HOSTED BY unisel UNIVERSITI SELANGOR

Selangor Science &Technology Review
Vol 4 No 1 (2020): Special Issue: STEM Education

The Relationship of 21st Century Skills on Students' Attitude and Perception Towards STEM

Yusman Istihat[1], Norhasbi Abdul Samad[2], Salina Rasli[3], Muhamad Ilham Khalit[1]

[1] Faculty of Engineering and Life Sciences. Universiti Selangor, 45600, Selangor, Malaysia
Email: yusman@unisel.edu.my, ilhamkhalit@unisel.edu.my
[2]Centre of Foundation and General Studies, Universiti Selangor, 45600, Selangor, Malaysia
Email: norhasbi@unisel.edu.my
[3]Faculty of Business and Accountancy, Universiti Selangor, 45000, Selangor, Malaysia
Email: rsalina@unisel.edu.my

Abstract: Science related courses, such as Science, Technology, Engineering and Mathematics (STEM) offered in secondary schools in Malaysia, have a low number of takers among Malaysian students. Therefore, this study is aimed to investigate the interest in STEM among Malaysian secondary school students. This research analyses the role of 21st Century skills on student's attitudes towards STEM. The samples in this study consist of 110 secondary students in Selangor. The Problem Based Learning and quantitative approaches are used to analyse the data. The results from regression analysis show that there is an only significant effect on 21st-century skills on student's attitudes towards Engineering and Technology compared to Science and Mathematics. Meanwhile, the Pearson Coefficient Correlation analysis shows that there is a negative correlation on 21st-century skills on students' perceptions towards the teacher's attitude in Mathematics. Therefore, the involvement of the private and government bodies is crucial to help implement and develop related policies and act as an agent to promote STEM.

Keywords:; Attitude, Motorized glider, Perception, STEM, 21st Century skills;

1. Introduction

Nowadays Malaysian student has shown a low number of taking science stream such as Science, Technology, Engineering and Mathematics (STEM) in secondary school. The Ministry of Education Malaysia introduces STEM education plan in a more comprehensive manner with the objective of the Malaysian aspirations to be a fully developed and industrialized nation. There are various strategies to strengthen the subjects in Science, Technology, Engineering and Mathematics (STEM) stated in The National Education Blueprint 2013-2025 (PPPM 2013-2025). Consequently, the formulation of the Standard Secondary School Curriculum (SSSC) has comprehensively described STEM as part of the school curriculum design.

Anjarwati, Sajidan & Prayitno (2018) had proposed the development module based on Problem-based Learning activities could motivate students in solving and identifying the problems. As a result, this method would encourage students to have creative thinking and imaginative ideas. Social Cognitive Career Theory (SCCT) indicated that attitude towards STEM is one of the important elements in nurturing the interest of the student in STEM (Razali, Talib, Manaf, & Hassan, 2018). In addition, Karahan and Roehrig (2017); Saxton et al. (2014); Meng, Idris, Eu and Daud (2013) highlighted that a positive attitude towards STEM must be carried out during the secondary school because the students realized the advantages of learning science curriculum that benefit the student's future need.

The purpose of this study is to analyze the relationship between 21st Century Skills on students' attitudes towards STEM and to examine the 21st-century skills on students' perceptions towards the teacher's attitude in STEM.

2. Methodology

The research methodology in this study involves a project-based and quantitative approach. The study was conducted among students in Form 4 and 5 from 20 schools from four districts in Selangor namely Kuala Selangor, Petaling, Klang, and Sabak Bernam. The students involved in the tournament held under UNISEL Eagle R/C Club (UERC) are responsible to design and create small scale motorized glider. The gilder was designed in an aerodynamic and this design made the glider fly easily without using the assistance of motor at a certain high level. After completing the tournament, the questionnaires were distributed to 150 students but only 110 questionnaires can be used for data analysis. Basically, the questionnaire asked about their attitude towards STEM that the students in representing their school. Fig. 1 below shows the Flow Chart of Research Activities.

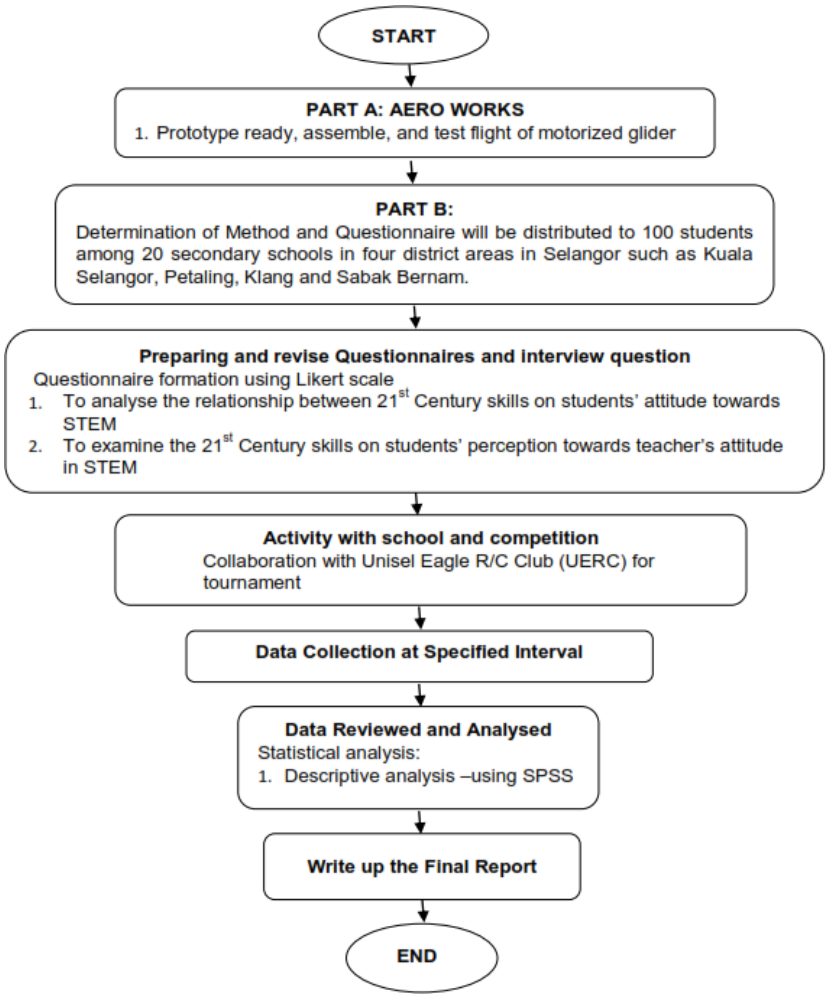

Fig. 1: Flow Chart of Research Activities

2.1 PART A

The processing flow chart shown below is about, the ways to design and analyze the motorized glider. Different tasks can be summarized using the flow chart that can help me to understand and accomplish the task in the correct way where the initial task can be completed

step by step to the final task with to obtain insight and understanding of the real product or to establish design information for the real products. The order of the project methodology is illustrated in schematic diagram that has been shown in Fig. 2.

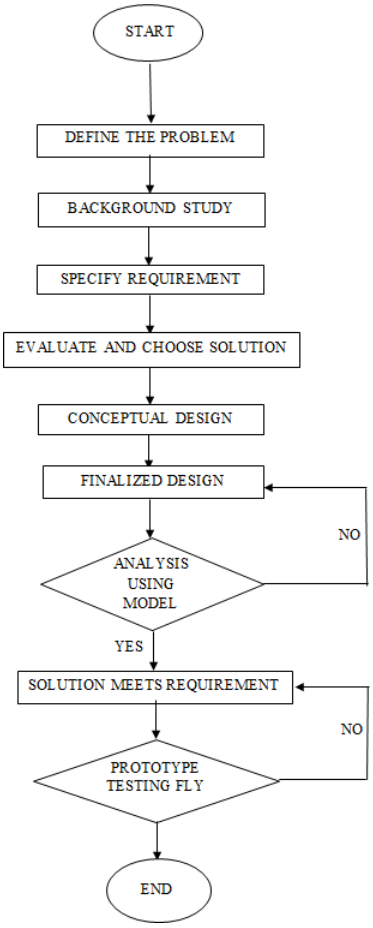

Fig. 2: Methodology Flow Chart for Glider Design

A glider is a heavier-than-air aircraft that is supported in flight by the dynamic reaction of the air against its lifting surfaces, and whose free flight does not depend on an engine. This type of aircraft only uses a control surface to control the flight at a certain height from the ground that is called as a glider. Selecting the material, white form board, hip foam board and recycle materials. Other than that, choosing a suitable radio control system for gliders such as 4 or 5 channel transmitters and receiver to control the flight using the control surface of the glider. Hence, by selecting the suitable materials of aerofoil, rudder, and elevator for the motorized glider it will make it work in good condition.

To design, analyse and fabricate a motorized glider. Therefore, to establish an Aerodynamics helps the Glider fly at the certain height from the ground. Designing the model of glider is using CATIA V5 software and to analyse it using ANSYS software. Move over, to fabricate the prototype of the motorized glider that has been design in CATIA V5. Thus, use the material that has been mention in specify requirement such as white form board, hip form board and some recycle parts as gift card and aero carbon shaft to build up the model of the motorized glider.

2.2 PART B

The School Glider Competition was held at UNISEL Sports Centre on Saturday, 17th of March, 2019, in conjunction with UNISEL Open Day 4.0. The invitation to the selected schools in the districts of Kuala Selangor, Petaling, Klang, and Sabak Bernam, was made via emails and phone calls. Each school was requested to send a team that consisted of five (5) students, and two (2) accompanying teachers as shown in Fig. 3. With the theme of "Sport and Culture", fun and innovative games were designed based on the students' creativity. This event was also part of the promotional strategy to disseminate information about UNISEL to the public.

On the Day of the event, the Master of Ceremony welcomed two contesting schools, SMK Bagan Terap that was represented by 2 girl teams, and SMK Sungai Besar that also sent two teams of mixed sexes. All the contestants were required to complete a survey form.

Fig. 3: Participants from various schools taking their foods

The method of judging was managed by one score form with three (3) judges (2 internal and 1 external). Two (2) internal judges were from UNISEL, Mr Yusman and Mdm Arni, and Pak Toha who is a senior member of RC Club had been appointed as an external judge. Before the game started, Mr Yusman presented a speech about UNISEL, the basic aerodynamics theory, and the rules and regulations of the event as shown in Fig. 4. The judging method was based on two areas; Beauty Category (Design – measurement, Aesthetic – art and Ergonomic – user-friendly), and the functions of the glider. Three (3) times of trial throwing should be enough for them to start. Fig. 5 showed a throw session by students during the trial session. The competition had motivated the contestants to use the opportunity given to create more models. Fig. 6 shows the judges collecting marks and insert in the form.

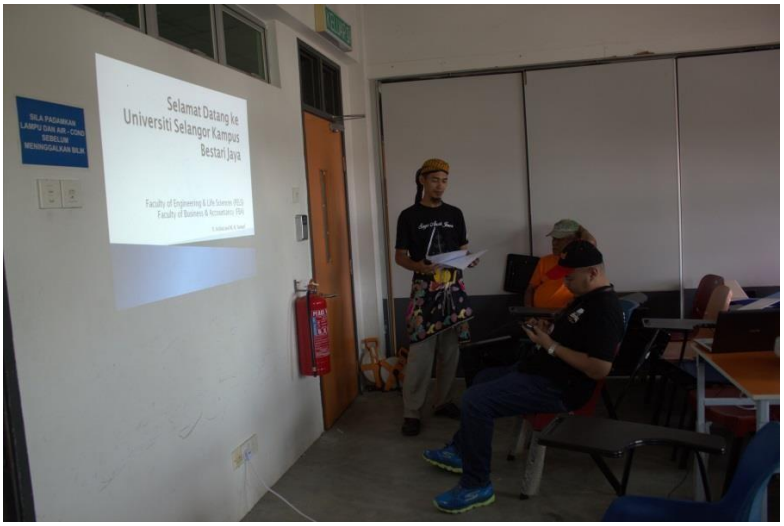

Fig. 4: Introduction and presentation by Mr Yusman

Fig. 5: Students from SMK Bagan Terap and SMK Sungai Besar showed their talent in throwing glider

Fig. 6: Pak Toha as a Chief Judge discussed the marks.

The event was successfully managed with the help of students. Fig. 7 shows students from Engineering and Science & Biotechnology Departments who were the members of the UNISEL Eagle RC Club. Fig. 8 shows the questionnaire filling form session and 25 sets of survey forms had been collected during this event. To complete all 150 respondents in this research, researchers also visit the listed school which cannot come due to their constraints.

Fig. 7: UERC club members are preparing certificates for participants

Fig. 8: Survey form filling session

A descriptive analysis was carried out by using SPSS. All surveyed data were key-in in the system and statistical results were obtained. The reliability test was conducted by using Cronbach's Alpha and a value of more than 0.60 indicates that the questionnaire is reliable and valid. Table 1 presents the results that all the variables are reliable with more than 0.60 such as 21st Century Skills (0.883), student attitude towards Mathematics (0.683), Science (0.865), Engineering and Technology (0.916).

Table 1: Reliability Test using Cronbach's Alpha for the construct

No	Construct	No of items	Cronbach's Alpha
1.	Students Attitude towards Maths	9	0.683
2.	Students Attitude towards Science	10	0.865
3.	Students Attitude towards Engineering and Technology	10	0.916
4.	21st Century Skills	11	0.883
		40	

To determine the relationship between the dependent variables (21st Century Skills) and the independent variable (students' attitude towards STEM), multiple linear regression techniques were utilized. This technique of analysis analyses the relationship between the dependent variables and its predictor based on the ordinary least square method. Finally, Pearson Correlation is used to measure the strength of the relationship between two variables is at medium level as defined by Alias (1997). Pearson Correlation coefficient applied in this study to measure the relationship of 21st-century skills on students' perceptions towards the teacher's attitude in STEM.

3. Results and Discussion

To measure the relationship between the dependent and independent variables, multiple linear regression was utilized. Based on Table 2 the model depicted as below:

$$21^{st} \text{ century skills} = 3.431 - 0.105(\text{Maths}) + 0.100(\text{Science}) + 0.259(\text{Engineering Technology})$$

It shows that as an increase in 1 unit in Mathematics variable the 21st-century skill will decrease about 0.105 scores on average. Science, engineering, and technology are remained fixed. The table below shows the regression model developed.

Table 2: The relationship of 21st Century Skills on student attitude on ST

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.431	.448		7.662	**.000**
	IV_Maths	-.105	.077	-.121	-1.369	**.174**
	IV_Science	.100	.075	.129	1.337	**.184**
	IV_EngineTech	.259	.066	.381	3.901	**.000**

a. Dependent Variable: DV

The result from the analysis shows that the student attitude on engineering and technology (p-value = 0.000) has only a significance effect on 21st Century Skills among student compared to student attitude towards mathematics and science.

Table 3: The relationship of 21st Century Skills on student's perception towards teacher's attitude in STEM

Correlations

		My teacher increases my interest in math.	My teacher increases my interest in science.	My teacher increases my interest in computer.	DV
My teacher increases my interest in math.	Pearson Correlation	1	-.151	-.259**	-.263**
	Sig. (2-tailed)		.116	.006	.006
	N	110	110	110	108
My teacher increases my interest in science.	Pearson Correlation	-.151	1	.371**	.363**
	Sig. (2-tailed)	.116		.000	.000
	N	110	110	110	108
My teacher increases my interest in computer.	Pearson Correlation	-.259**	.371**	1	.350**
	Sig. (2-tailed)	.006	.000		.000
	N	110	110	110	108
DV	**Pearson Correlation**	**-.263****	**.363****	**.350****	**1**
	Sig. (2-tailed)	.006	.000	.000	
	N	108	108	108	108

**. Correlation is significant at the 0.01 level (2-tailed).

Based on Table 3, the result revealed that there is a significant (p-value = 0.006) negative correlation (r = -0.263) between 21st-century skills on student's perceptions towards teachers' attitudes in mathematics. However, there is a significant (p-value = 0.000) positive correlation (r = 0.363) between 21st-century skills and teacher's attitudes in science. Meanwhile, there is a significant (p-value = 0.000) positive correlation (r = 0.350) between 21st-century skills and teacher's attitudes in engineering and technology at a 1% level of significance.

In conclusion, when an increase in teachers' attitudes towards science, engineering, and technology, student's perception of 21st-century skills will be increasing. However, students' perception of teachers' attitudes in mathematics is different. Even though teachers who have an interest in teaching mathematics, but students have not performed in mathematics' problem-solving.

4. Conclusion

Based on this research it is found that the Problem-Based Learning module of the development model of motorized glider is one of the alternative ways to improve the skills of creative thinking of students. Teachers can engage students in integrated STEM education using technology and engineering design problems (Bartholomew, 2017). Gliders "Tumblewing" are easy-to-make paper gliders that can challenge, excite and engage students. As students emphasize science and engineering practices while completing a challenge to tumblewing design, they will engage in both scientific inquiry and engineering design process. It was determined in the study of Popa and Ciascai (2017) that the students who participated in the research had been interested in the field of STEM since their secondary and high school education and developed positive attitudes towards gaining engineering knowledge and skills and in relation to engineering. In the study conducted on teacher candidates by Ozcakir, Sumen, and Caliser (2016), it was identified during the interviews that they assess STEM education as efficient, pleasant and enhancing the permanence of the knowledge. Therefore, teachers play an important role to improve students' creative thinking skills with problem-solving activities as needed to promote students in the STEM field.

Besides that, the development of appropriate policies, and the involvement of industries such as from private and government agencies should take into consideration as an agent to promote STEM.

5. Acknowledgements

The researchers would like to convey their gratitude to the University Selangor (UNISEL) for granting the precious opportunity to engage with this fascinating research, particularly in providing a specific grant (GPB/02-UNISEL18/SS-020) as the financial support throughout the research period and sponsoring this paper for this conference.

6. References

Anjarwati, P. G. P., Sajidan, & Prayitno, B. A. (2018). Problem-Based Learning Module of Environmental Changes to Enhance Students' Creative Thinking Skill. Biosaintifika: *Journal of Biology & Biology Education, 10*(2), 313-319

Bartholomew, S. (2017). Integrated STEM through tumblewing gliders. K-12 STEM Education, 3(1), 157-166.

Karahan, E., & Roehrig, G. (2017). Secondary school students' understanding of science and their socioscientific reasoning. *Research in Science Education, 47*(4), 755-782.

Meng, C. C., Idris, N., Eu, L. K., & Daud, M. F. (2013). Secondary School Assessment Practices in Science, Technology, Engineering and Mathematics (STEM) Related Subjects. *Journal of Mathematics Education, 6*(2), 58–69.

Ozcakır Sumen, O. & Calisici, H. 2016. Pre-service teachers' mind maps and opinions on STEM education implemented in an environmental literacy course. *Kuram ve Uygulamada Egitim Bilimleri, 16*(2): 459–476.

Popa, R. A., & Ciascai, L. (2017). Students' Attitude towards STEM Education. *Acta Didactica Napocensia, 10*(4), 55-62.

Razali, F., Talib, O., Manaf, U. K. A., & Hassan, S. A. (2018). Students Attitude towards Science, Technology, Engineering and Mathematics in Developing Career Aspiration. *International Journal of Academic Research in Business and Social Sciences, 8*(5), 962-976.

Saxton, E., Burns, R., Holveck, S., Kelley, S., Prince, D., Rigelman, N., & Skinner, E. A. (2014). A common measurement system for K-12 STEM education: Adopting an educational evaluation methodology that elevates theoretical foundations and systems thinking. *Studies in Educational Evaluation, 40*, 18-35.