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TEACHING MATHEMATICS IN TECHNICAL VOCATIONAL EDUCATION (TVET)

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ABSTRACT

Mathematics plays an important role to improve students' skills in Technical Vocational Education and Training (TVET). However, most of students at PTKI Medan have perceived the difficulties in accepting mathematics knowledge. All of the topics included were difficult to implement in their working lives. It means that in the process of learning mathematics, lecturers were less related the content to real life vocational education itself. So that, this paper aims to find out: 1). Does teaching mathematics contextually could positively impact for TVET students?, and 2). How significant the contextual method, based on the students' achievement, have a positive impact in the process of learning Mathematics in TVET? The data that used in this study were primary data that obtained from the students' final score, after all of the process of learning finished. The number of samples was 50 students that divided into two groups, including group experiment and class control. The analysis method used was descriptive statistics and independent samples t-test analysis by SPSS program. The result showed that the data distribution of experimental class more homogeny than control class. It means that, mean value of the experimental class will be more representative than the other class. This was as a positive impact for students. The knowledge was transferred evenly to all students. By looking at the significant value of Levene's Test (0.878 > 0.05), it found that the groups of data have the equality of variance. The final analysis result showed t-count value > t table value (5.755 > 2.01), by the significance value < 0.05. It means that there was a significant difference in the mean values between experiment and control classes.

***Key Words**: TVET, PTKI Medan, Contextual Mathematics*

INTRODUCTION

In the era of globalization and openness, many changes happened among various aspects of society. Disclosure of information and a variety of resources can flow freely from one country to another. It indicates that there will be a competition between nations to compete each other. Thus, in terms of being a valuable and relevant to the modern era, many countries are vying to increase their competitiveness. In fact, BNSP (2010) state that, the competitiveness of a country is no longer lies on the natural resources, but it also depends considerably on the human resources. It means that, the competitiveness of a country is depending on how good its human resources with all of their knowledge and competencies, could be able to make their country won the competition with other countries. In order to increase the quality of human resources, a country is believed should have an appropriate educational system, whether formal, or informal, that can make its citizens compete steadily among others.

Based on those facts above, many counties around the world, including Indonesia, have developed their national education system based on knowledge, skills and/or competences which are required in particular occupations, and later it is well known as Vocational Education system. The process of learning among technical vocational education and training system, in terms of delivering knowledge from lectures to students, are different. The learning procedure in TVET system is based on the rules of modern era. The rules are including competitiveness and full of skills that related to particular occupations. It means that, after joining TVET institutions, graduators are wished to have specific competitive skills which can be useful in particular jobs. Wagner (2008) in his book "The Global Achievement Gap" has written seven skills that can be useful to survive in the modern era, including: 1). Critical Thinking and Problem Solving, 2). Collaboration across Networks and Leading by Influence, 3). Agility and Adaptability, 4). Initiative and Entrepreneurialism, 5). Effective Oral and Written Communication, 6). Accessing and Analyzing Information, and 7). Curiosity and Imagination.

All of those skills will be able achieved by TVET students when their achievement in mathematics quite well. The reason is, it is believed that Mathematics plays an important role to produces those skills that is written by Wagner, as Ostrogradsky (in Maron, 2016) said, "the mission of teaching mathematics in special educational institutions is to give

knowledge necessary for studying of professional disciplines, and develop the mindset and mental skills of students". Moreover, Maron (2016) also stated, most of studies found that the nature of mathematics is to provide knowledge and learn to think. It means that, the student who could be able to get good result in mathematics will survive properly in the modern era. Accordingly, based on our opinion, the curriculum and the teaching methods of Mathematics should be well prepared, especially for vocational education. This aims to provide knowledge and critical thinking skill for students.

However, based on interview among the students where the authors take a sample (at PTKI Medan), seven of ten students perceive a negative statement about mathematics subject. The students find the difficulties to understand mathematics. The reason that most widely expressed by those students is they do not understand the usefulness of mathematics in the Institutional specification context, and lack of the basic mathematics concept. This situation indicates that, the students are difficult to receive the knowledge that transferred by the mathematics lecture. This situation will have consequences to the students in terms of their achievement in mathematics.

Therefore, through this study, the authors will find out the impact of teaching mathematics more contextual for TVET students.

Based on those opinions above, there will be a research questions:

1. Does teaching mathematics contextually could positively impact for TVET students?
2. How significant the contextual method, based on the students' achievement, have a positive impact in the process of learning Mathematics in TVET?

METHODS

This study is the quasi-experimental research by using the quantitative approach and unstructured interviews with the students. The population of this study was first grade students of Agribusiness Palm Oil at PTKI Medan, with the number of 200 students. Sampling technique in this research using a formula as stated by Arikunto (2010), n = 25% x N. Hence, the numbers of samples were 50 students. The students then divided into two classes, including experimental class and control class. The experimental class was a group of students that have been taught

contextually. On the other hand, for the control class was not taught contextually.

The data that used in this study were primary data that obtained from the students' final score, after all of the process of learning finished. Furthermore, the results of unstructured interviews with the students were also used to reinforce the findings from analysis of the primary data. The final scores were collected by using a final test, and unstructured interviews with students collected while the process of teaching and learning.

The statistical analysis used in this study was analysis of frequencies and independent samples t-test. The analysis aimed to measure the variability of the data by observing: data dissemination, range, and the difference of mean value between experimental and control class. Additionally, significant difference of mean value was perceived by using the t-test. Furthermore, the data were processed by using SPSS program.

RESULT AND DISCUSSION

Analysis of Frequencies

Frequency analysis is a descriptive statistics technique to interpret data by presenting some calculations in tables and graphs (Priyatno, 2016). It means that this analysis used to describe the collected data as it is. Moreover, this method of analysis is not generally used to make a conclusion, such as stated hypothesis, and decided whether there is a correlation between variables. Mostly, the analysis is useful to describe data distribution and to make a decision in choosing which group people or person is more consistent and solve problems.Table descriptive statistics on the next page.

Table 1. Descriptive Statistics

		Class Experiment Score	Control Class Score
N	Valid	25	25
	Missing	0	0
Mean		81.22	67.30
Std. Error of Mean		1.494	1.842
Median		80.00	67.50
Mode		85[a]	58
Std. Deviation		7.472	9.212
Variance		55.827	84.854
Skewness		.712	1.321
Std. Error of Skewness		.464	.464
Kurtosis		.095	2.451
Std. Error of Kurtosis		.902	.902
Range		29	37
Minimum		72	58
Maximum		100	95
Sum		2031	1683
Percentiles	25	74.75	57.50
	50	80.00	67.50
	75	85.00	70.50

a. Multiple modes exist. The smallest value is shown

Based on the table above, it can be described that the total samples was 50 students that divided into Experimental class and Control Class. Mean score for every class is 81.22 and 67.30 respectively. Furthermore, the control class's coefficient of Standard Deviation, Range and Variance is greater than the experimental class. It shows that, the data distribution of experimental class more homogeny than control class. It means that, mean value of the experimental class will be more representative than the other class. It is same with the statement from Hadi (2015) who said that one of the variability measurement functions is to make a decision which samples (group and/or person) value can representative the sample itself. The Skewness and Kurtois coefficient also shows that the experimental class data is more normal that the control one.

Besides, the description of measurement variability above can be clearly seen on the graph below. The graph will provide a well description about how the data distribute from the central tendency.

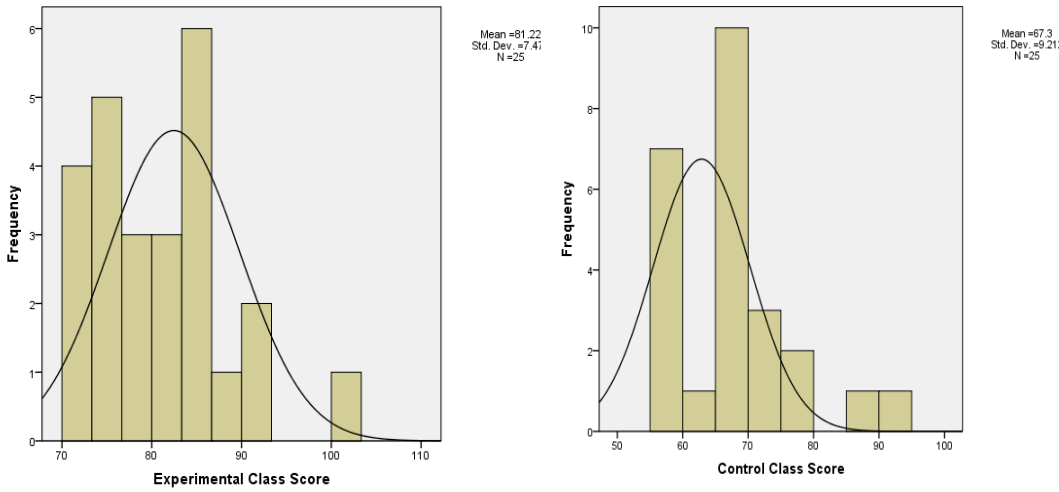

Figure 1. Graph of Data Distribution Class Experiment and Control Group

The graphs above indicate that control group Range is more than class experiment. The first graph shows there is a difference between maximum score and minimum score equals 29, wherein the second graph showed a difference of 37.

It can be concluded that the class experiment is more reliable in comparison with the control class. Therefore, this result shows that the distribution of mathematics knowledge among the class is more prevalent than the control class. By looking at the range of the data is from 71 to 100, and the median and mode is 80 and 85 respectively, then the generalization is the contextual method in teaching mathematics can give a positive impact to the students, such as distributing the knowledge to almost all of the students properly.

Independent Samples Test Analysis

Independent samples t-test is an analytical method used to test for mean differences between two independent samples. The results of the data analysis in this analytical method were shown by SPSS table below.

Table 2. Independent Samples Test

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Final Score	Equal variances assumed	.024	.878	5.755	48	.000	13.640	2.370	8.874	18.406
	Equal variances not assumed			5.755	46.080	.000	13.640	2.370	8.869	18.411

The first result that must be seen from the table is Levene's test (test of variance assumed). The usefulness of this test is to determine whether the variances of two samples are different or not. If the variance of those samples is equal, the Equal Variance Assumed values will be used, and conversely if the variance is different, then the Equal Variance Not Assumed values will be used in analyze the t-test.

Levene's Test

Determine null and alternative hypothesis for Levene's test:

H_o : The group variances are equal. $\sigma_1^2 = \sigma_2^2$

H_a : The group variances are unequal. $\sigma_1^2 \neq \sigma_2^2$

As can be seen on the table, the significance of Levene's test is 0.878. It means the value is greater than 0.05, or 0.878 > 0.05.

Based on the result, it can be concluded the null hypothesis is accepted. It can be said that the group variances are equal. Therefore, the values that included in equal variances assumed should be used to analyze t-test.

Independent Samples T Test

Determine the null and alternate hypothesis:

H_o : There is no mean deference between the experimental class and the control class.

H_a : There is mean deference between the experimental class and the control class.

This study has a significance level of 0.05. As can be seen on the table above, the value of t_{count} is 5.755, and the degree of freedom (df) is 48. Therefore, by looking at df value and the significance level, it can be found the t_{table} = 2.010. It means that the alternate hypothesis was accepted. Finally, it can be concluded that, there is mean difference between the experimental class and the control class.

By looking at the mean value, the difference was about 13.92 (20% of the control class mean's value). It was a massive difference. Hence, it can be generalized as a significant difference. Moreover, it shows that, teaching mathematics in TVET institution should be more contextual, it means, it should be more practices in the process of learning, in order to increase their understanding in the mathematics itself. As Linberg (2011) said, the teacher in TVET should build a bridge to relate the learning to other subjects or students' daily life. Moreover, Lucas (2012), also stated that one of questions that should be asked by teachers in vocational pedagogy is "How is the teaching methods influenced by context?" Based on the statements above, it can be concluded that teaching mathematics for TVET students should be more contextual to increase their higher order thinking, so that, their learning achievement could be more satisfied the students.

CONCLUSION

Based on the result, it can be concluded that:The effect of habits paying attention to lessons and reading books contributed 16.69% to the achievement of the students. The rest influenced by other factors in

education. It shows that, the learning achievement will be increased as the habits of paying attention to lessons and reading books are better.

ACKNOWLEDGEMENT

Based on the discussion above, it can be accomplished that:

1. Teaching mathematics contextually in TVET institution could positively impacted on students' achievement in the process and result of learning mathematics.
2. The impact was very significant, as can be seen on the difference mean values of the two classes (experimental and control class). The mean value of experimental class was considerably higher than the control class. The difference between two of them was approximately 13.92, or about 20% of the control class mean value.

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