Research and Innovation in Technical and Vocational Education and Training Vol. 2 No. 2 (2022) 041-049

RITVET

Homepage: http://publisher.uthm.edu.my/periodicals/index.php/ritvet
e-ISSN: 2785-8138

Level of Awareness, Interest Between Gender and Perception of Students Towards STEM

Liyana Masran[1], Adawiah Sulaiman[1], Alias Masek[1*]

[1]Faculty of Technical and Vocational Education,
Universiti Tun Hussein Onn Malaysia, Batu Pahat, 86400, Johor, MALAYSIA

*Corresponding Author Designation

DOI: https://doi.org/10.30880/ritvet.2022.02.02.006
Received 02 March 2022; Accepted 18 August 2022; Available online 30 September 2022

Abstract: The goals of this study are to investigate lower secondary student progress in their awareness, perceptions, and interests towards Science, Technology, Engineering, and Mathematics (STEM) within the context of a professional development program. Currently, less than 20% of students take STEM subjects compared to the target of 60%. Most STEM based study programs at Public Universities have been unpopular. Parents are less interested and do not encourage their children to study in STEM education. Students are also less interested in STEM education because they consider the subject difficult; the learning is less interesting and boring. Furthermore, they feel that another STEM graduate is able to get good jobs and career prospects. Previous research also reported that students 'attitudes and appreciation towards science were high while students' self -confidence in science was low. Although many students have positive attitudes and interests towards science and mathematics. A case study was conducted to 61 students (23 male: 38 female) in one of the schools in Johor using questionnaire. This research proved that positive awareness of students towards STEM (M=3.93, SD=0.68), positive interest of male (M=3.46, SD=0.78), positive interest of female (M= 3.92, SD=0.68) and perception (M=3.85, SD=0.68) on STEM. The results point to the need to help teacher in designing certain aspects of STEM lesson plans including program or webinar meaningfully into the lesson content.

Keywords: Science, Technology, Engineering, And Mathematics Education; Awareness; Perception; Interest; Vocational And Technical Education.

**Corresponding author: aliasmasek@uthm.edu.my*

1. Introduction

STEM is an essential element in 21st century science skills (Ceylan & Ozdilek, 2015). STEM is a teaching approach that integrates four disciplines simultaneously, namely science, technology, engineering, and mathematics. STEM learning in schools must be taught in an integrated manner. According to Bybee (2010), this is because STEM is (i) scientific knowledge, technology, engineering, and mathematics, (ii) a form of human endeavor, (iii) a form of the material, intellectual, and cultural world, and (iv) STEM as sentimental and contributing people's thinking in education.

Past studies have shown that students have a positive interest and attitude towards science and mathematics while there is a wide diversity of students 'perceptions about science and mathematics (Ghandiswari, 2009). TIMSS Trends 2007 also reported that students 'attitudes and appreciation towards science and mathematics were high while students' self -confidence in science and mathematics was low. Although many students have positive attitudes and interests towards science and mathematics, there are various factors that have led them to be eligible to follow the science stream but choose not to follow it.

There are many factors that have an impact on the subject choices that students make. Palmer, Burke & Aubusson (2017) used a best-worst scaling (BWS) survey to investigate the relative importance of factors thought to impact students' subject selection decisions. According to their findings, student ranked enjoyment, interest and ability, and perceived need in their future study or career plans as the most important factors in both choosing and rejecting subjects. They considered advice from teachers, parents, or peers to be relatively less important. According to several studies, enhancing students' enjoyment, interest, and perceptions of their ability in science, and their attitude towards it, as well as increasing student perceptions of the value of science in a future career may result in more students studying science at school (Palmer, Burke & Aubusson, 2017).

In addition, students' own beliefs that success in science depends on exceptional talent can negatively impact their motivation to learn as well as a lack of enjoyment and confidence (Wu, Deshler & Fuller, 2018). Without encouragement or adequate knowledge about the educational and career opportunities that STEM skills enhance, there is a risk that students will dismiss a STEM-based career path as a potential option for their future (Blotnicky *et al*. 2018). Although the gender gap in studying STEM subjects (such as number of courses taken and performance in those courses) has narrowed in recent decades (Välijärvi & Sulkunen, 2016), females continue to be less likely to pursue STEM careers than their male counterparts (Hübner *et al*, 2017).

Another important issue is the quality of STEM education where the teacher's role is essential. Slavit, Nelson & Lesseig (2016) suggest that a teacher's role is a complex mixture of learner, risk-taker, inquirer, curriculum designer, negotiator, collaborator, and teacher. It is important to understand teachers' own beliefs and perceptions related to STEM talent development. According to Margot & Kettler (2019), teachers with increased confidence in teaching STEM would likely be more effective at integrating STEM activities, and increased confidence leads to better performance during instruction, which leads to gains in student learning.

One of the main issues that Malaysia is battling is obtaining human capital demand by 2025 (Blueprint, 2012). Many students who have selected STEM fields have constantly declined in current years (Mohtar *et al*., 2019). Similarly, 18% of students in Malaysia have the degree of prerequisite skills as well as knowledge in science-related fields; in the meantime, 55% of them have the degree of prior knowledge in science (Klieme, 2016). Zhongming *et.al* (2016) reported that just 44.9% of students in Malaysia have shown interest in new scientific discoveries or inventions. So, it has low enrolment into STEM in public

universities may due to several factors that need to be investigated. So, this study is conducted to identify students' awareness, perception and interest between gender towards STEM at school level.

2. Methodology

The quantitative design used is in the form of a descriptive survey study in which data are collected to answer questions about the current status of the subject or something studied. Survey is a descriptive approach that is widely used in the field of research to collect data and information (Azizi Yahaya *et al.*, 2007). Questionnaire through google forms was chosen as the research instrument because the results of the study can be analyzed easily and also easy to manage (Ismail, 2021).

The study site is an important matter therefore, the selection of the study site should be chosen well so that it can be managed with excellence and can directly save the use of time to conduct research (Asri, 2009). A case study was conducted at Sekolah Menengah Kebangsaan Kundang Ulu because the teachers really concern about their academic performance and achievement. The school is a religious science stream where students take science and religion subjects.

Sampling is related to the process of selecting a number of subjects from a population to be the respondents of the study. The sample of this study is a student at the lower secondary level who learn the science and mathematics subjects. A case study was conducted to 61 students (23 male: 38 female) using the questionnaire.

In this study, the instrument used is in the form of a questionnaire. Questionnaire was used to obtain information to test the variables. The questionnaire was conducted using a Google Form where respondents were given a link to answer the questions. This questionnaire contains 2 parts, namely part A (Demographic and Respondent Information) and part B (Awareness of STEM). Part B (ii) is about the interest of different gender of science for the school and part B (iii) is the students' perception of STEM in teaching and learning. 5 scales Likert was used to measure students' knowledge and perception of STEM education.

To study the objectives of this study, the findings of the study through google forms were analyzed using SPSS 16.0 where the data obtained were analyzed using descriptive statistics using mean scores. This questionnaire uses a Likert scale from a scale of 1 to 5 which represents the interpretation as in the table 1.

Table 1: Likert scale

Scale	Interpretation
1.00	Strongly Disagree (SD)
2.00	Disagree (D)
3.00	Uncertain (U)
4.00	Agree (A)
5.00	Strongly agree (SA)

The measurement of the mean score is referred based on the interpretation of the mean score for the Likert scale is as shown in the table 2.

Table 2: The Interpretation of mean scores (Source: Landell, 1977)

Mean Score	Level of propensity
1.00-2.33	Low
2.34-3.67	Medium
3.68-5.00	High

3. Result and Discussion

The results are presented in three different sub sections which are according to the objective of the study.

3.1 Students' awareness towards STEM subject

Table 1: Frequency distribution (and percentage) and mean according to students' awareness against STEM

No	Item/ Question N=61	Mean	Std Dev	Level
1.	STEM is important in life and learning.	4.02	.885	High
2.	STEM can relate with life and learning.	4.15	.813	High
3.	STEM only focus on Science, Mathematics Technology and Engineering.	3.69	.941	High
4.	Concept of STEM is existed in class.	3.85	.891	High
5.	Concept of STEM is implemented in class.	3.93	.964	High

Table 1 show the result on students' awareness towards STEM. Through the data obtained shows that the importance of this STEM concept in life (M=4.02, SD=0.89) that can be created and implemented (M=4.15. SD0.81) and it is also capable of producing competitive and technological graduates (M=3.69, SD=0.94). This proves that students have a high awareness of the importance of STEM education and knowledge related to STEM is fully conveyed to students. Educators are actually has received high exposure because STEM teaching is new in nature and educators has been given appropriate training. Teacher education and professional development a program has incorporate more elements of Engineering Design, Scientific Investigation, Mathematical Reasoning and Thinking, and 21st Century Skills (Kelley, & Knowles, 2016). For item 3, of (M=3.69, SD=0.69) stated that STEM is only focused on Science, Mathematics, Technology and Engineering. It is proving the fact this STEM concept is comprehensive which it is existed and implemented in class. According to Shernoff *et al*., (2017), the argument for using this STEM approach is real -world in nature and crosses various types of knowledge rather than separate. Based on the data obtained, the overall mean is that STEM education is able to produce competitive graduates which is M=3.93, SD=0.68. This indicates that students' awareness and confidence in STEM education are very positive and high.

3.2 Students' perception on STEM

Table 2: Frequency distribution (and percentage) and mean according to students' perception against STEM in teaching and learning.

No	Item/ Question N=61	Mean	Std Dev	Level
6.	Approach in education of STEM is suitable in teaching and learning.	3.85	.813	High

7.	Implementation of STEM activity has no impact to time management.	3.49	.960	Moderate
8.	Learning of STEM can enhance the intellectual of student.	3.82	.940	High
9.	Learning of STEM is more effective and suitable to be practice.	3.70	.882	High
10.	Activity in STEM learning is suitable to do in group.	4.02	.904	High
11.	Learning of STEM can increase motivation towards Mathematics and Engineering.	3.92	.862	High
12.	Learning in STEM can challenge thinking skills of student.	4.00	.949	High
13.	I believe that STEM education can attract interest of student in Science, Mathematics, Technology and Engineering.	4.00	.949	High

Based on the analysis in Table 2, scores for students' perceptions of STEM in teaching and learning has a same mean score value, M=4.00, SD=0.95 for item 12 and 13. This is because student believe that learning in STEM subject can challenge their thinking skills and can attract their interest in STEM. Kong *et al*., (2020) said that students get a meaningful experience and have a positive perception in integrating STEM education based on certain topics thus students get a comprehensive understanding of the subjects involving STEM. Meanwhile, Fitzallen (2015) in his studies reveal that setup of lessons makes a substantive difference in what students learn on STEM subjects. Kelley & Knowles, (2016) said that it is how people learn, specifically in teaching and on a limited perspective of this educational model, learning science can be a relevant context and able to transfer scientific knowledge. Only item 7 shows moderate level on a mean score of (M=3.49, SD=0.96) This is because some of students are uncertain about the implementation of science activity has given no impact to time management. The highest score is on item 10 which has a mean of (M=4.02, SD=0.90). This show that students agree that activity in STEM learning is suitable to do in grouping. Wieselmann *et al*., (2020) said that, a small group learning also can be associated with positive outcomes related to STEM achievement and motivation. According to Büyükdede & Tanel, (2019), STEM encouraged group work which has led students to discover that they can produce something new. STEM also led students to do research, provided knowledge to be permanent. Based on the data obtained, the overall mean of perception of student on STEM is (M=3.85, SD=0.68) shows that student has positive perception towards STEM.

3.3 Interest Between Gender Towards Science Subject

Table 3: Frequency distribution and mean according to students' interest against the subject of science

No	Item/ Question	N		Mean		Std Dev	
		Male	Female	Male	Female	Male	Female
14.	I love to attend Science class.						
15.	I enjoy learning Science.						
16.	Every day I must do Science exercise.	23	38	3.46	3.92	0.78	0.68
17.	Doing Science exercise make me satisfied.						
18.	I do not like to skip class.						

Independent T-test sample

Interest	Gender	N	Mean	Std Dev
	Male	23	3.46	0.78
	Female	38	3.92	0.68

	F	Sig	T-test for Equality of means		
			t	df	Sig (2-tailed)
Interest	0.660	0.42	-2.42	59	0.019
			-2.337	41.516	0.024

Result in Table 3 indicated that male student's interest towards science subject were at low level (M=3.46, SD=0.78) than female student who has a high interest in STEM (M= 3.92, SD=0.68). Previous research has found mixed evidence regarding the influence of the gender of college faculty on STEM outcomes in college. Nevertheless, when the focus of such analysis is limited to math and science college faculty, researchers obtain findings similar to our own: the gender composition of the math and science faculty is significantly associated with female students' chances of participating in STEM. This relationship is even stronger for high-skilled young women (Bottia *et al*., 2015). An independent t-test sample found this pattern to be significant,

$$t\ (41.52) = -2.34,\ p=0.019,\ p<0.05\ \text{(female)}$$
$$t\ (59.0) = -2.42,\ p=0.024,\ p<0.05\ \text{(male)}$$

Together this suggest both genders are significant to the interest in STEM subject which is in Science subject because p-value is less than 0.05 ($p< .05$). This is differed from past research (Ahmad & Lajium,2020), which show number of items of mean, standard deviation, t-test and effect size has no significant difference between interest in STEM careers according to male and female gender. According to Izzet Kurbanoglu & Arslan (2015), on the gender variable, there was no significant difference in students' educational and career interest at $p > .05$. Students' scores related to the career interest subdimensions of science and mathematics do not show a significant difference according to gender coefficient. However, their scores related to the technology career interest subdimension show a significant difference according to the gender variable ($p < .05$).

4. Conclusion

This study indicated that students was generally positive towards STEM education, thus this study suggested that other factors may contributed to low enrolment in the public universities such as entry requirement into engineering and technology subjects. The findings also indicated that awareness, perception and interest of different gender in problem solving are likely to be interested in all four STEM subject areas. In conclusion, the results of this study provide an important information in STEM education especially in Malaysia. The STEM learning environment needs to be addressed and given a more thorough study as it is able to influence students 'interest in continuing studies in STEM. Whereas, other factors are capable influencing interest in STEM careers also needs to be studied more carefully in order to address many competitive students are able to build and develop careers over time a future that is capable of making a huge impact in the daily lives of the community with scientific knowledge and technological innovation. Next, Malaysia can become a developed country and continue to produce a scientific and competitive society in the field of STEM.

Acknowledgement

The author would like to express appreciation to the Faculty of Technical and Vocational Education, University Tun Hussein Onn Malaysia.

References

Aeschlimann, B., Herzog, W., & Makarova, E. (2016). How to foster students' motivation in mathematics and science classes and promote students' STEM career choice. A study in Swiss high schools. *International Journal of Educational Research*, *79*, 31-41.

Ahmad. N, Lajium. D (2020), Learning Environment and Interest in Stem Career, *International Journal of Modern Education (IJMOE)*, Volume 2 Issue 6 (September 2020) PP. 28-49 DOI: 10.35631/IJMOE.25004

Asri (2009). The finite horizon optimal multi-modes switching problem: the viscosity solution approach. *Applied Mathematics and Optimization*, *60*(2), 213-235.

Blotnicky, K. A., Franz-Odendaal, T., French, F., & Joy, P. (2018). A study of the correlation between STEM career knowledge, mathematics self-efficacy, career interests, and career activities on the likelihood of pursuing a STEM career among middle school students. International journal of STEM education, 5(1), 22 https://doi.org/10.1186/s40594-018-0118-3.

Blueprint, M. E. (2012). Malaysia education blueprint 2013–2025. Kementerian Pelajaran Malaysia, Putrajaya.

Büyükdede, M., & Tanel, R. (2019). Effect of the STEM Activities Related to Work-Energy Topics on Academic Achievement and Prospective Teachers' Opinions on STEM Activities. *Journal of Baltic Science Education*, *18*(4), 507-518.

Bybee, R. W. (2010). What is STEM education? *Science*, *329*(5995), 996-996.

Ceylan, S., & Ozdilek, Z. (2015). Improving a sample lesson plan for secondary science courses within the STEM education. *Procedia-Social and Behavioral Sciences*, *177*, 223-228.

Chumbley, S. B., Haynes, J. C., & Stofer, K. A. (2015). A Measure of Students' Motivation to Learn Science through Agricultural STEM Emphasis. *Journal of agricultural education*, *56*(4), 107-122.

Cohen, L., Manion, L., & Morrison, K. (2011). *Research Methods in Education*, Sixth Edition, *Taylor* & Francis or Routledge's, 101-105

Fitzallen, N. (2015). STEM Education: What Does Mathematics Have to Offer?*Mathematics Education Research Group of Australasia*.

Ghandiswari. 2009. Students 'Perceptions of Scientists and Students' Understanding of Science. [online]. Prepared: http://GHANDISARIAP O50057D2009TTP-1.pdf.7 January 2013

Gordon, M., & Bergeron, L. (2015). The use of multilevel modeling and the level two residual file to explore the relationship between middle years programme student performance and diploma programme student performance. *Social science research*, *50*, 147-163.

Hayden, K., Ouyang, Y., Scinski, L., Olszewski, B., & Bielefeldt, T. (2011). Increasing student interest and attitudes in STEM: Professional development and activities to engage and inspire learners. *Contemporary issues in technology and teacher education*, *11*(1), 47-69.

Hübner, N., Wille, E., Cambria, J., Oschatz, K., Nagengast, B., & Trautwein, U. (2017). Maximizing gender equality by minimizing course choice options? Effects of obligatory coursework in math on gender differences in STEM. Journal of Educational Psychology, 109(7), 993 Retrieved from https://doi.org/10.1037/edu0000183.

Kaptan, K., & Timurlenk, O. (2012). Challenges for science education. *Procedia-Social and Behavioral Sciences*, *51*, 763-771.

Kelley, T. R., & Knowles, J. G. (2016). A conceptual framework for integrated STEM education. *International Journal of STEM education*, *3*(1), 1-11.

Klieme, E. (2016). TIMSS 2015 and PISA 2015. How are they related on thecountry level. German Institute for International Educational Research (DIPF).

Knapp, T. R., & Mueller, R. O. (2010). Reliability and validity of instruments. *The reviewer's guide to quantitative methods in the social sciences*, 337-341.

Kong, S. F., Effendi, M., & Matore, E. M. (2020). STEM approaches in teaching and learning process: Systematic Literature review (SLR). *Jurnal Pendidikan Sains Dan Matematik Malaysia*, *10*(2), 29-44.

Konting, M (2006). Sense of efficacy among beginning teachers in Sarawak. *Teaching Education*, *17*(3), 265-275.

Lee, K. S., Leung, A. N., Mayo, J. R. & Bankier, A. A. (2017). Guidelines for management of incidental pulmonary nodules detected on CT images: from the Fleischner Society 2017. *Radiology*, *284*(1), 228-243.

León, J., Núñez, J. L., & Liew, J. (2015). Self-determination and STEM education: Effects of autonomy, motivation, and self-regulated learning on high school math achievement. *Learning and Individual Differences*, *43*, 156-163.

Margot, K. C., & Kettler, T. (2019). Teachers' perception of STEM integration and education: A systematic literature review. *International Journal of STEM Education*, 6(1), 2 Retrieved from https://doi.org/10.1186/s40594-018-0151-2.

Mohtar, L. E., Halim, L., Rahman, N. A., Maat, S. M., Iksan, Z. H., & Osman, K. (2019). A model of interest in stem careers among secondary school students.Journal of Baltic Science Education,18(3), 404–416

Najib, N. U. M., & Abidin, N. Z. (2011). Student residential satisfaction in research universities. *Journal of Facilities Management*.

National Academy of Engineering (2008). Changing the conversation: Messaging for improving public understanding of engineering. Washington, DC: *The National Academies Press*.

Nordin, A., & Lin, H. L., (2011), The Relationship of Attitudes Towards Science Subjects with the Mastery of Basic Science Concepts of Form Two Students, *Journal of Science & Mathematics Educational*, Faculty of Education, Universiti Teknologi Malaysia 81310 Johor, Malaysia, Pages 89-101

Nordin, N. L. M (2019), Persepsi Pelajar Semester 1 Terhadap Pendidikan Stem Di Politeknik Ungku Omar, Ipoh. Satu Kajian, *Jurnal Kejuruteraan, Teknologi dan Sains Sosial Vol. 1 Issue 1 (Special Issue - NaCoSC'19) 37 JKTSS*. 1 Politeknik Ungku Omar

Palmer, T. A., Burke, P. F., & Aubusson, P. (2017). Why school students choose and reject science: A study of the factors that students consider when selecting subjects. *International Journal of Science Education*, 39(6), 645–662 Retrieved from https://www.tandfonline.com/doi/abs/10.1080/09500693.2017.1299949.

Potvin, P., & Hasni, A. (2014). Interest, motivation and attitude towards science and technology at K-12 levels: a systematic review of 12 years of educational research. *Studies in science education*, *50*(1), 85-129.

Shahali, E. H. M., Halim, L., Rasul, M. S., Osman, K., & Zulkifeli, M. A. (2016). STEM Learning Through Engineering Design: Impact On Middle Secondary Students' Interest Towards STEM. *EURASIA Journal of Mathematics, Science and Technology Education*, *13*(5), 1189-1211.

Shernoff, D. J., Sinha, S., Bressler, D. M., & Ginsburg, L. (2017). Assessing teacher education and professional development needs for the implementation of integrated approaches to STEM education. *International Journal of STEM Education*, *4*(1), 1-16.

Slavit, D., Nelson, T. H., & Lesseig, K. (2016). The teachers' role in developing, opening, and nurturing an inclusive STEM-focused school. *International Journal of STEM Education*, 3(1), 7 Retrieved from https://doi.org/10.1186/ s40594-016-0040-5

Välijärvi J., & Sulkunen S. (2016). Finnish school in international comparison. In H. Niemi, A., Toom, & A. Kallioniemi (Eds.) Miracle of Education (pp. 3-21). *Rotterdam, Netherlands: Sense Publishers.* https://doi.org/10.1007/978-94-6300-776-4_1

Wieselmann, J. R., Dare, E. A., Ring-Whalen, E. A., & Roehrig, G. H. (2020). "I just do what the boys tell me": Exploring small group student interactions in an integrated STEM unit. *Journal of Research in Science Teaching*, *57*(1), 112-144.

Wu, X., Deshler, J. M., & Fuller, E. (2018). The effects of different versions of a gateway STEM course on student attitudes and beliefs. International Journal of STEM Education., 5(44). https://doi.org/10.1186/s40594-018-0141-4

Yahaya, A. (2007). Mastering research in education: Theory, analysis & interpretation of data. *PTS Professional*.

Yeoh, K. K., & Mahmood, R. (2013). The relationship between pro-innovation organizational climate, leader-member exchange and innovative work behavior: A study among the knowledge workers of the knowledge intensive business services in Malaysia. *Business Management Dynamics*, *2*(8), 15-30.

Zhongming, Z., Linong, L., Xiaona, Y., Wangqiang, Z., & Wei, L. (2016). Ministry ofScience, Technology and Innovation (MOSTI), Malaysia [06-02-10-SF0195]. Retrieved from https://www.mosti.gov.my/web/en/corporate-profile/management/menteri/