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The Effect of Theoretical University Courses Towards Practical Work Result Based on Learning Motivation

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ABSTRACT

PLN Tertiary Education of Engineering is one of universities that focused on energy and electricity. The type of courses offered in Electrical Engineering major are theoretical courses and practical courses. One of the courses that consist both theoretical and practical courses is Electrical Measurement (EM). PLN Tertiary Education of Engineering suggested that students should apply for theoretical course before starting any practical course, or to take both courses in the same semester. However, there are still students who applied for practical courses before finishing theoretical course. Is there any correlation between theoretical and practical courses, as well as connection between Learning Motivation and Practical Course?. This research is conducted using Two-Way Analysis of Variance (*two-way ANOVA*) with factorial design of 2x2, and further testing using Tukey's Range Test using the data of 2018 students' results who are applying for practical courses with prior theoretical course participation and those without any prior theoretical course participation. Step 1: Data collection; Step 2: Requirement analysis test (normality and homogeneity); Step 3: Validity and Reliability test using learning motivation questionnaires; Step 4: Two-way ANOVA; Step 5: Tukey's Range Test. Interaction found between EM course and student's learning motivation towards the result of their EM practical work. This is evident from $F_h = 16{,}66$ and $F_t = 4{,}04$ at $\alpha = 0{,}05$ with $F_h > F_t$ which means H_1 is accepted. Therefore, there is an impact between theoretical courses towards practical courses.
Keyword: *Two-Way ANOVA, Tukey Test, Analysis of Variance, Factorial Design of 2x2*

INTRODUCTION

PLN Tertiary Education of Engineering is one of universities that focused on energy and electricity. This title is represented by the majors offered in PLN Tertiary Education of Engineering, one of them is Electrical Engineering. To achieve the institutional vision and mission, PLN Tertiary Education of Engineering needs to fulfill the entirety of curriculum based on energy and electricity, which through the courses that applied by the students. The type of courses offered in Electrical Engineering major are theoretical courses and practical courses. Aside from applying to adequate courses, students also need to have high motivation to learn so they could compete in and outside the campus.

One of the courses that consist both theoretical and practical courses is Electrical Measurement (EM). This course is offered to the students starting from the third semester. Before applying for practical course, students are recommended to apply theoretical course first, or both courses in the same semester. This aims to equip the students with basic knowledge of the practical courses they will apply to.

PLN Tertiary Education of Engineering suggested that students should apply for theoretical course before starting any practical course, or to take both courses in the same semester.

However, there are still students who applied for practical courses before finishing theoretical course. In this research, we set out to determine any correlation between theoretical and practical courses, as well as connection between Learning Motivation and Practical Course (Yawalikar, 2017; Nursofah,2018).

METHOD

Statistical Analysis

This research is designed using experimental research, which is 2x2 factorial design as a form to determine the treatment.

Table 1. Experimental Research Design

Student Learning Motivation (B0)	EM Practical Work (A0)		$\sum\beta$
	With Prior Theoretical Course Participation (A1)	Without Prior Theoretical Course Participation (A2)	
High (B_1)	A_1B_1	A_2B_1	A_0B_1
Low (B_2)	A_1B_2	A_2B_2	A_0B_2
$\sum$k	A_1B_0	A_2B_0	A_0B_0

The instruments used in this research are the result of Electrical Measurement (EM) practical work gained from students with prior theoretical course participation or without prior theoretical course participation, as well as the student learning motivation. The instrument of student learning motivation represented in a fom of questionnaires which consist of questions about learning motivation with four choices for each question. This instrument is used to classify the students into students with high learning motivation and students with low learning motivation. Before conducting the research, we carried out validity and reliability test towards learning motivation instrument that would be used later during research. For validity test, we use *Point-Biserial Correlation formula.*

$$r_{bis(i)} = \frac{\bar{X}i - \bar{X}t}{S_t}\sqrt{\frac{p_i}{q_i}} \quad (1)$$

Annotation:

$r_{bis(i)}$ = Biserial correlation coefficient item score with total score
$\bar{X}i$ = Mean for total score of respondent
$\bar{X}t$ = Mean for total score of all respondents
S_t = Standard deviation for total score of all respondents
p_i = Proportion of correct answers for item question number i
q_i = Proportion of incorrect answers for item question number i

This formula would determine the validity of one question item with comparing between r_{item} and r_{table} using 0,05 significant level. If $r_{item} > r_{table}$, the item is considered valid or accepted. And if $r_{item} \leq r_{table}$, the item is considered invalid or rejected. After conducting validity test, we carried on reliability test so that learning motivation instrument could be generalized. In reliability test, we used Kuder-Richardson Formula 20, as follows:

$$r_{\Pi k} = \frac{k}{k-1}\left[1 - \frac{\sum pq}{S_t^{\,2}}\right] \quad (2)$$

Annotation:
r_{kk} = Reliability coefficient
k = Amount of valid items
Σpq = Amount of variants in item score
St^2 = Variants of total score

Research Flowchart

The framework on the research is as follow:

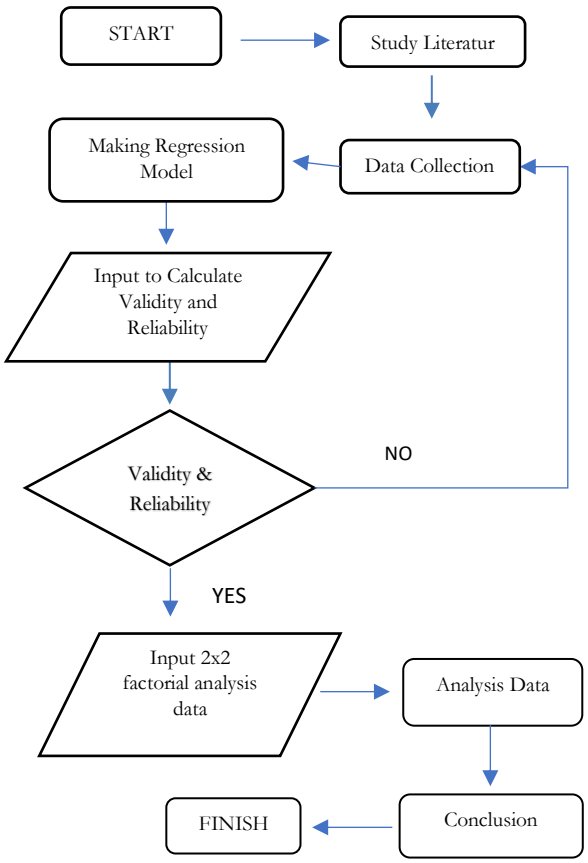

Image 1. Research Flowchart

RESULT AND DISCUSSION

Data gained during the research were analyzed using Two-Way ANOVA with 2x2 factorial design. Before conducting data analysis, we performed requirement analysis test beforehand, which are normality and homogeneity tests towards both groups. While performing normality test, we were using significant level of $\alpha = 0{,}05$ with criteria: if $L_{table} > L_{calculation}$ then the data is normal. After conducting normality test, we performed further testing, which is homogeneity test using Bartlett's test. If the significant value gained > 0,05 then the sample was from the data with homogenous variant.

Table 2. Description of Research Result Data

Student Learning Motivation (B0)	EM Practical Work (A0)		$\sum\beta$
	With Prior Theoretical Course Participation (A1)	Without Prior Theoretical Course Participation (A2)	
Tinggi (B1)	89,46	69,69	9,58
Rendah (B2)	66,85	58,62	2,73
$\sum$k	78,15	64,15	1,15

The result of this research based on hypothetical testing showed that the entire hypothesis is accepted; therefore EM theoretical course affecting the result of EM practical work can be concluded as follow:

1. The result of EM practical work of the students with prior theoretical course participation are higher than those without prior theoretical course participation.
   This is proven by F_h = 142,04 and F_t = 4,04 at α = 0,05 with $F_h > F_t$ which means H_1 is accepted.
2. Interaction is occurred between EM theoretical course and students learning motivation towards the result of EM practical work. This is proven by F_h = 16,66 and F_t = 4,04 at α = 0,05 with $F_h > F_t$ which means H_1 is accepted.
3. In group of students who have high learning motivation, those with prior theoretical course participation gain higher result compared to those without prior theoretical course participation. This is proven by F_h = 14,02 and F_t = 4,04 at α = 0,05 with $F_h > F_t$ which means H_1 is accepted.
4. In group of students who have low learning motivation, those with prior theoretical course participation gain higher result compared to those without prior theoretical course participation. This is proven by F_h = 66,85 and F_t = 4,04 at α = 0,05 with $F_h > F_t$ which means H_1 is accepted.

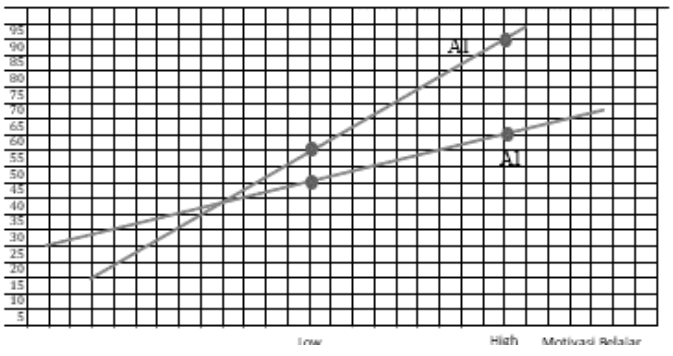

Image 2. Interaction between EM theoretical course and students learning motivation towards the result of EM practical work

If there were an interaction occurred between students learning motivation with the result of students' EM practical work, therefore testing would be conducted further using Tukey's Range Test.

Table 3. summary of the Tukey Test

No	Compared Groups	Qcalculation	Qtable	Conclusion
			0.05	
1	A1B1 with A2B1	14.02	4.15	Significant
2	A1B2 with A2B2	5.84	4.15	Significant

Based on Tukey's Range Test, the result could be concluded as follow:

a. From Tukey's Range Test we gain result of value $Q_{calulation} = 14,02$ and $Q_{table} = 4,15$ therefore $Q_{calculation} > Q_{table} = 4,15$. This proves that a significant discrepancy has occurred. Therefore, H_0 is rejected and H_1 is accepted. Then, it can be stated that students with high learning motivation and with prior EM theoretical course participation are different from students with high learning motivation and without prior EM theoretical course participation. Looking at the result of the analysis, it shows that mean of EM practical work result, for students with high learning motivation and with prior EM theoretical course participation to be 89.46, however mean of EM practical work result, for students with high learning motivation but without prior EM theoretical course participation is 69,69. Therefore, students with high learning motivation and with prior EM theoretical course participation have higher results compared to those without prior EM theoretical course participation.
b. From Tukey's Range Test we gain result of value $Q_{calculation} = 5,84$ dan $Q_{table} = 4,15$ therefore $Q_{calculation} > Q_{table} = 4,15$. This proves that a significant discrepancy has occurred. Therefore, H_0 is rejected and H_1 is accepted. Then, it can be stated that students with low learning motivation and with prior EM theoretical course participation are different from students with low learning motivation and without prior EM theoretical course participation. Looking at the result of the analysis, it shows that mean of EM practical work result, for students with low learning motivation and with prior EM theoretical course participation to be 66,85, however mean of EM practical work result, for students with low learning motivation but without prior EM theoretical course participation is 58,62. Therefore, students with low learning motivation and with prior EM theoretical course participation have higher results compared to those without prior EM theoretical course participation.

CONCLUSION

There was and effect between theoretical course towards practical course, as well as an interaction was found between learning motivation with practical course. As this research is conducted, we would like to believe that students will be wiser on deciding which course to choose, also to give more input for the institutions to limit students who will apply to practical course with no prior theoretical knowledge.

In the end, the writer experienced shortage and deficit of data while constructing this experiments, especially the difficulties to collect data on students who have and have not applied to theoretical and practical courses.

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