunities to learn about STEM than non-STEM students.

The STEM students were given sufficient exposure and training about STEM careers, they had more specific expectations of the work contexts in STEM careers such as the length of work hours, and physical work conditions. On the other hand, STEM careers were regarded as alternate option for non-STEM students where they were not provided much exposure as STEM students. Hence, non-STEM students' perception towards the work environment and work contexts in STEM careers might not be as evident as the STEM students. Likewise, as students were split into different streams, STEM students were expected to join the workforce as STEM professionals while non-STEM students were more likely to be STEM associates if they pursue STEM careers. This could have led to the differences in terms of STEM and non-STEM students' expectations towards STEM careers such as income, career advancement, and opportunities. Due to the differences in knowledge and skills required for the two categories of STEM jobs, students from STEM and non-STEM stream tend to have different prospects for STEM careers.

5.2 Limitations, Recommendations & Conclusion

The findings of the present study would contribute to understanding of the new streaming system in the Malaysian national curriculum. The arts and science streaming system were abolished to consolidate its education system and make STEM available for all students in the upper secondary level. However, the classification of students into STEM and non-STEM is still a form of academic streaming that discerns the learning contents and trainings for students. Considering the small effect of the results, this study could still be a meaningful reference to the policy makers to emphasize STEM opportunities for non-STEM students, so that they are not isolated from STEM despite having the chance to enter the STEM industries (e.g.: STEM associates). Additionally, the new streaming system is still at the early stage of its implementation. This study offers insights about the most updated STEM scenario to the direct consumers of the education system, STEM and non-STEM students.

There are a few limitations in this study that should not be overlooked. The results generated from this study can only represent students from the East Coast of Malaysia. This limitation has restricted the generalizability of the research finding, thus future studies can expand the research scope by including students from other regions of Malaysia, especially those from the central region. According to the Ministry of Education (2013), the central region of Malaysia is the education hub where access and resources are generally given the utmost priority. On the contrary, students from other regions such as the East Coast might have less opportunities and access about work environment and

career prospect in STEM due to access restrictions. Pertaining to this, it is also suggested that future research could use other variables such as career interest and career choice intention to test the differences between STEM and non-STEM stream students.

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