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The Influence of Numbered Head Together (NHT) Learning Model on Mathematical Problem Solving Ability Viewed from Student's Learning Motivation

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ABSTRACT

This study aims to describe and analyze: (1) the effect of the interaction of the Numbered Head Together (NHT) learning model with learning motivation on mathematics learning outcomes, (2) For students with high learning motivation, is there any difference in mathematics learning outcomes between students who NHT teaches and direct instruction, (3) For students with high learning motivation, is there a difference in mathematics learning outcomes between students taught by NHT and direct instruction. This is quasi-experimental research. The population in this study were all eighth-grade students of Junior High School 3 Sungguminasa. The research sample consisted of one class for applying the NHT model and one class for the direct instruction model. The sampling technique used was cluster double random sampling. Data were collected using questionnaires, observations, and tests. The data analysis techniques used were descriptive and inferential analysis. The results of the analysis show: (1) there is no influence of the interaction of learning models with learning motivation towards mathematics learning outcomes of students, (2) For students with high learning motivation, there are differences in mathematics learning outcomes of them taught by NHT and direct instruction (81.66 > 72.22), (3) For students with low learning motivation, there are differences in mathematics learning outcomes of them taught by NHT and direct learning (78.88 > 74.44).

Keywords: *Numbered Head Together, Motivation, Learning Outcomes*

1. INTRODUCTION

Learning is essentially related to how to build good interactions between two components, namely teachers and students. A good interaction can be described as a situation where the teacher can make students learn easily and encourage them to learn.

Based on the researcher's experience, some problems related to the student behavior in the classroom are 1) some students are busy playing, telling stories that are not related to the topic they learn, and even some are asleep while the teacher is explaining the material being studied since they think the topic they are learning is not interesting; 2) students lack the initiative to ask a question because they do not know what they are learning; and 3) when the teacher gives a problem to students, only a few of them give responses because they are afraid to answer since if they give an incorrect answer, they will be considered that they do not pay attention to the teacher's explanation. Due to these problems, students' motivation to learn mathematics decreases. Furthermore, another problem that still often arises is the inappropriate use of learning models by teachers. Teachers are less creative in teaching mathematics in schools.

From the description above, it can be seen that the learning model applied by the teacher affects students' learning outcomes. Slavin [1] states that the learning model references a learning approach, including its

objectives, syntax, environment, and management system.

To anticipate the problems above, teachers should apply an appropriate learning model. With an appropriate learning model, teachers can improve the motivation and learning outcomes of students. One of the learning models that can be considered is the cooperative learning model. Huda [2] stated that cooperative learning refers to a learning model in which students work together in small groups and help each other in learning. Cooperative learning generally involves groups of 4 students with different abilities.

The selection of the appropriate learning model will make it easier for students to understand the lesson. One of the learning models that can improve students' mathematics learning outcomes and motivation is the cooperative learning model of type Numbered Head Together (NHT). This learning model leads students to work together in groups so that each group member understands the results of their work. In addition, they will automatically feel that they need to be actively involved in the learning process.

This study aims to find the influence of the interaction of the Numbered Head Together (NHT) learning model with learning motivation on mathematics learning outcomes.

2. LITERATURE REVIEW

2.1 Cooperative Learning Model

Cooperative learning is one of the efforts to realize active, creative, effective, and fun learning. Cooperative learning is of the models providing students opportunities to experience a very effective learning process to achieve more optimal learning outcomes compared to the students who learn only by listening to the teacher's explanation.

Nanang and Cucu [3] points out that cooperative learning is a learning model that uses small groups of students to work together to optimize learning conditions to achieve learning goals. Students learn and work together to achieve a group learning experience.

Jauhar [4] states that there are six stages in cooperative learning, namely: (1) conveying goals and motivation, (2) presenting information, (3) organizing students into study groups, (4) guiding work and study groups, (5) evaluation, (6) giving awards.

2.2 Numbered Head Together (NHT)

According to Ibrahim [5], Numbered Head Together (NHT) is an approach developed to involve more students in studying the material covered in a topic and check their understanding of the content of the lesson instead of asking questions to the whole class. Meanwhile, Kagan in [6] states that “Numbered Head Together (NHT) is another instructional strategy designed to actively engage more pupils during the lesson and thereby improve their academic performance." Learning using Numbered Head Together learning has six steps according to the needs of this research implementation. The six steps are as follows: (1) Preparation, (2) Formation of groups, (3) Discussion of problems, (4) Calling member numbers and giving answers, (5) Giving conclusions, (6) Giving awards.

3. METHOD

This study is Quasi-Experimental research. This study involved two experimental groups, the experimental group I and the experimental group II, to know the influence of the application of Numbered Head Together learning model and direct instruction on students' mathematics learning outcomes based on student learning motivation. The variables in this study are student motivation, student mathematics learning outcomes, and student activities taught using the Numbered Head Together learning model and direct instruction. The population in this study were all eighth-grade students of Junior High School 3 Sungguminasa. Using the cluster Double Random Sampling method, two classes were selected as samples, namely class VIII C as the experimental group I applying Numbered Head Together learning model and class VIII I as the experimental group II using the direct instruction model. Data were analyzed by descriptive and inferential statistical analysis.

3.1 Descriptive Statistics Analysis

3.1.1. Mathematics learning outcomes

In this study, descriptive statistical analysis was applied to describe the characteristics of students' mathematics learning outcomes. This analysis included the average, standard deviation, maximum, minimum, and frequency distribution table. The data of students' learning outcomes were then categorized qualitatively based on categorization techniques according to the methods of grading in Summative Evaluation from [7] as follows:

Table 1. Learning outcome categories

Scores of learning outcome	Categories
$90 \leq x$	Very High
$75 \leq x < 90$	High
$60 \leq x < 75$	Moderate
$40 \leq x < 60$	Low
$x < 40$	Very Low

1) Learning motivation

In this study, data about student learning motivation were obtained from a learning motivation questionnaire. Questionnaires were given to students who would be taught using the cooperative learning model of type Numbered Head Together and direct instruction. The learning motivation scale in this study was designed based on the Likert model scale containing several statements describing the object revealed. To measure learning motivation, five answer options were provided, namely "Very Often (SS)" with a score of 5, "Often (S)" with a score of 4, "Rarely (J)" with a score of 3, "Ever (P)" with a score of 2, and "Never (TP)" with a score of 1.

2) Learning Implementation

The analysis of learning implementation was carried out based on the assessment result from the observation about the teacher's activities in carrying out learning. The categorization of the learning implementation of the learning is given in Table 2 below:

Table 2. Categorization of learning implementation

Percentages Respons	Categories
$0\% - 25\%$	Not implemented
$26\% - 50\%$	Less implemented
$51\% - 75\%$	Implemented enough
$76\% - 100\%$	Well implemented

3) Student activity

The aspect of the student activities was determined based on the categorization of student activeness as follow:

Table 3. categorization of student activeness

Percentages student Active (x)	Categorization
$80\% \leq x \leq 100\%$	Very active
$60\% \leq x < 80\%$	Active
$40\% \leq x < 60\%$	Active enough
$20\% \leq x < 40\%$	Less active
$0\% \leq x < 20\%$	Not active

3.2. Inferential Statistical Analysis

1) Test of homogeneity

The homogeneity test was carried out using the Levene test to investigate whether the variance of the two sample groups is the same or not. In this study, a significance level of 5% or 0.05 was used. The hypotheses to be tested are as follows:

H_0: All populations have the same variance

H_1: Not all populations have the same variance.

With test criteria, H_0 is accepted if the significant value $p_{value} \geq 0.05$; otherwise, H_0 is rejected.

2) Test of hypotheses

In the hypothesis test, there were 2 data to be tested, namely posttest scores and motivation scores of students after being taught using the cooperative learning model of type Numbered Head Together and direct instruction model.

To test the posttest scores and the motivation scores of students, an F-test was applied through the SPSS for Windows version 23 program using Two Ways ANOVA with the assumption that the data were homogeneous. The proposed hypothesis is formulated in the form of statistical hypotheses as follows:

$$H_0: \mu_{AxB} = 0 \text{ and } H_1: \mu_{AxB} \neq 0$$

where :

μ_{AxB}: The parameters of the interaction between the NHT learning model and students' mathematics learning motivation

$$H_0 : \mu_{11} = \mu_{21} \text{ and } H_1 : \mu_{11} \neq \mu_{21},$$

where:

μ_{11}: The parameters of the average score of learning outcomes of students with high motivation taught using the cooperative learning model of type Numbered Head Together.

μ_{21}: The parameters of the average score of learning outcomes of students with high learning motivation taught using the direct instruction model.

$H_0 : \mu_{12} = \mu_{22}$ and $H_1 : \mu_{12} \neq \mu_{22}$,

where:

μ_{12}: The parameters of the average score of learning outcomes of students with low motivation taught using the cooperative learning model of type Numbered Head Together.

μ_{22}: The parameters of the average score of learning outcomes of students with low learning motivation taught using the direct instruction model.

With test criteria, H_0 is accepted if the significant value $p_{value} \geq 0.05$; otherwise, H_0 is rejected.

4. RESULTS AND DISCUSSION

The research was conducted at Junior High School 3 Sungguminasa, where class VIII C was the experimental group I and class VIII I was the experimental group II. The research was carried out in 14 meetings, of which 1 meeting for giving a questionnaire, 1 meeting for conducting posttest, and 12 meetings for mathematics learning process using the cooperative learning model of type Numbered Head Together and direct instruction.

4.1. Descriptive statistical analysis

4.1.1. Learning implementation

The summary of observation result of learning implementation is given in table 4 and table 5 as follow:

Table 4. Observation result of learning implementation using *Numbered Head Together*

Meetings	Average scores	Categories
1	3,90	Well implemented
2	4,00	Well implemented
3	3,80	Well implemented
4	4,00	Well implemented
5	4,00	Well implemented
6	3,93	Well implemented
7	4,00	Well implemented
8	4,00	Well implemented
9	4,00	Well implemented
10	4,00	Well implemented
11	4,00	Well implemented
12	4,00	Well implemented
Average of all scores	3,97	Well implemented

Table 5. Observation result of learning implementation using direct instruction

Meetings	Average scores	Categories
1	3,94	Well implemented
2	3,90	Well implemented
3	3,89	Well implemented
4	4,00	Well implemented
5	4,00	Well implemented
6	4,00	Well implemented
7	3,94	Well implemented
8	4,00	Well implemented
9	4,00	Well implemented
10	4,00	Well implemented
11	4,00	Well implemented
12	4,00	Well implemented
Average of all scores	3,97	Well implemented

According to Table 5 dan Table 6, learning implementation of both two learning models has average scores of 3,97, categorized as Well implemented.

4.1.2. Learning motivation

Data about students' motivation to learn mathematics were divided into two categories: high motivation and low motivation. The division of data categories was conducted by sorting the average of motivational scores based on the value in the categorization guideline for students' motivational questionnaire statements that have been scored with the z distribution approach in the questionnaire test.

After being sorted, the top 50% of students were in the high learning motivation group, and the bottom 50% were in the low learning motivation group. Therefore, 15 students with high motivation for experimental group I and 15 students with low motivation for experimental group II.

4.1.3. Learning outcomes

From the results of data analysis of students' mathematics learning outcomes based on mathematics learning motivation obtained from the posttest, recapitulation of students' mathematics learning outcomes data is shown in Table 6 below.

Table 6. students' mathematics learning outcomes based on mathematics learning motivation

Statistics	*High Motivation*		*Low Motivation*	
	Group I	***Group II***	***Group I***	***Group II***
Sample size	15	15	15	15
Mean	81,66	72,22	78,88	74,44
Standard Deviation	7,18	7,49	7,62	8,60
Variance	51,57	56,17	58,15	74,01
Score Range	25,00	16,66	16,66	16,66
Highest Score	91,67	83,33	83,33	83,33
Lowest Score	66,67	66,67	66,67	66,67

The mathematics learning outcomes of students based on the Minimum Completeness Criteria applied in class VIII C and VIII I taught using the cooperative learning model of type Numbered Head Together and direct instruction, respectively, can be seen in Table 7.

Table 7. Achievement of students post-test score based on Minimum Completeness Criteria (MCC)

Test	**Experimental group**	**Motivation**	**MCC**	**Percentage of classical completeness**	
				completed	**Not completed**
Post-Test	Group I	High	75	86,67%	13,33%
	Group II			40,00%	60,00%
	Group I	Low		73,33%	26,67%
	Group II			46,67%	53,33%

Based on Tables 6 and 7, it can be seen the mathematics learning outcomes of students in class VIII C who were taught using the cooperative learning model of type Numbered Head Together have better learning outcomes compared to the students in class VIII I taught using direct instruction model.

4.1.4. Student activities

The result of student activities is given in the following table:

Table 8. Observation result of activities of students taught using *Numbered Head Together*

Meetings	**Percentages**	**Kategori**
1	93,7%	Very Active
2	100%	Very Active
3	97,9%	Very Active
4	100%	Very Active
5	100%	Very Active
6	100%	Very Active
7	100%	Very Active
8	100%	Very Active
9	100%	Very Active
10	97,9%	Very Active
11	100%	Very Active
12	100%	Very Active
Accumulative Percentage	99,1%	Very Active

Table 9. *Observation result of activities of students taught using direct instruction*

Meetings	***Percentages***	***Kategori***
1	*81%*	*Active*
2	*85%*	*Active*
3	*84,6%*	*Active*
4	*82%*	*Active*
5	*83%*	*Active*
6	*82%*	*Active*
7	*84%*	*Active*
8	*85%*	*Active*
9	*82%*	*Active*
10	*82%*	*Active*
11	*81%*	*Active*
12	*80%*	*Active*
Accumulative Percentage	*82,6%*	*Active*

According to Tabel 8 and Table 9, it can be seen that student activeness in both learning models 99,1% for *Numbered Head Together* model and 82,6% for direct instruction so that they are categorized in very active and active categories, respectively.

4.2. Inferential statistical analysis

4.2.1 Test of homogeneity

The result of the homogeneity test is shown in the following table

Table 10. test of homogeneity

F	**df1**	**df2**	**Sig.**
2,443	3	56	0,074

Based on Table 10, it can be seen that the p_value is 0.074, which is greater than =0.05. Therefore, it can be concluded that H_0 is accepted, which states that the two groups have the same variance, implying no difference in abilities between students in the experimental group I taught using Numbered Head Together and students in the experimental group II taught using Direct Learning.

4.2.2 Test of hypotheses

The result of Two ways ANOVA test is shown in Table 11.

Table 11. The result of Two ways ANOVA test

Source	Type III mean of average Quadrat	Df	Average Quadrat	F	Sig.
Corrected Model	817,827[a]	3	272,609	4,545	0,006
Intercept	353942,018	1	353942,018	5901,101	0,000
Learning model(a)	722,940	1	722,940	12,053	0,001
Motivation(b)	1,162	1	1,162	0,019	0,890
a * b	93,725	1	93,725	1,563	0,216
Error	3358,823	56	59,979		
Total	358118,667	60			
Total of correction	4176,650	59			

a. R square =0,196 (Adjusted R square =0,153)

Based on Table 11, it can be seen that the first Sig. The contrast test (assuming the equality of variance hold) is 0.001, less than alpha=0.05, so H_0 is rejected. Therefore, for students with high motivation to learn, there is a significant difference between the mathematics learning outcomes of students taught using Numbered Head Together and direct learning.

Relevantly, [8] found that PBL model was more effective in improving students' mathematical literacy model than the Direct Instruction. Furthermore, the application of learning models Number Head Together has a role in improving student learning outcomes [9].

5. CONCLUSION

Based on the results and discussion above, we can derive conclusion as follow:

1. There is no influence of the interaction of learning model with learning motivation on mathematics learning outcomes of students Junior High School 3 Sungguminasa on topic cube and cuboid.
2. The average score of students with high learning motivation in class VIII C after being taught using the cooperative learning model of type Numbered Head Together (NHT) with a topic cube and cuboid is 81.66 from an ideal score of 100. It is in category B that is the high category, while the average score of students with high learning motivation in class VIII I after being taught using the direct instruction model is 72.22 from an ideal score of 100. It is in category C that is the medium category.
3. The average score of students with low learning motivation in class VIII C after being taught using the cooperative learning model of type Numbered Head Together (NHT) with a topic cube and cuboid is 78.88 from an ideal score of 100. It is in category C that is the high category, while the average score of students with low learning motivation in class VIII I after being taught using the direct instruction model is 74.44 from an ideal score of 100. It is in category C that is the medium category.
4. For other researchers, this research can be a reference for further research by adding other relevant research variables to obtain accurate information.

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