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The Impacts of Aeromech Project Based-Learning on Students' Achievements

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Abstract
This study examines the effectiveness of an Aeromech project-based learning which integrates aero physics, mechanics and mathematics in circular measure topic to improve students' achievement. The students' achievement towards Aeromech is compared by gender and the interaction effect between groups and gender were studied. The instrument used in this research is Achievement Towards Aeromech Skills Test (ATAST). This quasi-experimental research involved two groups of 62 upper secondary school students. The two-way ANOVA analysis showed that the effectiveness between groups on the post ATAST mean score is significant. The effectiveness of achievement towards ATAST on gender is not significant. This analysis also showed that the interaction effect between groups and gender is not significant.
Keywords: Project-based Learning, Aeromech, Gender, STEM, ATAST.

Introduction
Many research showed that the project-based learning (PBL) approach can be utilized to help the students to solve real-world problems and to encourage students in exploring Science, Technology, Engineering and Mathematics (STEM) meaningfully. A PBL activity is more interactive because it contains some authentic contextual activities and experience which forms the basis of an achievement in STEM subjects (Hans, 2015). The STEM-PBL is a student-centered pedagogy and is a 'heavy assignment but produces useful output' for students because the combination of pedagogy and technology that builds strong knowledge and basic mathematical knowledge (Marino, Black, Hayes & Beecher, 2010). Scholars believed STEM-PBL activities had developed students' understanding of science and mathematical knowledge and deepens the understanding across curricula in terms of principles, concepts and skills in engineering and technology (Capraro & Nite, 2014).

Past literature has shown positive effect of STEM-PBL on students attitudes towards the STEM field and had improved academic achievement in mathematics (Han, Rosli, Capraro, Capraro, 2016). However, limited studies were conducted on

how the integration of a STEM-PBL activities with the aid of information technology positively affects the academic achievement in specific contents. Therefore, the objective of this study is to identify how the STEM-PBL base Aeromech project based-learning in circular measure topic has an impact on students' achievement in mathematics, aero physics and mechanics.

Methodology

Research Design

This research uses quasi-experimental design to compare the effectiveness of Aeromech project-based learning (experiment group, EG) and non Aeromech approach (control group, CG) on students' achievement towards circular measure topic.

Instrument

This research is conducted using a survey questionnaire. The questionnaire is Achievement Towards Aeromech Skills Test (ATAST). This questionnaire was used before and after the treatment. The Cronbach's alpha reliability for the questionnaire is 0.87.

Sample

This research is conducted in a National Secondary School (NSS) in Malaysia. A class was selected fo experiment group (EG), while another class was engaged for conventional approach (control group, CG). Overall, this study involved a total of 62 participants with 30 in CG and 32 in EG.

Data Analysis

The data was analyzed using descriptive and inference statistic. Descriptive data was discussed by using mean, standard deviation and frequency. While inferential data was discussed by using two-way ANOVA.

Procedure

The teacher who involved in this project was given lesson plans for three weeks by the researcher. The selected month is January 2019, because that was right time where no exams are conducted. At the end of the Aeromech project, students will be master facts in circular measure topic in additional mathematics, basic facts in aero physics and mechanics and STEM skills based 21 st Century Education. Usually the project would run for 2 to 3 days a week. If the students do not have enough time in the class, they will continue outside of the school. Whereas CG will be taught by same teacher on circular measure topic without Aeromech project. At the end, both EG and CG will be assess with ATAST.

Research Results

Table 1 shows that the post mean score of achievement in ATAST (M = 4.37, SD = 0.76) is higher than the pre mean score achievement in ATAST (M = 3.70, SD = 1.14). Descriptive result shows that the pre mean score of the EG (M = 3.39, SD = 1.14) is higher than the mean score CG (M = 3.31, SD = 1.15). For gender, the pre mean score

of male (M = 3.42, SD = 1.21) is higher than female (M= 3.33, SD = 1.07). In CG, the pre mean score of male (M = 3.61, SD = 1.12) is higher than female (M = 3.52, SD = 1.08). In EG, the pre mean score of female (M =3.59, SD = 1.17) is higher than male (M = 3.48, SD = 1.16). In the post mean score of EG (M = 4.39, SD = 0.74) is higher than the CG (M= 4.10, SD = 0.71). In the post mean score between gender, the male (M = 4.38, SD = 0.69) is higher than the female mean score (M = 4.20, SD = 0.57). Among gender in the post mean score for male participants in the CG, the mean score of (M = 4.12, SD = 0.48) is higher than female participants (M = 4.08, SD = 0.65). While the post mean score among gender in EG, the mean score of female (M = 4.37, SD = 0.70) is higher than the male (M = 4.21, SD = 0.54).

Table 1. Descriptive statistics pre and post survey ATAST mean score for group and gender

ATAST	Group	Gender	M	SD	N
Pre	Control	Male	3.61	1.12	14
		Female	3.52	1.08	16
		Total	3.31	1.15	30
	Experiment	Male	3.48	1.17	16
		Female	3.59	1.12	16
		Total	3.39	1.14	32
	Total	Male	3.42	1.21	30
		Female	3.33	1.07	32
		Total	3.70	1.14	62

ATAST	Group	Gender	M	SD	N
Post	Control	Male	4.12	0.48	14
		Female	4.08	0.65	16
		Total	4.10	0.71	30
	Experiment	Male	4.21	0.54	16
		Female	4.37	0.79	16
		Total	4.39	0.74	32
	Total	Male	4.38	0.69	30
		Female	4.20	0.57	32
		Total	4.37	0.76	62

Table 2 shows two-way ANOVA analysis of the main effects and interaction effects on students' achievement towards Aeromech project for circular measure topic. The main effect of the group on the overall ATAST score was significant, $F_{(1,62)} = 1.204$, P = 0.041. The results of the two-way ANOVA analysis were also used to find interaction effect between group and gender based on overall score of ATAST. Interaction effect between gender is not significant, $F_{(1,62)} = 0.036$, P = 0.689. Furthermore interaction effect between gender and group also not significant, $F_{(1,62)} = 0.234$, P = 0.611.

Table 2. Two-way ANOVA Analysis for Group and Gender

Resources	Sum of squares	df	Mean Square	F	P
Group	0.594	1	0.594	1.204	0.041
Gender	0.013	1	0.013	0.036	0.689
Group*Gender	0.079	1	0.079	0.234	0.611
P < 0.05					

Discussion

Overall descriptive results shows that the post mean score of EG is higher than CG. This shows that achievement of students' towards Aeromech project is better compared to conventional approach. Between the groups, EG performed better than CG in both pre and post mean score. Between the gender male performed better in both pre and post, mean score. Even though descriptive results shows increases among parameters, but when we analyze using two-way ANOVA, only interaction effect between groups are significant. Interaction effect between genders is not significant. Furthermore interaction effect between gender and groups not significant.

Conclusion

This results indicates that STEM PBL activities in Aeromech project are affect students' knowledge positively to circular measure topic. When solving a classroom project in groups, students show interest and excitement that eventually can enhance their creative thinking and critical thinking skills (Capraro, Capraro & Morgan, 2013). The group activities in Aeromech project were developed various positive attitudes and reduce anxiety towards aero physics, mechanics and mathematics. At present STEM education has become part of the school curriculum especially in Malaysia, thus, many PBL activities based on engineering and technology applications have been designed and implemented by teachers to engage students in learning. Aeromech activities based on engineering provide students with real-world contexts, promote interest, improve student's problem solving and communication skills. This allows students to arouse their curiosity and critical thinking skills while engaging in scientific inquiry through doing and learning. The overall implications of the results on STEM PBL on Aeromech project has greater impact on students' learning compare to non STEM PBL group.

Acknowledgements

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References

Capraro, R. M., Capraro, M. M., & Morgan, J. R. (Eds.). (2013). *STEM project-based learning: An integrated science, technology, engineering, and mathematics (STEM) approach*. Rotterdam, The Netherlands: Sense

Capraro, M. M., & Nite, S. B. (2014). STEM integration in mathematics standards. *Middle Grades Research Journal*, 9(3),1.

Han, S. (2015). *Korean students' attitude toward STEM project based learning and major selection*. Paper presented at the 2015 Joint Conference of Korean Mathematics Societies, Seoul, Korea

Marino, M. T., Black, A. C., Hayes, M. T., & Beecher, C. C. (2010). An analysis of factors that affect struggling readers' achievement during a technology-enhanced STEM astronomy curriculum. *Journal of Special Education Technology*, 25(3), 35.