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The Effect of the Application of the Jigsaw Type Cooperative Learning Model on the Motivation to Learn Applied Physics Courses at the Merchant Marine Polytechnic of Makassar Cadets

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Keywords

Jigsaw, Cooperative Learning, Motivation to Learn

ABSTRACT

This research is a quantitative-research using an experimental approach. The type of research used is experimental research. The objectives of this study are (1) to determine the significant effect of the jigsaw cooperative learning model on the motivation to learn Applied Physics for cadets at the Merchant Marine Polytechnic of Makassar, (2) to determine the effect of the level of motivation before and after using the jigsaw cooperative learning model. The research was carried out at the Merchant Marine Polytechnic of Makassar from April to September 2022. The population in this study were all cadets of the Engineering Study Program semester II for the Academic Year 2021/2022 at the Merchant Marine Polytechnic of Makassar, totaling 48 cadets. Data collection techniques using a questionnaire. The data analysis technique used normality test, correlation test, homogeneity test, and test of difference in average value (t test). The results showed that the application of the Jigsaw learning model had a significant effect on the motivation to learn applied physics for cadets at the Merchant Marine Polytechnic of Makassar with a correlation coefficient of 0.436. Furthermore, there are differences in the level of learning motivation in the control class and the experimental class. The learning motivation in the control class is in the medium category while the experimental class is in the high category.

INTRODUCTION

Education is one of the factors that can advance a nation(Adeola, Gyimah, Appiah, & Lussier, 2021). Law of the Republic of Indonesia Number 20 of 2003 explains that the National Education System clearly states the purpose of national education, namely in order to develop the potential of students so that they become human beings who believe and fear God Almighty, have noble character, healthy, knowledgeable, capable, creative, independent, and become democratic and responsible citizens (Ministry of National Education in 2003)(Santoso, 2021).

To realize these educational goals, the role of educators in this case teachers and lecturers is very important. A professional lecturer or lecturer is a person who has special abilities and expertise in the field of learning, so that he is able to perform his duties and functions as a teacher or lecturer with maximum ability.

Makassar Shipping Science Polytechnic is one of the educational institutions that has teaching staff or lecturers who strive to apply various learning methods so that students in this case are cadets able to

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understand and master the courses they have. One of the compulsory courses for cadets is applied physics. Applied physics is a course that requires a comfortable learning atmosphere with interesting methods so that cadets are able to understand the course well(Prontenko et al., 2019). So that in the learning process, lecturers who teach applied physics courses at the Makassar Shipping Science Polytechnic have applied various learning methods to create a learning atmosphere that can increase the enthusiasm for learning cadets.

One of the learning models applied by lecturers in applied physics courses is the jigsaw type cooperative learning model (Karacop, 2017) This learning model is a learning model with a method of forming learning groups with the aim that cadets who have high understanding are able to keep up with cadets who have low understanding (Alexander, 2015). So through this method, cadets are expected to be able to understand applied physics in depth through high learning motivation (Lindsay & Morgan, 2021).

Through the jigsaw type cooperative learning model, it is expected to provide new solutions and an interesting atmosphere in learning so as to provide new concepts (Huang, Liao, Huang, & Chen, 2014). The jigsaw-type cooperative learning model brings the concept of innovative understanding, and emphasizes the activeness of cadets and is expected to increase cadets' learning motivation in participating in courses, especially applied physics courses.

Based on the description above regarding the application of the jigsaw type cooperative learning model at the Makassar Shipping Science Polytechnic, the researcher is interested in raising the title "The Effect Of The Application Of The Jigsaw Type Cooperative Learning Model On The Motivation To Learn Applied Physics In Cadets Of The Makassar Shipping Science Polytechnic".

METHODS

The type of research used in this study is experimental research(Gerring & McDermott, 2007). Experimental research can be interpreted as a research method used to look for the effect of certain treatments on others under controlled conditions (Ariel et al., 2017). The research location is at the Makassar Shipping Science Polytechnic in April – September 2022. The subjects in this study are cadets of the Makassar Shipping Science Polytechnic Engineering Study Program in the second (two) semester of the 2021/2022 academic year consisting of 2 (two) classes with a total of 48 cadets (Huliatunisa, Suhardan, Permana, Nurdin, & Komariah, 2022). The 48 cadets will be divided into two classes, namely 1 (one) experimental class and 1 (one) control class so that each class consists of 24 cadets (Sulistyorini, 2023).

The object of this study is the influence of the use of the application of the jigsaw type cooperative learning model on the motivation to learn Applied Physics (Silalahi & Hutauruk, 2020).

In this experimental study, the form of design used is *Posttest-Only Control Design*. In the study there were two groups selected(Ignacio Montero & León, 2007). The first group is the treated group called the experimental group and the second group is the untreated group named the control group. The research design used is as follows (Manuel L. Montero, Liu, Orozco, Casiano, & De Leon, 2020):

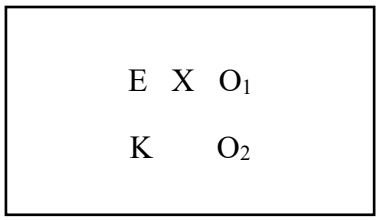

Figure 1 Relationship between Research Variables

Information:
E : Experimental Class
K : Control Class
X : Treatment
O_1 : The effect of the application of the jigsaw-type cooperative learning model on cadet learning motivation
O_2 : The influence of conventional learning on cadet learning motivation

RESULTS

The data in this study consisted of data related to the application of the *jigsaw* type cooperative learning model and data related to the level of cadet learning motivation in both the control class and the experimental class. The application of the jigsaw-type cooperative learning model in this study was carried out online using

the *zoom meeting* application. The division of groups is carried out by dividing the class into a control class and an experimental class.

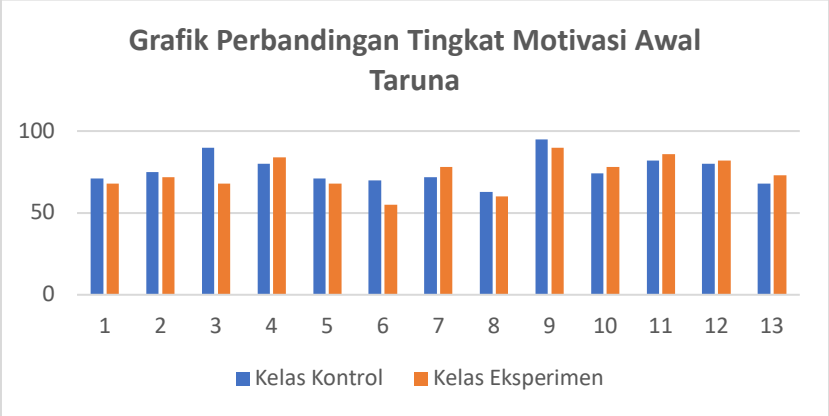

Figure 2. Comparison Chart of Cadets' Early Learning Motivation Levels

Before the *jigsaw-type* cooperative learning model is applied, it is first measured the initial motivation level of cadets in Applied Physics learning both in the control class and experimental class. Figure 2. is preliminary data on the level of learning motivation of cadets. If the results of the graph are grouped in category scale, then the data in table 1 is obtained.

Table 1. Interval scale of initial motivation level of cadets in the control class

Control class motivation interval scale

		category	Frequency	Valid Percent	Cumulative Percent
Valid	13-29	Low	0	0	0
	30-46	Keep	22	91.7	91.7
	47-65	Tall	2	8.3	100.0
	Total		24	100.0	

Table 2. Interval scale of initial motivation level of cadets in experimental classes

Experimental class motivation interval scale

		category	Frequency	Valid Percent	Cumulative Percent
Valid	13-29	Low	1	4.2	4.2
	30-46	Keep	21	87.5	91.7
	47-65	Tall	2	8.3	100.0
	Total		24	100.0	

The results of the analysis of research data that have been obtained are as follows:

Normality Test

Using *Kolmogorov Smirnov's One Sample* test. Data is declared normally distributed if the significance is greater than 5% or 0.05. Table 3. It shows that the significance for the application of the jigsaw-type cooperative learning model is 0.076, for cadet learning motivation in *the* control class is 0.061 and for cadet learning motivation in the experimental class is 0.060. So, it can be concluded that the data of the three variables are normally distributed with the significance of each variable greater than 0.05.

Table 3. Results of Normality Test Analysis for the Application of *Jigsaw* Type Cooperative Learning Model, Cadet Learning Motivation (Control Class), and Cadet Learning Motivation (Experimental Class)

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistics	Df	ig.	Statistics	f	ig.
Application of the jigsaw-type learning model	.041	24	076	.961	4	062
Control class motivation	.017	24	061	.891	4	020
Motivation of the experimental class	.086	24	060	.927	4	042
a. Lilliefors Significance Correction						

Correlation Test

The correlation test aims to determine the level of influence between the application of the *jigsaw* type cooperative learning model on the motivation to learn applied physics in cadets. The results of the correlation test are shown in table 4.

Table 4. Correlation Analysis Results

Correlations

		Jigswa Learning Model	Learning motivation
Application of jigswa learning model	Pearson Correlation	1	.436**
	Sig. (2-tailed)		.010
	N	24	24
Learning motivation	Pearson Correlation	.736**	1
	Sig. (2-tailed)	.010	
	N	24	24
**. Correlation is significant at the 0.01 level (2-tailed).			

Based on the results of the correlation coefficient analysis of 0.436. In accordance with the correlation coefficient interpretation guidelines, the value shows that the influence between the application of the Jigsaw type cooperative learning model on learning motivation is positive so that the better the application of the *Jigsaw* type cooperative learning model, the higher the motivation to learn Applied Physics. Furthermore, the correlation value also shows that the influence between the two variables is in the medium category.

Homogeneity Test

The homogeneity test aims to see whether the research data in both the control class and the experimental class are normal or not. Based on the results of the homogeneity test, the following data were obtained:

Table 5 Homogeneity test results

Test of Homogeneity of Variances

Learning motivation			
Levene Statistic	df1	df2	Sig.
.633	1	112	.428

Based on the homogeneity test in table 5 shows that the significance value is greater than 0.05 which means that the population variance is homogeneous so that it can be continued with *independent sample* test (t-test) analysis.

Test t

The t test aims to determine whether there is a difference in the level of learning motivation of cadets in the control class with the experimental class with the research hypothesis if the significance value is greater than 0.05, then the learning motivation of cadets in the experimental class is not higher than the control class.

But if the significance value is less than 0.05, then the average learning motivation of cadets in the experimental class is higher than that of the control class. Based on the results of the t-test analysis, the values in table 6 are obtained.

Table.6. Test t Analysis Results

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means					
		F	ig.	t	f	ig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference
									Lower / Upper
Learning Motivation	Equal variances assumed	633	428	- 12 15.171		00	-11.52632	.75977	-13.03171 / -10.02092
	Equal variances not assumed			-02.69 15.1719		00	-11.52632	.75977	-13.03320 / -10.01943

Based on the results of the analysis on the t test above, it shows that the significance value (*2-tailed*) is 0.00 or less than 0.05, so it shows that learning motivation in the experimental class is higher than learning motivation in the control class. Figure 2. is the result of a comparison of the level of motivation to learn applied physics cadets for each statement item.

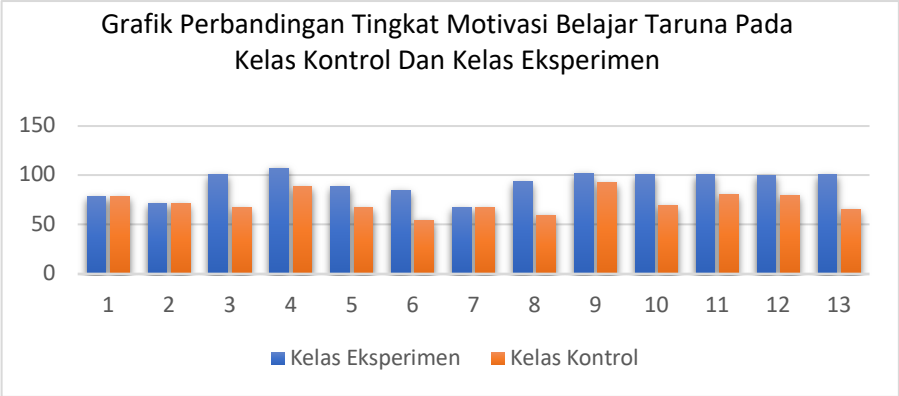

Figure 2. Final Learning Motivation Level Comparison Chart

Based on the graph above, it shows that there are significant differences for some statements on learning motivation indicators. However, there are 2 statements that have the same level. Furthermore, to see the level of motivation categories in experimental and control classes is presented in table 7.

Table 7. Results of Correlation Analysis in Experimental Class

Experimental class motivation interval scale

		category	Frequency	Valid Percent	Cumulative Percent
Valid	13-29	Low	0	0	0
	30-46	Keep	5	20.8	20.8
	47-65	Tall	19	79.2	100.0
	Total		24	100.0	

Based on the two tables of motivation levels for learning applied physics, cadets above show that there are differences in motivation levels between the experimental class and the control class.

Discussion

Overview of Research Implementation

This research was carried out at the cadets of the Engineering Study Program in the second semester of the 2021/2022 Academic Year of the Makassar Shipping Science Polytechnic. This research uses experimental methods conducted in the Applied Physics course with Heat material. The research subjects were divided into 2 (two), namely the experimental class consisting of 24 cadets and the control class consisting of 24 cadets. The research was conducted through several stages, namely:

Experimental Class

In the experimental class, the initial motivation of cadets was measured before the implementation of the *Jigsaw* type cooperative learning model. Next introduce the learning method to be applied. In the experimental class, cadets are divided into 3 groups of 8 people. Applied physics material related to Heat is divided into several subsections. In this study, each member of the study group received a different subsection. In each group, each member gets sub-material related to the concept of heat, other members get sub-material related to type heat, heat capacity, azaz black, type heat and other sub-sub-materials.

Furthermore, members of each group studying the same sub-material meet to meet in expert groups for discussion. And after that return to give an explanation to their respective groups. After the process of applying the *Jigsaw* type cooperative learning model, the lecturer takes the final measurement of cadet learning motivation.

Control Class

In the control class, an initial measurement of cadets' learning motivation was carried out. Furthermore, delivering the material to be taught, namely heat material. In this activity, the learning process is carried out conventionally. After the activity is completed, the final level of motivation for cadets is measured again.

1. Overview of Cadets' Early Learning Motivation

The initial motivation picture in this study is the level of cadet learning motivation before the application of the *jigsaw* type cooperative learning model. Based on the results obtained in figure 4.1 regarding the comparison chart of the level of initial learning motivation of cadets, it shows that the learning motivation of cadets in the control class and the experimental class is almost the same. For some statements the control class is higher than the experimental class, and some other statements indicate that the experimental class is higher than the control class.

In the control class, the level of cadet learning motivation measured through statements related to cadet learning activities when going to exams, cadets' awareness of subject matter that has not been understood, cadets' curiosity about applied physics subject matter, pleasure in the learning methods applied by lecturers and interest in the method of division of study groups is higher when compared to experimental classes.

Furthermore, statements related to the cadets' willingness to catch up with lagging lessons, reading books related to physics, the level of focus of cadets on the subject matter and the desire to get higher grades, in the experimental class is higher when compared to the control class. However, when viewed from the interval scale in tables 4.1 and 4.2, it shows that the level of motivation in the control class and experimental class are both still in the medium category with percentage levels that are not too different, namely 91.7% and 87.5%.

2. The influence between the application of *the jigsaw* type cooperative learning model on cadet learning motivation

The effect between the application of the *jigsaw-type* cooperative learning model on cadet learning motivation in the experimental class was obtained through a correlation test illustrated in table 4. Table 4. indicates that the correlation coefficient value is positive. This shows that the better the application of the jigsaw-type cooperative learning model, the better the level of motivation for cadets to learn in the Applied Physics course.

Furthermore, in the correlation analysis table, it is also obtained that the value of the correlation coefficient is 0.436. This value means that the influence between the application of the *jigsaw-type* cooperative learning model is in the medium category. The degree of influence between the application of the *jigsaw-type*

cooperative learning model which is in the medium category shows that cadets' learning motivation after the application of the learning model increases significantly but the increase varies. Some statements reflect a picture of high increase in learning motivation, but there are still some statements whose increase is still relatively low.

3. Different Levels of Cadet Learning Motivation

The differences in the level of learning motivation of cadets in the control class and experimental class are illustrated in table 4.6. Table 4.6 related to the results of the t-test analysis shows that the significance value (*2-tailed*) is 0.00 or less than 0.05, so it shows that learning motivation in the experimental class is higher than learning motivation in the control class.

Furthermore, to see an overview of the difference in motivation levels between the experimental class and the control class, namely in figure 4.2 which shows that each statement in the experimental class is higher than the control class. The learning motivation of cadets measured through the cadets' encouragement to catch up in following lessons increased compared to the control class, while the cadets' interest in reading books related to applied physics did not differ much between the experimental class and the control class.

Indicators of cadets' interest or pleasure in learning methods applied by lecturers there is a high difference between the experimental class and the control class. The cadets' pleasure in the experimental class towards the learning methods applied by the lecturer in applied physics subjects makes the cadets want to understand applied physics material more deeply and ultimately has a positive effect on the learning patterns of cadets. Whereas in control classes are more likely to study only when the exam will be held. While in the experimental class, the average cadet learns long before the exam will be held.

The next difference lies in the cadets' efforts to get higher scores. In the experimental class, cadets are already interested in the group division method applied by the lecturer so that the cadets try to be more interactive in following lessons. So that the efforts of cadets to get higher scores are shown by their active learning activities. While in the control class, the learning method is carried out without the division of learning groups so that the active ones are only cadets who basically already understand the existing material.

Meanwhile, cadets' curiosity about the next material to be taught by lecturers is almost no different between experimental classes and control classes. This shows that even though in the control class, cadets have been interested in the learning methods applied by lecturers, but these methods have not succeeded in fostering high curiosity in cadets about the next material to be delivered by lecturers.

The description above shows that the level of motivation of cadets in the experimental class still varies, namely there are 20.8% or 5 cadets whose learning motivation is in the medium category and 79.2% or there are 19 cadets who have high learning motivation. While in the control class 91.7% or 22 cadets with moderate motivation and 8.3% or 2 cadets who had high learning motivation.

Based on the results described above, both based on the correlation analysis table that shows the effect of applying the jigsaw type cooperative learning model and based on the comparison table of cadet learning motivation levels in experimental and control classes, it shows that through the application of the *jigsaw* type cooperative learning model Able to increase cadet learning motivation compared to conventional learning models. This is because in the conventional learning model, lecturers have a dominating role in delivering material so that cadets do not have more encouragement to master more deeply the existing material because the learning process is centered on lecturers.

CONCLUSION

Based on the results of the research that has been obtained, the conclusions in this study are as follows: There is a significant influence between the application of the jigsaw type cooperative learning model on the motivation to learn Applied Physics of Makassar Shipping Science Polytechnic Cadets. The motivation to learn Applied Physics in the experimental class increased after applying the jigsaw type cooperative learning model.

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