THE DIFFERENCE OF STUDENT'S SPATIAL ABILITY TAUGHT BY USING COOPERATIVE LEARNING TPS WITH STAD FOR GRADE VIII IN SMP NEGERI 4 PAKKAT

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ABSTRACT

The aim of this research is to know whether student's Spatial Ability taught by using Cooperative Learning TPS type is higher than Cooperative Learning STAD Type for Grade VIII in SMP Negeri 4 Pakkat. The population is all students of grade VIII in SMP Negeri 4 Pakkat. Sampling Techniques that is used in this research is random sampling. There are two samples in this research namely, Experimental class A is VIII-A taught by cooperative learning TPS and Experimental class B is VIII-B taught by cooperative learning STAD. Each of class consist of 34 students. This research using pretest and posttest where, data of pre test and post test are normal distribution and homogeneous. The result of the research shows that the average score of pretest in experiment class A and B are 37,6176 and 43,9142. After doing treatment in experiment class A and B obtained average score of posttest are 84,911 and 80. Hypothesis testing that have been conducted in this research is by calculating manually and results of hypothesis test of data from both experimental class in post test was found that $t_{calculated}$ $(2{,}11024) >$ t_{table} (1.66827). *It indicates that H_0 is rejected. So, we can conclude that Students' spatial ability taught by using cooperative learning TPS type is higher than cooperative learning STAD type.*

***Keyword**: Spatial Ability, TPS, STAD*

ABSTRAK

Tujuan dari penelitian ini adalah untuk mengetahui apakah Kemampuan Spasial Siswa yang diajarkan dengan menggunakan model pembelajaran TPS lebih baik daripada model pembelajaran STAD untuk Kelas VIII di SMP Negeri 4 Pakkat. Teknik pengambilan sampel yang digunakan dalam penelitian ini adalah random sampling. Ada dua sampel dalam penelitian ini yaitu, Kelas A adalah VII-A yang diajarkan oleh TPS dan Kelas B adalah VII-B yang diajarkan oleh STAD. Masing-masing kelas terdiri dari 34 siswa. Teknik analisis data terdiri dari normalitas, homogenitas, dan uji hipotesis. Penelitian ini menggunakan pretest dan posttest dimana hasil pretest dan postest berdistribusi normal dan homogen. Hasil penelitian ini menunjukkan rata-rata nilai pretest di kelas A dan kelas B adalah 37,6176 dan 43,9142. Setelah melakukan pembelajaran di kelas A dan B rata-rata nilai posttest nya menjadi 84,911 dan 80. Uji Hipotesis pada penelitian ini dihitung secara manual dan hasil uji hipotesis dari kedua kelas tersebut didapat bahwa $t_{calculated}$ $(2{,}11024) > t_{table}$ (1.66827) *ini mengakibatkan H_0 ditolak. Sehingga dapat disimpulkan bahwa model pembelajaran TPS lebih tinggi daripada model pembelajaran STAD.*

***Kata kunci:** Kemampuan Spasial, TPS, STAD*

BACKGROUND

Mathematics is a foundation and framework of the development of science and technology. In everyday life we use and need mathematical concepts and principles, as a tool in applications other disciplines as well as in the development of mathematics itself. Seeing the importance of the role of mathematics in everyday life, mastery of the subject areas of mathematics is a must. Mathematics is one of the most important subjects that provide several vital skills to the learners. The characteristics of math abilities also as principle and process standards in mathematics that will be developed in the National Council of Teachers of Mathematics (NCTM, 2000) are problem solving, reasoning, communication, connection, and representation. The five of characteristics are the goal to be achieved in mathematics learning.

In addition to these 5 ability math Material can develop other ability. One of the measurable abilities in mathematics is spatial ability (Subroto, 2016).

According to Tambunan (in Azustiani, 2017) defined that spatial abilities are abstract concepts which include spatial perceptions involving spatial relationships including orientation to complex abilities involving manipulation and mental rotation. Then the spatial ability of students is very important role in learning on the material geometry. Tambunan says that with good spatial ability can help in understanding about mathematical concepts.

Many definitions about spatial ability so that many of the definitions about the components in spatial ability. Three components in spatial ability according to Urfan (2016) Spatial intelligence gives individuals ability to define orientation and mobilization. Such capability can be represented as three capabilities of cognitive maps, cognitive collage, and spatial mental. These three capabilities represent the human ability to roam the earth's surface by transforming the various types of information obtained from the environment into spatial information.

Piaget & Inhelder (1971) (in Azustiani, 2013), mentions that spatial ability as an abstract concept which includes spatial relationships (the ability to observe the relationship of the position of objects in space), the frame of reference (the sign used as a benchmark to determine the position of objects in space), the projective relationship to see objects from different points of view), distance conservation (the ability to estimate the distance between two points), spatial representation (the ability to represent spatial relations by cognitive manipulation), mental rotation (imagine rotation of objects in space).

According to experts. Slavin (2016) defined Cooperative learning is the ideal solution to the problem of providing opportunities for cooperative and not superficial interaction to students from different backgrounds. Cooperative learning provides an opportunity for personal contact so that it can have a profound effect on intergroup relationships.

Students' mathematical spatial ability can be increased because students are required to think and cooperate with their peers, and not to hesitate to express their ideas and ask the teacher. One of the learning models that suits the characteristics is the cooperative learning model of think pair share (TPS). TPS type cooperative learning

begins with the students being asked to think about the material or problems the teacher conveys, then the students are asked to pair with the other person and express their own thoughts, some groups share the results of their discussion. In the share stage, the teacher directs the discussion on the subject matter and adds the material that the student has not disclosed. as the final activity, teachers and students draw the conclusions of learning.

In addition, there is also a Student Teams Achivement Divisions (STAD) model that can be applied to the process of teaching and learning. Student Teams-Achievement Divisions is a cooperative learning strategy created by Robert Slavin in which students are assigned to four or five member learning teams that are mixed in performance level, gender, and ethnicity. The teacher presents a lesson, and then students work together within their teams to make sure that all team members have mastered the lesson. Finally, all students take individual quizzes on the material, at which time they may not help one another. Students' quiz scores are compared to their own past averages, and points are awarded on the basis of the degree to which students meet or exceed their own earlier performance.

Cooperative learning TPS and STAD types has a relationship with the students' spatial ability. Where, cooperative learning TPS and STAD types differ in implementation steps, but they have influence in developing students' spatial ability. In lessons, students are required to actively think. in this case, students will be stimulated to develop ability of ability in the form of images, tables, graphs, or math symbol, etc., to solve the problem.

Based on the description above, the researcher has interested in conducting research entitled "The Difference of Students' Spatial Ability by using cooperative learning TPS with STAD for Grade VIII in SMP Negeri 4 Pakkat"

RESEARCH AND METHOD

This type of research is a kind of quantitative research, because the data obtained is quantitative data on students' spatial ability, which are used to analyze the data by using a hypothetical equality of two average to determine whether there are difference in student's spatial ability students who got a learning model of TPS and student STAD on the subject of cube and cuboid

The method used in this study is an experimental research. There are two types of study design is based on the merits of the experiment and perfect absence of experimentation, ie pre experimental design and true experimental design (Campbell & Stanley in Arikunto, 2009: 77). In this study the types of experiments are pre-experimental (not an actual experiment). This experiment is often also called quasi-experimental or experimental mock. Researchers use the type of pre-experimental studies because in this study did not use a control group.

The location of the research in this study will be conducted at SMP Negeri 4 Pakkat. The research will be conducted on topic cube and cuboid in Academic Year of 2017/2018.

Sampling Techniques that is used in this research is simple random sampling. Simple random sampling is the sample that is choose from a groups in population randomly. There are two samples in this research, they are one class for TPS as Experiment Class A and another one for applying for STAD as Experiment Class B.

This research is classified to quasi – experiment, while the research design of randomized contol group only.

based on the research objectives, researcher intends to use two groups pretest and posttest. Pretest given before treatment and Posttest is test that given after the treatment.

RESULT AND DISCUSSION

1. Difference of student's Spatial Ability of class A and class B

Table 1 Data Pre-test of Student's Spatial Ability of Experiment Class A and Experiment Class B

No	Statistics	Exp Class A	Exp Class B
1	N	34	34
2	Sum	1503	2754
3	Average	37,6176	43,9142
4	STDEV	11,3245	12,414
5	Variance	128,2433	154,107
6	Maximum score	54	63
7	Minimum score	17	21

Pretest result are obtained from the average of student's Experiment Class A is 37,6176 and the average of student's Experiment Class B is 43,9142.

Table 2 Data Post-test of Student's Mathematical Representation Ability of Experiment Class A and Experiment Class B

No	Statistics	Exp Class A	Exp Class B
1	N	34	34
2	Sum	2921	2754
3	Average	84,91	80
4	STDEV	8,4364	10,6287
5	Variance	71,1738	112,97
6	Maximum score	96	96
7	Minimum score	71	63

Post test result are obtained from the average of student's Experiment Class A is 84,91 and the average of student's Experiment Class B is 80.

2. Normality Test

Normality test was done in order to know whether the population of data was taken from normal distribution or

not. This is also important to be done before doing the inferential statistics analysis. Results of Normality test of data from both experimental class in normalized gain, was found that all $L_{calcutated}<L_{tabte}$. It indicates that data are normally distributed. Table below shows details of the test results.

Table 3 Normality Test data result

	Data	L_{cal}	L_{tab}	**Distribution**
Pre test	Experiment Class A	0,095897	0.151948	Normal
	Experiment Class B	0.075057	0.151948	Normal
Post test	Experiment Class A	0,111209	0.151948	Normal
	Experiment Class B	0.095237	0.151948	Normal

So, it can be concluded that data of pre test and post test of student's spatial ability with using cooperative type TPS and STAD are normal distribution.

3. Homogeneity Test

After normality test produced normal distribution population, homogeneity test is executed. Homogeneity test is done to know whether the sample of data were from population which has homogeneous variance or not. Homogeneity test is executed for both of experiment classes.

Table 4 Homogeneity Test data result (manually)

Data	**Biggest Variance**	**Smallest Variance**	F_{cal}	F_{tab}	**Conc**
Pretest	154,107	128,2433	1,201685	1.787822	Homogeneous
Post test	112,97	71,1738	1,587241	1.787822	Homogeneous

For pretest $\boldsymbol{F_{calculated}\,(1,201685) < F_{table}(1.787822)}$ and for post test $\boldsymbol{F_{calculated}\,(1,587) < F_{table}(1.787)}$
So, it can be concluded that variance population of student's spatial ability with using cooperative type TPS and STAD are homogeneous.

4. Hypotheses Test

Based on the normality and homogeneity test of the pre-test and post-test data. It can be concluded that sample is normal-distributed and homogeneous. Results of hypothesis test of data from both experimental class in normalized gain was found that $\boldsymbol{t_{calculated} > t_{table}}$. It indicates that H_0 is rejected. Table below shows details of the test results.

Table 5 Hypothesis Test data result (manually)

Average		$t_{calculated}$	t_{table}	H_0
Experiment class A	**Experiment class B**			
84,91	80	2,11024	1.66827	Rejected

From the table above can be seen that: $t_{calculated}(2,11024) > t_{table}(1.66827)$.So, we can conclude that the criteria of hypothesis testing is reject Ho. It means that Student's spatial ability taught by using TPS type is higher than by using STAD type.

5. Discussion

a. Spatial ability

One of the measurable abilities in mathematics is spatial ability. The ability of spatial can helps students in building concepts, understand mathematical ideas, and facilitate students in developing the skills they have. Spatial ability in mathematics learning is one of the standards to be achieved by students. But its implementation is not an easy thing because of the limited knowledge of teachers and students learn habits by conventional means. The development of students' learning outcomes is increasing where it relates to Piaget's theory that cognitive development is not only the result of organism maturity, nor is it the environmental influence, but the interaction between organism maturation and environment influence. Piaget's theory is also not much different from J.S Bruner's theory that the results of mathematics learning can be improved when doing a presentation, because the learning process, the concept will be more attached if doing the representation. Piaget's Theory and Bruner's Theory support this research about students' spatial ability.

For knowing the level of students' spatial ability, the researcher formulates the scoring guideline for every indicator. All indicators are exist in every problem given. The indicators are (1) Spatial Perception, (2) Mental Rotation, (3) and Spatial Visualization. This the table about mean score of spatial ability based on the indicator.

Table 6. Table of Mean Score of Students' Spatial Ability Test in Both of Experimental Classes

Indikator	TPS	STAD	Ideal Score
Spatial perception	**3,79**	**3,63**	**4,00**
Mental Rotation	**2,52**	**2,17**	**4,00**
Spatial Visualization	**3,91**	**3,81**	**4,00**

Next, the diagram below also represent difference of the mean score of students' spatial ability test in both experimental class A and class B.

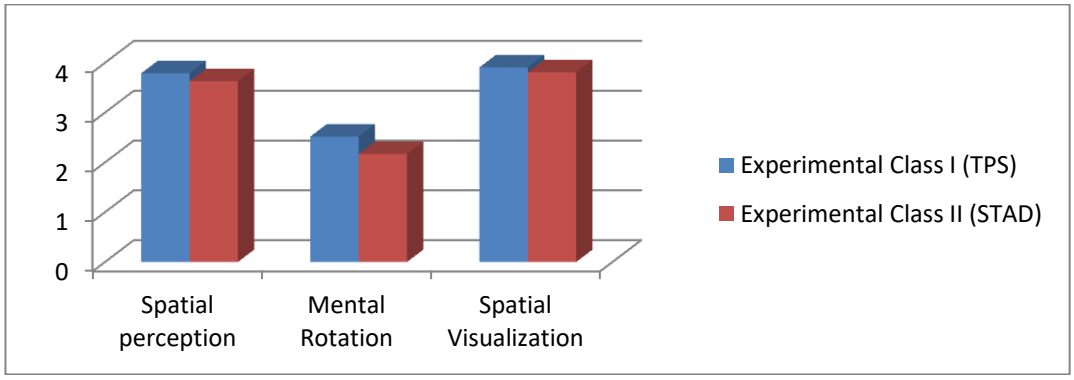

Figure 1 Diagram Bar of Mean Score of Students' Spatial Ability Test in Both of Experimental Classes

Based on the description above, we obtained the mean score of students' spatial ability test in experimental class I (Think Pair Share) is better than the mean score of students' spatial ability test in experimental class II (Student Teams Achievement Division).

b. Cooperative Learning TPS type.

TPS type cooperative learning begins with the students being asked to think about the material or problems the teacher conveys, then the students are asked to pair with the other person and express their own thoughts, some groups share the results of their discussion.

Nevertheless TPS is one of the simplest cooperative models that can be applied to improve student spatial. It is also common in this research, where average score of experiment Class A which is taught by TPS have increased from 37, 6176 (pretest) to be 84,9118 (post test). This is relevant with Zuhanisani (2016) states that the application of the TPS model is well used in improving the students' spatial intelligence than conventional learning, and the students' answers were taught with TPS were more varieties and better than conventional learning.

c. Cooperative Learning STAD type

In cooperative model learning STAD, the students are divided into learn teams consisting of four-five people that ability level , gender, and ethnic background are different.. In this case, Cooperative learning STAD type is also affect improvement of students' spatial ability.*"*. Occur in this research, where average score of experiment Class B which is taught by STAD have increased from 43,914 (pre-test) to 80 (post-test). However the researchers also found weaknesses of this cooperative namely time application was not enough and many students are noisy in class. This is relevant with Arcat (2014) showed that mathematical spatial abilities of students who get learning of the cooperative model of Winged-Wired STAD are also used and get good value.

From statement above can be seen that the cooperative learning TPS type and STAD type can improve spatial ability. But, in this case the researchers wanted to see the difference between the two cooperative learning which one is better. Research from Anggriani (2017) understanding of students' ability in cooperative model of TPS type better than STAD type cooperative model. Based on that statement, researcher surmised that Students' spatial ability

taught by using cooperative learning TPS type is higher than cooperative learning STAD Type.

When was held Research, both experimental class are given a pretest, treatment, and post test. Based on the answers that have been obtained, many students are not able to resolve question of the second indicator correctly because students have not been able to rotates an object. This is because in question in second indicator, students are required to be able Identify an object and elements that have been manipulated its position, where manipulation is a rotation of an object. Then from the test results, it was found that the ability of both classes are homogeneous and data from both classes are normally distributed. In hypothesis tests, the data are processed based on post-test shows that $t_{calculated}$= 2,11024 and t_{table}= 1.66827then it shows that $t_{calculated}>t_{table}$, it means H_0 rejected. So, researchers can conclude that Cooperative Learning TPS type is higher than STAD type in improving Student's spatial ability

CONCLUSION

Based on the problem formulation, research objectives, and result of research in the previous chapters, the data are processed based on difference of post-test shows $t_{calculated}$ = 2,11024 and t_{table}= 1,66827 then $t_{calculated}>t_{table}$ that it's mean H_0 rejected. So, can be concluded that Student's spatial ability taught by using cooperative learning TPS type is higher than cooperative learning STAD type.

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