

# APPLICATION OF THE INSIDE OUTSIDE CIRCLE COOPERATIVE LEARNING MODEL TO THE PYTHAGOREAN THEOREM M ATERIAL OF SMP NEGERI 13 BANDA ACEH STUDENTS

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#### ABSTRAK

The purpose of this study is to determine the Implementation of the Inside Outside Circle Cooperative Learning Model on Pythagorean Theorem Material for Students of SMP Negeri 13 Banda Aceh. The method used in this study is a quasi-experimental research method. The research design used was one group pre test-post test design. This research was conducted at SMP Negeri 13 Banda Aceh and was carried out on December 11, 2023 in class VIII in the odd semester of the 2022/2023 academic year. The population in this study was all 31 students of Class VIII SMP Negeri 13 Banda Aceh. While the sample is class VIII-5 consisting of 31 students. Most students obtained grades greater than or equal to KKM scores, with an

average score of 87.56. From the analysis of the t test, it was calculated that it was 3.82 greater than the table t. This shows that the Inside Outside Circle model affects the learning outcomes of Pythagorean Theorem material for grade VIII students of SMPN 13 Banda Aceh. The implementation of the Inside Outside Circle Cooperative Learning Model on the Pythagorean Theorem material grade VIII SMPN 13 Banda Aceh achieved maximum learning completeness. This model is very good to be applied to the teaching and learning process, because it can stimulate students to concentrate on the material being studied.

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#### INTRODUCTION

Education is one of the efforts to improve the intelligence of the next generation of a nation (Kurniawan, et al. 2022). Education is considered an important and strategic factor in national development, with efforts oriented towards improving the quality of human resources (Putri et al., 2020; Rogahang, 2019; Sukendar et al., 2019). Producing an *P-ISSN: 2355-004X E-ISSN: 2502-6801* / 131

intellectual generation and being able to combine knowledge and skills used as the basis of social life should be a top priority for education (Darmaji et al., 2019; Flores-Tena, 2020; Raharjo et al., 2019). These priorities are in line with the educational goals of improving abilities and preparing students to live in social life (Corsi, 2020; Musanna, 2017; Pozo-Armentia et al., 2020). Mathematics became the basis for other disciplines. The problems faced in learning mathematics include students feeling that mathematics is scary, boring, and confusing, so that the material delivered by teachers to students is not conveyed properly (Hudson, 2015). Education plays an important role in improving the ability to compete in the development of science and technology. Education should be managed systematically from the school curriculum through teaching activities, it aims to ensure that education is carried out in a timely and effective manner to achieve goals. In the teaching and learning process, the subject that is still not in demand by students is mathematics, this is because they consider mathematics to be a difficult and boring subject. Therefore, many students get poor grades in mathematics, and not a few of them avoid mathematics (Zuliana, 2015).

One model that is considered effective to be applied in mathematics learning is the cooperative learning model. The application of the cooperative model has proven effective in improving student achievement. All cooperative models focus on learning in groups rather than working together in groups. In cooperative learning, students are trained to be able to cooperate and acknowledge differences of opinion with others. The cooperative learning model in addition to helping students understand difficult concepts is also useful for helping students grow cooperation skills in their groups and train students in critical thinking so that students' ability to understand the subject matter delivered can increase.

One type of cooperative learning model is the Inside Outside Circle learning model or large circle and small circle. Inside Outside Circle is a learning model where students work in groups in a circular game and verbally summarize parts of the material learned. Inside Outside Circle is a learning model with a small circle and large circle system (Istarani, 2011: 129) where students share information with each other at the same time with different pairs briefly and regularly. The technique of teaching inside – outside – circle was developed by Spencer Kagan to give students the opportunity to share information at the same time. The most suitable study materials to use with this technique are those that require the exchange of ideas and information between students. One of the advantages of this technique is the presence of a clear structure that allows students to share with different pairs briefly and regularly.

The most suitable study materials to use with this technique are those that require the exchange of ideas and information between students. One of the main materials taught at SMP Negeri 13 Banda Aceh that requires the exchange of ideas and information between students is the Pythagorean Theorem material, although there is only one formula but the formula can be developed in various forms of models which in its use are widely used in solving spatial building problems. A Pythagorean Theorem was obtained from a Greek mathematician named Pythagoras who lived in the 6th century BC. This theorem applies only to right triangles. With Pythagorean Theorem two sides is known. Based on the 2013 curriculum, the Pythagorean Theorem material is studied in class VIII in the first semester.

#### METHODS

#### Approaches and types of research

The method used in this study is a quasi-experimental research method, namely experimental research carried out in one group only called the experimental group without any comparison group or control group. The research method of pseudoexperiments on the grounds that it is difficult to find a control class comparable to the experimental class, because the characteristics of junior high school students who are the subjects of research in each class are very diverse. The research design used was one group pre-test-post test design, which is experimental research carried out on one group that was randomly selected and did not test the stability and clarity of the group's condition before being treated.

This research was conducted at SMP Negeri 13 Banda Aceh and was carried out on December 11, 2023 in class VIII in the odd semester of the 2022/2023 academic year. Population is the entire research subject used as a source of research data (Suharsimi Arikunto, 2006: 130). The population in this study was all 31 students of Class VIII SMP Negeri 13 Banda Aceh. While the sample is part or representative of the population studied (Suharsimi Arikunto, 2006: 130).

Based on the existing population, the author only took one class as a sample, namely class VIII-5 consisting of 31 students. Sampling is carried out by purposive sampling, which is a sampling technique used by researchers if researchers have certain considerations in sampling (Suharsimi Arikunto, 2006: 130).

The data collection technique in this study is a test technique, and the instrument used is a test question. Where to use a single group pretest and post test. The experimental group before the treatment/program service was given a pretest and after getting the treatment/program service was given a post test.

To test the significance of the difference in the average learning outcomes of students who have not been treated and students after being given treatment, the data analysis used is a t-test. The t-test is used to test the significance of the difference in average student learning outcomes between KKM scores and teaching with the Inside Outside Circle model of mathematics, variance, and standard deviation.

## **RESULTS AND DISCUSSION**

## **Research Results**

In accordance with the research problems presented in Chapter I, this section presents the results of research and discussion, namely: The implementation of the Inside Outside Circle Cooperative Learning Model on the Pythagorean Theorem Material has reached completion at SMP Negeri 13 Banda Aceh.

Then because the data processing technique uses tests, the research results presented are test results. The test is in the form of an essay of 4 questions and the time needed to carry out this test is 2x40 minutes. The following is the material test score data of Pythagorean theorem of grade VIII students of SMP Negeri 13 Banda Aceh which is tabulated in the following table.

N.L.		Ques	stion	Number	and	Number	Percentage
INO	Student Code	1	2	3	4	of Scores	(%)
1	AS	20	20	30	10	80	80
2	AF	20	20	30	25	95	95
3	AZI	20	20	10	10	60	60
4	AM	20	20	30	25	95	95
5	DM	20	20	30	5	75	75
6	DF	20	20	30	10	80	80
7	FR	20	20	30	25	95	95
8	F	20	20	30	10	80	80
9	GPB	20	20	30	15	85	85
10	IF	20	20	30	5	75	75
11	KN	20	20	30	25	95	95
12	KS	20	20	30	10	80	80
13	MRH	20	20	30	24	94	94
14	MH	20	20	30	10	80	80
15	MHB	20	20	10	10	60	60
16	MM	20	20	30	24	94	94
17	MF	20	20	30	5	75	75

Pythagorean Theorem Material Test Score Data Table for Class VIII Students of SMP Negeri 13 Banda Aceh

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18	NA	20	20	30	10	80	80
19	NA	20	20	30	10	80	80
20	RU	20	20	30	10	80	80
21	RJ	20	20	30	25	95	95
22	RF	20	20	10	15	65	65
23	RI	20	20	30	23	93	93
24	SA	20	20	30	5	75	75
25	SP	20	20	30	10	80	80
26	S	20	20	30	15	85	85
27	SM	20	20	30	20	90	90
28	SY	20	20	30	10	80	80
29	TMAF	20	20	30	15	85	85
30	VY	20	20	30	5	75	75
31	ZA	20	20	10	16	66	66
Sum	$(\Sigma)$	620	620	850	437	2527	2527
Aver	age (x)	20	20	27,4 1	14,0 9	81,51	81,5
Perce	entage (%)	100	100	90,3 2	90,3 2	81,96	81,96

#### a. Normality Testing

Before the data is analyzed using the statistical test t, the data must first meet the analysis requirements, namely the normality of data distribution. The normality calculation steps are with a range of 35, the number of class 6 and the length of the interval class 6.

Based on the data above, a table of frequency distribution of test scores for grade VIII students of SMP 13 Banda Aceh was compiled as follows:

Table of Frequency Distribution List of Student Test Scores on Pythagorean	Theorem
Material	

Student Grade Interval	Frequency ( <i>f</i> <sub>i</sub> )	Middle Value ( <b>x</b> <sub>i</sub> )	$f_i x_i$	$x_i^2$	$f_i x_i 2$	
60 - 65	3	62,5	187,5	3906,25	11718,75	
66 - 71	1	68,5	68,5	4692,25	4692,25	
72 - 77	5	74,5	372,5	5550,25	27751,25	
78 - 83	10	80,5	805	6480,25	64802,5	
84 - 89	3	86,5	259,5	7482,25	22446,75	
90 - 95	9	92,5	832,5	8556,25	77006,25	
Sum	31	465	2525,5	36667,5	208417,75	

So, the standard deviation is = 9,43.

a. The test of data normality can be seen in the following description: Determine the interval class that has been determined in the previous data processing, then also

determine the real limit of the interval class, namely the upper limit of the interval class plus 0.5

b. Determine the area of the boundary area using the table "area under the standard normal curve from o to z" but must first determine the z-score value with the formula:  $z_{score} = \frac{Upper \ real \ limit - \overline{x}}{s}$ 

Ex: Interval Class 60 - 65 with real limits 59,5 dan 65,5 so

 $z_{score} = \frac{59,5-81,46}{9,43} = -2,32$  and  $z_{score} = \frac{65,5-81,46}{9,43} = -1,69$  so that the area limits obtained are 0.4898 and 0.4545. Likewise for the next interval class.

- c. With the known regional boundaries, it can be determined the area for each interval class, namely the difference between the two boundaries based on the z\_score curve, namely: 0.4898 0.4545 = 0.0353.
- d. The expected frequency () is determined by multiplying the area by the amount of data.
- e. The observation frequency () is the frequency of each class of intervals.

To a significant degree  $\alpha = 0.05$  with degrees of freedom (dk) = 5-1 = 4, hence from the Chi – Squared distribution table obtained  $\chi^2_{(0.95)(4)}$  =

9,49.  $Because\chi^2_{count} > \chi^2_{tablel'}$  so it can be concluded that the distribution of student test score data on the Pythagorean Theorem material class VIII SMP Negeri 13 Banda Aceh is not normally distributed so that it is eligible to be used as a sample in the study.

Furthermore, a list of normality tests was compiled for the distribution of test data for grade VIII students of SMPN 13 Banda Aceh in the following table.

			<b>SIVIL'IN 15</b>	Danua Acel	n	
Value	Class limits	Z For class	Area of normal	Area of each	Frequency of expectations	Picking frequency
	$(x_i)$	limits	curve	interval	$(E_i)$	$(0_i)$
			alea	Class		
	59,5	- 2,32	0,4898			
60 - 65		<b>,</b> -	-,	0,0353	1,0943	3
	65,5	-1.69	0.4545			
66 - 71	,-	,	-,	0,1014	3,1434	1
	71,5	-1.05	0.3531			
72 – 77	, -	,	-,	0,194	6,014	5
	77,5	-0,41	0,1591			
78 - 83	, -	-,	-,	0,2423	7,5113	10
	83,5	0,21	0,0832			
84 - 89	,	,	,	0,2191	6,7921	3
	89,5	0,85	0,3023			

Table of Normality Test List Distribution of Test Data for Class VIII Students of SMPN 13 Banda Aceh

90 - 95				0,1283	3,9773	9
	95 <i>,</i> 5	1,48	0,4306			
Sum					28,5324	31

To a significant degree  $\alpha = 0.05$  with degrees of freedom (DK)= 5-1 = 4, hence from the Chi – Squared distribution table obtained  $\chi^2_{(0.95)(4)} = 9.49$ . So,  $\chi^2_{hitung} > \chi^2_{tabel}$ , so it can be concluded that the distribution of student test score data on the Pythagorean Theorem material class VIII SMP Negeri 13 Banda Aceh is not normally distributed so that it is eligible to be used as a sample in the study.

# b. Hypothesis Testing

To test the hypothesis, the authors used t-test statistics at a significant level  $\alpha = 0.05$ . This hypothesis was tested using right-party test statistics because based on the previous explanation, the author suspected that the implementation of the Inside Outside Circle cooperative learning model on the Pythagorean Theorem material in students reached completeness.

- $H_0: \mu = \mu_0$ : The implementation of the Inside outside circle cooperative learning model on students' Pythagorean Theorem material has not yet reached completion.
- $H_a: \mu > \mu_0$ : The implementation of the Inside outside circle cooperative learning model on the Pythagorean Theorem material of students has reached completion.

In this  $case\mu_0 = 75$ , is a standard of completeness that is used as a guideline to find out the implementation of the Inside Outside Circle cooperative learning model on the Pythagorean Theorem material has reached completeness.

According to Sudjana (2005: 231) the test criteria for right-party t-test statistics using a significant level = 0.05 is reject H0 if tcalculate > ttable and accept Ha if in other cases.

With a significant level of  $\alpha = 0.05$ , degrees of freedom (dk) = (n-1) = 31-1 = 30, from the distribution list t (can be seen in the Appendix List Test t) obtained t\_(0.95)(30) = 1.697. Because tcalculate > ttable which is 3.82 > 2.09 which is located to the right of the rejection area H0. So it can be concluded that the implementation of the Inside Outside Circle cooperative learning model on the Pythagorean Theorem material has reached completion.

## **Discussion of Research Results**

This study aims to determine the effectiveness of the Inside Outside Circle cooperative learning model on the Pythagorean Theorem material of SMP Negeri 13 Banda Aceh students. In this study, researchers took samples of class V111-5 with purposive sampling techniques. The experimental class received the Inside Outside Circle cooperative learning model treatment.

The use of this learning model is expected to overcome the limitations of learning time in schools. In addition, the use of this model is expected to stimulate students in carrying out individual or group learning activities, can develop student independence outside of teacher supervision, can foster student responsibility and discipline and can develop student creativity.

Based on the data analysis that has been done, it can be known the effectiveness of the Inside Outside Circle cooperative learning model on the learning outcomes of grade V111 students of Pythagorean Theorem material. The data analysis obtained is as follows:

a. Student learning outcomes on Pythagorean Theorem material.

To determine the results of student learning on the Pythagorean Theorem material, a subjective test instrument in the form of a description is used. This test (post test) was carried out after the Inside Outside circle cooperative learning model was completed on the Pythagorean Theorem material. The results of the analysis showed that student learning outcomes on the Pythagorean Theorem material were the highest 95 and the lowest 60. While the average quality of learning outcomes on the Pythagorean Theorem material is 85.8 and the Standard Deviation is 6.041.

The improvement of student learning outcomes in this study can be seen from the test results given at the last meeting, namely an essay-shaped test totaling 4 questions. The expected ability is the student's thinking process in solving the given problem after the application of the Inside Outside Circle cooperative learning model. However, there are some students who have difficulty in solving the problems of the Pythagorean Theorem. The following will describe the students' answer errors in solving the Pythagorean Theorem problem presented in the following Table.

# The table describes students' answer errors on the Pythagorean theorem material with the Inside Outside Circle model of SMP Negeri 13 Banda Aceh

		Students	
Student Name	Question	Student Answers	Answer Key
MHB	A right triangle ABC has a hypotenuse side 35 cm long and the base side has a length of 28 cm. Determine the area of the	C 35cm	C 35cm
	triangle! C	A 28cm B	A 28cm B
	35cm	$L_{\Delta}ABC = \frac{1}{2} \times AB \times BC$	$L_{\Delta}ABC = \frac{1}{2} \times AB \times BC$
		$-\frac{1}{2} \times 28 \times 35$	$=\frac{1}{2} \times 28 \times$
	A 28cm B	= 980 cm <sup>2</sup>	= $490 \ cm^2$ So, the area of a triangle is $490 \ cm^2$
AZI	Known triangle PQR Right with length PR = 20 cm and magnitude $.Calculate thelength of PQ!P45^{\circ}20 cm$	P $45^{\circ}$ 20  cm R Q PR : PQ = 2 : $\sqrt{3}$ $20$ : PQ= 2 : $\sqrt{3}$ $20 \times \sqrt{3} = PQ \times 2$	P $45^{\circ}$ 20 cm R Q PR : PQ = 2 : $\sqrt{3}$ 20 : PQ= 2 : $\sqrt{3}$ 20 : $\sqrt{3}$ = PQ × 2 20 $\sqrt{3}$ = 2 PQ PQ = 20 $\sqrt{3}$ : 2

RQ	$\sqrt{3 \times 20} = PQ \times 2$	$= 10\sqrt{3}$ cm
		So, long PQ $10\sqrt{3}$ cm
		1045 cm

Based on the table above, the author found that the MHB was able to master the concept of the Pythagorean Theorem. But there is a concept when he solves the problem, it can be seen from the way he solves the problem

$$L_{\Delta ABC} = \frac{1}{2} \times AB \times BC$$
$$= \frac{1}{2} \times 28 \times 35$$
$$= 980 \ cm^2$$

He didn't share the results, so he didn't get the results, he should have replied:

$$L_{\Delta ABC} = \frac{1}{2} \times AB \times BC$$
$$= \frac{1}{2} \times 28 \times 35$$
$$= 490 \ cm^2$$

So based on the MHB's answer, then question no. 1 above can be categorized into a medium question because there are few concepts in the MHB answering it. Meanwhile, AZI is less able to master the Pythagorean Theorem material. It can be seen from the answer to test question number 2, he only answered half of the answer key. That's because AZI doesn't understand how to find roots. So based on the AZI's answer, question no. 2 above can be categorized into difficult questions. From the explanation above, the author concludes that the difficulties experienced by students in solving Pythagorean Theorem and lack of practice in solving Pythagorean Theorem problems.

b. The effectiveness of the Inside Outside Circle cooperative learning model.

To determine the effectiveness of the Inside Outside Circle cooperative learning model, a one-sided t-test (two-point similarity test) was used. The hypotheses proposed are Ho :  $\mu = \mu 0$  and Ha :  $\mu > \mu 0$ . From the results of the t-test analysis at a significant level of 4% with dk = 31-1 obtained tcount = 3.82 and ttable = 2.09. So it can be concluded that the Inside Outside Circle cooperative learning model on the Pythagorean Theorem material is quite effective. This means that the Inside Outside Circle cooperative learning model is suitable to be applied at SMP Negeri 13 Banda Aceh, especially on the Pythagorean Theorem material

## Conclusion

Most students obtained grades greater than or equal to KKM scores, with an average score of 87.56. From the analysis of the t test, it was calculated that it was 3.82 greater than the table t. This shows that the Inside Outside Circle model affects the learning outcomes of Pythagorean Theorem material for grade VIII students of SMPN 13 Banda Aceh. The implementation of the Inside Outside Circle Cooperative Learning Model on the Pythagorean Theorem material grade VIII SMPN 13 Banda Aceh achieved maximum learning completeness. This model is very good to be applied to the teaching and learning process, because it can stimulate students to concentrate on the material being studied.

## Suggestion

Based on the conclusions above, suggestions that can be given in the hope of improving the quality of mathematics learning and improving students' mathematics learning outcomes are as follows:

- The Inside Outside Circle learning model has a good influence on student achievement on the Pythagorean Theorem material, so teachers should be able to apply the learning model.
- 2. Teachers should choose the learning model that will be used when teaching in accordance with the material to be taught, because if the teacher uses the right model, student learning achievement will also increase.
- 3. In the teaching and learning process, mathematics teachers should reduce conventional and monotonous learning, one of which is using the Inside Outside Circle learning model as an alternative in mathematics subjects because using the learning model will motivate students to be better prepared for learning.
- 4. In order for students to be more enthusiastic when learning, teachers should further increase the motivation of students, for example by providing rewards in the form of additional value for students who have dared to express their opinions or by giving praise.

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