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Application of Jigsaw type Cooperative Learning Model to Learning Outcomes and Motivation in Colloidal Materials Assisted by Practicum at SMA Negeri 1 Laubaleng

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Abstract: Application of Jigsaw-type Cooperative Learning Model to Learning Outcomes and Motivation in Pratctic-Assisted Colloidal Materials at SMA Negeri 1 Laubaleng. The learning model applied in this study is a jigsaw-type cooperative learning model. The purpose of this study is to find out whether there is an increase in learning outcomes, student learning motivation and there is a significant correlation between learning motivation and student learning outcomes learned with a jigsaw-type cooperative model assisted by practicum on colloidal materials. The sample in this study was taken from two classes, namely class XI Science 1 which is called the experimental sample of 34 students who are taught with a jigsaw-type cooperative model assisted by practicum and XI Science 3 which is called the control sample of 34 students who are taught with a conventional model assisted by practicum, the sample is determined by random sampling technique, the results of the study show that the average learning outcome of students in the experimental class is 86.47 while the students in the control class 65.29; The average motivation of students in the experimental class while the students in the control class was 78.35 while the students in the control class were 64.24 and there was a significant correlation between student learning motivation and student learning outcomes learned by the JIGSAW-type cooperative model assisted by practicum, with a correlation coefficient of 0.92 and the contribution of student motivation to the improvement of student learning outcomes by 85% while 15% was influenced by other factors.

Keywords: Jigsaw Type Cooperative, Learning Motivation, Learning Outcomes, Practicum, Colloid.

Abstrak: Penerapan Model Pembelajaran Kooperatif Tipe Jigsaw Terhadap Hasil Belajar Dan Motivasi Pada Materi Koloid Berbantuan Pratktikum Di SMA Negeri 1 Laubaleng. *Model pembelajaran yang diterapkan dalam penelitian ini yaitu model pembelajaran kooperatif tipe jigsaw. Tujuan dari penelitian ini adalah untuk mengetahui apakah ada peningkatan hasil belajar, motivasi belajar siswa serta ada korelasi yang signifikan antara motivasi belajar dengan hasil belajar siswa yang dibelajarkan dengan model kooperatif tipe jigsaw berbantuan praktikum pada materi koloid. Sampel pada penelitian ini diambil dari dua kelas yaitu kelas XI IPA 1 yang disebut sampel eksperimen berjumlah 34 siswa yang dibelajarkan dengan model kooperatif tipe jigsaw berbantuan praktikum dan XI IPA 3 yang disebut sampel kontrol berjumlah 34 siswa yang dibelajarkan dengan model konvensional berbantuan praktikum pada materi koloid, sampel ditentukan dengan teknik sampling random, sebelum dilakukan penelitian siswa diberikan pretest yang mendapatkan rata-rata pada kelas eksperimen 39,12 sedangkan kelas kontrol 37,65. Hasil*

setelah dilakukan penelitian menunjukkan bahwa rata-rata hasil belajar siswa kelas eksperimen sebesar 86,47 sedangkan siswa kelas kontrol sebesar 65,29; rata-rata motivasi siswa kelas eksperimen eksperimen 78,35 sedangkan siswa kelas kontrol sebesar 64,24. dan ada korelasi yang signifikan antara motivasi belajar siswa dengan hasil belajar siswa yang dibelajarkan dengan model kooperatif tipe jigsaw berbantuan praktikum, dengan koefisien korelasi sebesar 0,92 dan kontribusi motivasi siswa belajar siswa terhadap peningkatan hasil belajar siswa sebesar 85% sedangkan 15% dipengaruhi faktor lain.

Kata kunci: *Kooperatif Tipe Jigsaw, Motivasi Belajar, Hasil Belajar, Praktikum, Koloid.*

▪ INTRODUCTION

Education aims to shape quality and develop human potential. In the learning process, students are expected to play an active role in developing the potential that exists in them in order to have the personality, intelligence, and skills necessary for themselves and society. In this case, education must have good quality so that the goals of education can be achieved properly (Dony et al., 2018).

Chemistry was obtained and developed based on experiments to find answers to questions, especially those related to the composition, structure, properties, transformations, dynamics and energetics of substances. Therefore, in studying chemistry, we must pay attention to the characteristics of chemistry as attitudes, processes and products. Chemistry learning not only aims to convey a concept and theory, but also develops students' science skills (Assriyanto et al., 2014).

Chemistry is a subject based on abstract concepts, therefore it is difficult to understand, especially when students put themselves in a position to believe without seeing. In addition, students are basically familiar with a number of relevant concepts as a result of the learning concept that has the potential to present prejudices about the world itself can be reflected in chemistry lessons and can sometimes grow into misunderstandings. Misunderstandings tend to occur in chemistry can cause students to be less successful in applying appropriate concepts and the possibility of students failing to learn chemical concepts. This suggests that misunderstandings in the initial concept will be a barrier to students' academic abilities (Pikoli, 2020).

Based on the results of interviews at SMA Negeri 1 Laubaleng, the school still tends to use a teacher-centered learning model and use the lecture method in chemistry learning. From the results of the initial interview, 10% of students whose scores have not met KKM 74. Chemistry learning is usually difficult for students to understand if it involves theories and concepts, one of which is colloidal material in grade XI students in even semesters, while at SMA Negeri 1 Laubaleng school has not applied a dominating learning model to students and has not applied learning methods to chemistry materials so that learning outcomes are low and students lack motivation in participating in chemistry learning.

learning colloidal system material, namely memorization, this is related to the memory ability of students. Each student has different memory abilities. Memory includes remembering, storing, and reproducing (Rosyana et al., 2014). Therefore, the presentation of colloidal material by dominating students to work with their groups is expected to be able to provide more memorable learning and can contribute to increasing students' motivation to always excel in learning

Cooperative learning is a strategy of teaching and learning a number of students whose members have different levels of understanding, the cooperative model has the goal of being able to influence outside of academic learning, especially in increasing

acceptance between groups and social groups and group skills so that an interactive and effective learning process occurs (Abdullah & Ramlih, 2017).

Jigsaw type cooperative learning is a learning model that requires students to be responsible for their respective tasks and teach other group members, so that they are able to understand each other among students. This model contains more aspects of theories than formulas or equations in the material taught, so students are required to first understand a material to be able to use it as the basis for their knowledge (Kahar et al., 2020).

According to (Hamida et al., 2013),the practicum method in the laboratory is a special form of teaching that is used as optimally as possible so that students have the opportunity to test and implement in real circumstances what is obtained in theory. In this method, students can actively conduct experiments directly, observe the process and conclude the results of the experiments, so that students can form concepts from the theory they have learned.

According to (Abadi & Bahriah, 2016), practicum is a very effective learning method in understanding the concepts of chemistry. Learning chemistry, which is part of science, is not enough just by teaching concepts, but it is also necessary to emphasize the process towards these concepts which can be formed through scientific processes in practicum activities.

Motivation and learning are two things that affect each other. Motivation can basically help and understand and explain individual behavior, including the behavior of individuals who are learning. Learning is a change in behavior that is relatively permanent and potentially has a goal to achieve a certain goal (Widarta, 2020).

Learning outcomes are the realization of the goals of education in students who participate in learning, learning outcomes are also interpreted as changes in human beings both in terms of behavior and attitudes (Ariyanto, 2016). Purwanto argues that "Learning outcomes are changes in student behavior after completing learning in accordance with the goals of education". So, learning outcomes are the results obtained from learning activities that are suitable for the purpose of education (Hutahuruk & Simbolon R, 2018).

The success of learning is caused by several factors, including the learning environment at school, the family, and the students themselves. Every student is different from each other, and their personality affects how they respond to and understand the lesson. Students' attitudes and learning methods have an impact on how well they learn. The way a person receives and assimilates information is combined to form their learning style. Educators must be aware of the variation of students' learning styles in order to meet their needs during the learning process (Rijal & Bachtiar, 2015).

Motivation is an effort to prepare certain conditions, so that a person is willing and willing to do something and if someone is not interested, they will try to eliminate or discard the feeling of disinterest. So that motivation can be aroused from external factors, but motivation arises in a person, as for external factors that arouse motivation in a person to learn, one of them is the environment (Emda, 2017).

Motivation is a force both within and outside the self that encourages a person to achieve a predetermined goal. Or in other words, motivation can be interpreted as a mental encouragement for every person or group of people in carrying out their duties and carrying out their obligations (Setyowati & Widana, 2016). Motivation and learning are closely related. Learning is a person's behavior caused by learning based on goals in order to achieve certain goals (Fauziyah et al., 2017).

In order for the learning process to increase students' enthusiasm and motivate students, teachers must first know the students' initial abilities. Initial abilities are important to know by teachers before delivering learning because it can be known whether students have the knowledge to participate in learning and to what extent students already know the material to be delivered. By knowing this, teachers will design better, because if students are given material that is already known, they will get bored quickly (Razak, 2018).

Based on previous research by (Abdullah & Ramlih, 2017), it was stated that the learning outcomes achieved by students in learning chemistry with the application of jigsaw-type cooperative learning have increased learning outcomes that are classified as good. Selanjutnya, berdasarkan hasil penelitian oleh (Tandi et al., 2020)bahwa model pembelajaran kooperatif tipe jigsaw disertai praktikum berpengaruh signifikan terhadap hasil belajar pada materi sifat koligatif larutan. Hal ini juga ditunjukkan dari hasil belajar kelas pada eksperimen yang menggunakan model pembelajaran kooperatif tipe jigsaw disertai praktikum lebih tinggi dari pada hasil belajar pada kelas kontrol menggunakan pembelajaran konvensional. Then based on research by (Widarta, 2020), it was stated that the jigsaw type cooperative learning model was able to increase student motivation and learning outcomes, as seen from the increase in the first cycle of 82% and in the cycle it increased to 89%.

▪ METHOD

Population and Sample

The population in this study is all students in grade XI of SMA Negeri 1 Laubaleng. The number of XI Science classes is 3 classes, from three classes are selected with random sampling techniques, then 2 classes are selected as samples, namely the experimental class and the control class which is taught with the 2013 curriculum with a total of 68 students. Each class averages 34 students. The random sampling technique is used because the population is considered homogeneous based on its cognitive level, that is, there is no superior class in the population. The selected class was used as an experimental class taught with a jigsaw-type cooperative learning model assisted by practicum and in the control class was taught with a conventional learning model assisted by practicum.

Research Design

The design used in this study is pretest – posttest Control Group Design. Design Illustration. The illustration of the research design is given as follows:

Tabel 1. Research Design

Class	Initial Test	Treatment	Final Test
Erxperrirmernt	O1	X	O2
control	O2	Y	O2

Keterangan :

O_1 = Initial test (Pretest) in the experimental and control classes

O_2 = Final test (Posttest) in the experimental and control classes

X = Treatment in the experimental class with a jigsaw type cooperative model

Y = Treatment of control classes with conventional model

Data Analysis Hypothesis Testing

Normality Test

The normality test of the data was carried out using the Chi-Squared test, it was obtained that the motivation values of the two sample groups had two normal data or $x^2{}_{count} < x^2{}_{table}$. At a significant level of 0,05 for the experimental class and the control class, it can be stated that the data is normally distributed (Silitonga, 2014).

Homogeneity Test

The results of the calculation for the homogeneity test from the pretest and posttest data of both the experimental class and the control class by comparing the F_{count} and F_{table} is said to be homogeneous when $F_{count} < F_{table}$. (Silitonga, 2011) To find out the sirgnirfircancer lerverl of $\alpha = 0{,}05$ you can use the following formula.

$$F_{count} = \frac{S_1^2}{S_2^2} = \frac{\text{Largest Variance}}{\text{Smallest Variance}}$$

Gain Test

The gain test is a test that is carried out to determine the increase in results before being given treatment (pretest) and after being given treatment (posttest) in the learning process. (Pohan, 2017) says the formula used is the normalized gain formula as follows:

$$g = \frac{\text{Posttest Score} - \text{Pretest Score}}{\text{Maximum Score} - \text{Pretest Score}}$$

Analysis of the effectiveness of improving learning outcomes

$$\%g = \frac{\text{Skor Posttest} - \text{Skor Pretest}}{\text{Skor Maksimum} - \text{Skor Pretest}} \text{ x } 100\%$$

Hypothesis Test I and II

The t-test is used as in the testing of this hypothesis after the prerequisite test is met. Hypothesis testing is carried out with a t-test to meet the acceptance or rejection of the hypothesis. Test criteria if $t_{count} < t_{table}$, then the alternative hypothesis (Ha) is accepted. Hypothesis I test and is carried out by t_{count} using the formula:

$$t_{count} = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\frac{{s_1}^2}{N} + \frac{{s_2}^2}{N}}}$$

Hypothesis Test III

According to Silitonga (2011) This hypothesis test was carried out to find out whether there is a correlation between learning motivation and student learning outcomes taught by a jigsaw type cooperative learning model which can be calculated with the formula:

$$rxy = \frac{N\Sigma XY - (\Sigma X)(\Sigma Y)}{\sqrt{[(N\Sigma X^2 - (\Sigma X)^2(N\Sigma Y^2 - (\Sigma Y)^2]}}$$

Where, if $r_{count} > r_{table}$ ($\alpha = 0.05$) and db = (n-2) then there is a correlation between the data.

▪ RESULT AND DISCUSSION

Normality Test

The normality test of the data was carried out using the Chi-Squared test, it was obtained that the motivation values of the two sample groups had two normal data or $x^2{}_{count} < x^2{}_{table}$. At a significant level of 0,05 for the experimental class and the control class, it can be stated that the data are normally distributed as presented in Table 2.

Tabel 2. Normality Test of Learning Outcomes and Motivation

Class	Data	x^2_{hitung}	x^2_{tabel}	Information
Exsperimen	Pretest	7,58	11,07	Normal
	Posttest	5,25	11,07	Normal
	Motivation	8,85	11,07	Normal
Control	Pretest	9,13	11,07	Normal
	Posttest	8,58	11,07	Normal
	Motivation	9,04	11,07	Normal

From the data on tabel 2 above, it could be conclud that the x^2_{count} inside the pretest, posttest and motivation facts for the examination class and the standard class is smaller than x^2_{table} so the data is refered to as typically normally distributed.

Homogeneity Test

Homogeneity analysis was carried out with criterion that if $F_{count} < F_{table}$ with significant level of $\alpha = 0,05$, then the data is called homogeneus. Data on the homogeneity of student's education outcomes and motivation are presented on Tabel 3.

Tabel 3. Homogeneity Test of Learning Outcomes and Motivation

Class	Data	F_{count}	F_{table}	Description
Examination	Pretest	1,78	1,79	Homogeneous
Standard				
Examination	Posttest	1,17	1,79	Homogeneous
Standar				
Examination	Motivation	1,71	1,79	Homogeneous
Standard				

From the data on Tabel 3 above, homogeneity test of student education outcomes and motivation obtained $t_{count} < t_{table}$ then the data is normally because there is no difference within the variance of the data in the examination and standard class Homogeneous distributed.

Gain Test

The gain test was carried out to see the improvement of learning outcomes in the sample class used. Based on the calculation of the gain value of the experiment and the control class as presented in table 4.

Tabel 4. Data on Improving Learning Outcomes

Class	Instalment Gain	% Gain	Criterion	Information
Exsperiment	0,78	78%	g%<0,3 : Low 0,3≤g≤0,7 : Medium g≤0,7 : Height	Height
Control	0,44	44%		Medium

Hypothesis Test

Hypothesis Test I

The data analysis concluded that the posttest data gathering from the two classes are normaly allots and homogeneous. The hypothesis will be tested using the righ accepted. Tabel 5 presented the finding of the first hypothesis test.

Tabel 5. Hypothesis Test Results I

Class	$\bar{X}$	S^2	t_{count}	t_{table}	Information
Exsperiment	86,47	23,53	8,89	1,695	Ho was rejected and Ha was accepted
Control	65,29	112,83			

From the results of the calculation of the table above, it is known that $t_{count} = 8{,}89$ and $t_{table} = 1{,}695$ where $t_{count} > t_{table}$ until Ha is accepted and H_0 is rejected. Therefore, it can be concluded that the learning outcomes of students taught with the jigsaw type cooperative learning model are higher than the scores with the conventional learning model.

Hypothesis II

The student's motivation data was tested the righ handed t statistical test with the criteria $t_{count} > t_{table}$ for Ha is accepted and H_0 is rejected. Table 6 convey and findings of the second hypothesis test.

Tabel 6. Hypothesis Test Results II

Class	$\bar{X}$	S^2	t_{count}	t_{table}	Information
Experiment	78,35	81,39	7,19	1,695	Ho was rejected and Ha was accepted
Control	64,24	50,19			

From the results of the calculation of the table above, it is known that $t_{count} = 7{,}19$ and $t_{table} = 1{,}695$ where $t_{count} > t_{table}$. until Ha is accepted and H_0 is rejected. Therefore, it can be concluded that the motivation of students taught with the jigsaw type cooperative learning model is higher than the value with the conventional learning model.

Hypothesis III

Where, if $r_{count} > r_{table}$ ($\alpha = 0.05$) and db = (n-2) then there is a correlation between the data. The calculation of the hypothesis test can be seen in table 7.

Tabel 7. Hypothesis III Test Correlation Between Motivation and Learning Outcomes

Class	r_{count}	r_{table}	α	Information	Category
Exsperiment and Control	0,80	0,339	0,05	Ho was rejected and Ha was accepted	High relationship

From the results of the calculation of the tabler abover, irt irs known that $r_{count} = 0{,}80$ and $r_{tabler} = 0.339$ where $r_{count} > r_{table}$. untirl Ha irs accepted H_0 is rejected. Therrerforer, irt can ber concluderd that therrer irs a rerlatironshirp bertwerern lerarnirng motirvatiron and studernt lerarnirng outcomers usirng a jirgsaw typer cooperratirver lerarnirng moderl on colloirdal materrirals.

This research began with the provision of a pretest to the experimental class and the control class before starting learning to find out the students' initial ability in colloidal material. From the pretest that has been carried out, the average pretest score of students in the experimental class is 39.12 and in the control class is 37.65. Based on the average pretest scores obtained by the two classes, it shows that both classes have almost the same

initial ability because of the difference in the average pretest scores in each class, probably because students have not learned colloidal material.

The next step in the first, second, and third meetings was the learning process where the experimental class was taught with a jigsaw-type cooperative learning model assisted by practicum and the control class was taught with a conventional learning model assisted by practicum. At the last meeting, a posttest was carried out to find out the extent of students' learning outcomes after learning using a jigsaw-type cooperative learning model and using a conventional learning model in the control class. The average result of the students' scores obtained was 86.47 in the experimental class and 65.29 in the control class. After the posttest, students were given a motivation questionnaire to find out the level of student learning motivation in the experimental class and the control class. The average result of the students' motivation score obtained in the experimental class was 78,35 and in the control class was 64,24.

In the process of the jigsaw-type cooperative learning model, students are responsible for mastering part of the learning meter must be able to teach the part to other team members, while the conventional learning model process is centered on the teacher so that students only pay attention to the explanation from the teacher.

After the data is obtained, data analysis is carried out as a prerequisite test in the parametric statistical test. The tests carried out were normality and homogeneity tests in the experimental class and control class on pretest & posttest data and motivation data. It is known that the experimental class and the control class on the pretest & posttest data as well as the students' learning motivation values are normally distributed because the calculation results are $x^2{}_{count} < x^2{}_{tabel}$.

Furthermore, a homogeneity test was carried out on the pretest & posttest data in the experimental class and control class by calculating the variance, then on the learning motivation data by calculating the variance, then on the learning motivation data by calculating the variance and standard deviation. In the pretest data, the experimental class obtained a variance value of 85,56 and the control class obtained a variance value of 109.45. And in the posttest data, the experimental class obtained a variance value of 23,53 and the control class obtained a variance value of 40,82. As for the motivation data of the experimental class, a variance value of 81,39 was obtained and the control class obtained a variance value of 50,19. So that the data of the pretest & posttest of the experimental class and the control class as well as the value of learning motivation were declared homogeneous.

After the normality test and homogeneity test were carried out, the gain test was used to measure the improvement of student learning outcomes in the experimental class and control class using pretest and posttest data. With high criteria, the gain in the experimental class was 0,78. In the experimental class, the percentage of learning outcomes was 78%. And in the control class with medium criteria, a gain value of 0,44 was obtained, which is with a percentage of 44%. In line with the results of (Muhlis, 2017) research, the improvement of chemistry learning outcomes in colloidal materials using a jigsaw-type cooperative learning model with a gain value of 0,63 or 63% in the medium category. Then calculations were carried out to find out the students' learning motivation by filling out a questionnaire, it was known that the average student motivation score in the experimental class was 78,35 (high category) while in the control class it was 64,36 (medium category).

The results of hypothesis I testing obtained student learning outcomes with t_{count} is 889 and $t_{0,05\,(66)}$ is 1,66827 because $t_{count} > t_{\propto}$ can be concluded that H_0 is rejected

and Ha is accepted. This means that the learning outcomes of students in the jigsaw-type cooperative learning model are higher with an average score of 86,47 compared to the learning outcomes of students who are taught with the conventional model with an average score of 65,29. The influence of the jigsaw-type cooperative learning model here is because of the student-centered learning model so that the increase in student motivation in learning results in increased student activity in seeking information and also providing the information to peers so that student learning outcomes increase. This is supported by the results of the study (Hariadi et al., 2019) showing that the jigsaw-type cooperative learning model has a better influence than the conventional learning model on learning outcomes in thermochemical materials because in this learning, each student involves himself physically, mentally, and intellectually in the learning process and is able to exert all his or her abilities in understanding the material obtained. Especially when teaching the knowledge that is understood to friends in one group, so that their learning outcomes increase, which can be seen from the average pretest score of the experimental class of 24,06 and the control class of 25,42 after the treatment, the posttest score in the experimental class is 76,06 while the control class is 68,09.

After that, hypothesis test II was carried out with a hypothesis test t-test to determine the effect of the use of a jigsaw-type cooperative learning model on learning outcomes, known $\mathrm{t_{count}}(7{,}19) > t_{tabel}(1{,}66827)$. Then the alternative hypothesis (Ha) is accepted and the null hypothesis (H0) is rejected. The learning motivation of students taught with the Jigsaw-type cooperative learning model is higher than the learning motivation of students taught with the conventional model. The influence of the jigsaw-type cooperative learning model here is because the learning model requires students to work together positively interdependent, be responsible for mastering the material and be able to teach that part of the material to other team members, while the conventional learning model is only teacher-centered so that the learning motivation of students in the experimental class is higher than in the control class. As the results of the study according to (Widarta, 2020) explained that the use of a jigsaw-type cooperative learning model greatly affects student motivation and learning outcomes during learning. Based on the results obtained, it can be seen that the average student learning outcomes on colloidal materials using the learning model have changed quite well compared to the conventional learning model.

Then the hypothesis test III was calculated with the correlation formula and obtained $r_{count} = 0{,}92$ and $r_{tabel} = 0{,}339$ where $r_{hitung} > r_{tabel}$. Then the alternative hypothesis (Ha) is accepted and the null hypothesis (H_0) is rejected. There is a correlation between learning outcomes and motivation through the application of a practicum-assisted jigsaw-type cooperative learning model on high-category colloidal materials. And the meaning of the correlation coefficient $r = 0.92$ including a high correlation with the contribution of student motivation to learning outcomes is 85%, while 15% is caused by other factors.

▪ CONCLUSION

After conducting research, data calculation and hypothesis testing, the conclusions obtained are; The learning outcomes of students who were taught using the jigsaw-type cooperative learning model assisted by practicum were higher than the learning outcomes of students who were taught using the conventional learning model assisted by practicum on colloidal materials, The motivation of students who were taught using the jigsaw-type cooperative learning model assisted by practicum was higher than the motivation of

students who were learned using the conventional learning model assisted by practicum on colloidal materials, and there is a significant correlation between learning outcomes and student motivation taught with the jigsaw-type cooperative learning model.

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