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The Effect of Bruner Theory Implementation on Learning Outcomes on Solids Volume in Grade V Students at Public Elementary School Kebonsari 04 Jember

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Abstract: *This study aimed to determine the effect of the Bruner theory implementation on the learning outcomes of the solids volume subject of Grade V at Public Elementary School Kebonsari 04 Jember. This research focused on the solids volume material with Bruner's stages, which are enactive, iconic and symbolic. The research method used is an experimental method with a quasi-experimental research design and a non-equivalent control group design. The respondents in this study were class VA and VB, each of which consisted of 30 students. The results of the analysis obtained a mean value difference in the pretest and posttest; the experimental class was of 18,966 and the control class was of 11,900. The data obtained were then analyzed by using t-test. The analysis showed that there were significant differences in learning outcomes between groups of students who took part in learning with Bruner's theory and groups of students who did not use Bruner's theory in its application of* t_{count} *4,709 greater than 2,000. This shows that Bruner's theory affects the learning outcomes of the solids volume material in Public Elementary School Kebonsari 04 Jember.*

Keywords: Bruner's theory, solids volume, learning outcomes

1. INTRODUCTION

Mathematics is a discipline that is able to improve the ability to think and argue in solving everyday problems and provide support in the development of technology. Learning geometry in elementary schools needs to be taught and applied with thought processes that are in line with the abilities of elementary school students. According to Sunardi (2016), most teachers in learning geometry only give examples of concepts, but rarely provide examples of non-concept. Elementary school teachers tend to give formulas without inviting students to find or lower formulas and rarely present the nature relation among shapes. According to Yuniarti (2012) students' difficulties in learning are inseparable from the learning activities that have been taking place. The process of learning mathematics tends to be focused on achieving curriculum targets. The teacher considers if the indicators on the curriculum have been fulfilled then the teacher's task is complete. Preliminary observations in grade V of Public Elementary School Kebonsari 04 Jember obtained student learning outcomes in mathematics classified as low and not yet achieved the learning objectives.

Observations on teacher and student activities in the learning process are still focused by the teacher. Students have not been active and creative in taking notes, asking questions and expressing opinions. Inter-group discussions are also rarely held so there is a lack of interaction among students. The process of students in learning is less encouraged to develop ways of thinking. Students are only directed by memorizing formulas, using formulas, and working on problems. According to Jarvis (in Ibda, 2015), the concrete operational stage of a child has used logical thinking, but only the physical objects that are in front of him. The learning process is an attempt to make students learn, so that the situation is a learning event (event of learning) that is an attempt to change behavior from students.

According to Buto (2010), Bruner's theory is learning for students' cognitive development. According to Bruner, a person's cognitive development is through three stages, namely the enactive, iconic and symbolic (Malawi, 2019). The enactive stage is a sensory representation of the motor formed through action or movement. Presentation is done through the actions of children directly involved in manipulating an object. The iconic stage is related to images, which is the stage of learning something that is realized in the form of visual imagery, images or diagrams that depict concrete parts or concrete situations that are in the enactive stage. The symbolic stage is related to mathematical language and symbols.

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Applying Bruner's learning theory can be one of the actions that can be done by the teacher for teaching materials in the volume of space. Bruner's learning theory emphasizes learning that is adapted to the stages of cognitive development, namely the enactive stage, the iconic stage, and the symbolic stage, so that the inculcation of mathematical concepts implanted will be more meaningful. Not only understanding mathematical concepts, but also knowing the applications in everyday life.

Based on the explanation above, the research problem is formulated in this research namely (1) What are the steps in applying the Bruner learning theory to the subject of class volume building for grade V SDN Kebonsari 04 Jember? (2) "Is there a significant effect on the Bruner theory implementation on the solids volume learning outcomes of the V th grade students of Public Elementary School Kebonsari 04 Jember.

2. RESEARCH METHOD

The research method used is Quasi experiment with a nonquivalent control group design which can be seen 1 as follows (Sugiyono, 2018).

$$\begin{array}{cccc} E & : & 0_1 \quad x & 0_2 \\ \hline C & : & 0_3 & 0_4 \end{array}$$

Figure 1. Research Design *Nonequivalent Control Group Design*

Information:
E: Experimental class
C: Control class
O_1: Pre-test the experimental group
O_2: Post-test experimental group
O_3: Pre test control group
O_4: Post test control group
X: Treatment

This research was conducted at Kebonsari 04 Jember Elementary School with respondents grade in students of Public Elementary School Kebonsari 04 Jember, Sumbersari Subdistrict, Jember Regency in the academic year of 2019/2020 which consisted of VA and VB classes, consisting of 60 students. Previously, the two classes were tested for homogeneity from the midterm test results obtained sig 0,529 > 0,05 thus there is no significant difference The results of these calculations indicated the initial ability level of students before being treated is homogeneous. The variables involved are Bruner's theory as the independent variable and the learning outcome dependent variable.

Data collection techniques in the form of tests (pretest and posttest) which will be tested for data analysis using a separate sample t-test. The difference between the F test and the T test is the F test used to measure the magnitude of the difference in variance between the two or several groups. Whereas the T test is a test that measures the difference between two or several means between groups. The research instrument was validated by one lecturer of Mathematic Education at Jember University and 2 teachers of Public Elementary School Kebonsari 04 Jember. The result of the question calculation was declared feasible of 93% with a very decent category. The research was done by giving treatment to two samples with different methods; both samples will be given a pretest and posttest which its results will be analyzed to find out the difference. Data were analyzed in the form of different pretest and posttest values in the experimental class (VB) and control class (VA). Afterwards, it was analyzed to test the hypothesis as a basis for analysis in this study; the formulation of the statistical hypothesis was proposed as follows. Ha = There is a significant effect of the Bruner's theory implementation on the learning outcomes of the solids volume subject of Grade V at Public Elementary School Kebonsari 04 Jember academic year 2019/2020 by testing the t_{count} compared to the t_{table} at a significance level of 5%. Data analysis was done to answer the problem formulation submitted, then the t-test statistical analysis was performed. T-test calculations were supported by SPSS version 24.

3. RESULTS AND DISCUSSION

This study uses different pretest and posttest with the same problem, before the treatment students will be given pretest questions to find out the students' initial understanding, after the treatment the students will be given posttets about the final test. As for the matter of pretest and posttets in Figure 2 below.

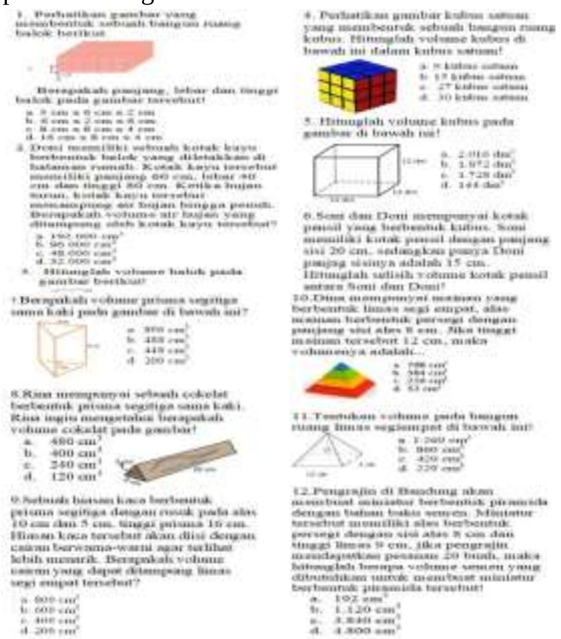

Figure 2. About the pretest and posttest

These questions will be used as a matter of pretest and postets in the treatment of the control class and the experimental class. The experimental class treatment uses the application of the Bruner learning theory, which has enactive, iconic and symbolic stages that are applied to the material of the volume of the geometric space.

The initial step of the present research was by giving pretest questions to two respondents namely the experimental class (VB) and the control class (VA) to determine the students' initial abilities. The teacher prepared real objects in the form of solids. The teacher directed students to observe these objects and to know each object to construct students' initial knowledge. In the enactive stage, students inserted unit cubes into transparent beams until they fulfill the transparent beams, can be seen in the picture 3 as follows.

Figure 3. Enactive stages

The teacher asked students to find the length, width and height of the beams. The iconic stage no longer used real objects but used pictures. The teacher prepared a beam picture. The students determined the length, width and height of the picture that has been explained and were able to find the multiplication result on the pictures listed. The students were directed to determine the interrelation of the results of the experimental image to determine the beam volume. Symbolic stage is a stage that no longer uses concrete objects or images but has used mathematical symbols. Students were able to use symbols to determine the volume of cubes and beams. After the Bruner stages were carried out, the teacher distributed student worksheets. The students would present in front of the class. The teacher with students would conclude the learning according to the Bruner stage.

The second meeting discussed about the volume of the triangular prism. In the enactive stage, the teacher directed how to determine the volume formula of a triangular prism. The teacher brought a beam-shaped object and a triangular prism made of cardboard. The teacher asked whether there is a relation between the beam and the triangular prism. The teacher asked students to cut one beam into two equal parts. The tudents found two triangular prisms in one beam. To prove it, the students poured sand into two triangular prisms, then it will be poured into the beam until it was full. The teacher asked students to measure the shape of the solid and calculate the volume of the triangular prism pyramid. In the iconic stage, the teacher provided a picture of a triangle prism solid that is obtained from half the volume of the beam attached to the blackboard. Students came forward and explained the picture by linking the two structures to make a mathematical concept. The teacher asked students to come forward and look for the volume of the triangular prism in the picture on the board. Furthermore, in the symbolic stage, the teacher directed students to use symbols to determine the volume of a triangular prism.

The third meeting discussed the volume of rectangular pyramid. In the enactive stage, the teacher divided the group into 5 each consisting of 6 students consisting of low, medium and high abilities. The teacher distributed rectangular pyramid, beam, and sand. The students poured sand into the beam until it was full. The students were directed to find a rectangular pyramid volume with two solids. The teacher directed students to be able to manipulate the two solids so as to form a concept, after finding how many times the pour was to form the volume of the pyramid, the teacher asked students to calculate the volume of the rectangular pyramid. Previously, it was known that the rectangular pyramid is one third of the beam volume formula with the same base size. The teacher asked students to calculate the volume of a rectangular on a concrete object. In the iconic stage, the teacher prepared rectangular beam and pyramid pictures in an upside down position that was put on the board. The teacher asked the students to observe the picture and be able to calculate the volume in the rectangular pyramid pictures with the known area of the base and height of the prism. An image is a real form according to the enactive stage so that students understood the picture of an object better. The students no longer imagined the picture of an object.

The teacher directed students to represent the enactive stage of the picture to determine the volume of the solid, and the students were able to find relation with an image. Using pictures was very helpful for students in constructing the understanding that was obtained in the enactive stage. In the symbolic stage, the teacher asked the students to use the mathematical symbols to determine the volume of rectangular pyramid. The teacher distributed the student worksheets and was able to conclude in accordance with Bruner stage. learning using learning becomes active. Menurut Whetten & Clark (1996) (dalam Hackathorn 2011:41) berpendapat "The most active teaching technique is

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the in-class activity. This is advantageous because students may not truly understand a concept until they have manipulated it for themselves.

This is an experimental research with the aim of knowing whether or not there is an effect of the Bruner theory implementation on the learning outcomes of the solids volume subject of Grade V at Public Elementary School Kebonsari 04 Jember. After the treatment, it can be calculated by using the t-test with SPSS version 24 shows in Table 4 as follows.

Table 4 t-test results
Independent Sampel t-test

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal Variances assumes	.817	.370	4.709	58	.000	7.066	1.50	4.062	10.070
Equal Variances not assumed			4.709	54.74	.000	7.066	1.50	4.058	10.074

Based on calculations by using the SPSS program, the mean value of the different pretest and posttest scores in the experimental class was 18,966, the mean difference in the pretest and posttest scores in the control class was 11,900. The results of calculations with the t test formula using SPSS obtained t_{count} = 4,709. This result was consulted with t_{table} with degree of freedom df = number of students in the experimental class and control class (30 + 30) - 2 = 58, at a significance level of 5% and obtained t_{table} = 2,000. Based on the analysis, t_{count} and tt_{able} (4,709 > 2,000) were obtained.

The results in this study indicate there are differences in the effect of learning outcomes used as benchmark for effectiveness indicators on the use of the Bruner's theory implementation. The relative effectiveness test results in the analysis of the data obtained ER = 45%, these results indicate that Bruner's theory is relatively about 45% compared to without using Bruner's theory.

Bruner's theory affects the difference in student learning outcomes of the experimental class which is higher than the control class. The stage that mostly contributes to the difference in learning outcomes is the enactive stage. In the enactive stage, the teacher carries concrete objects so that they can be seen, held and manipulated by students, so the learning process becomes interesting. The learning process in the experimental class students look more active; students are directed to recognize real objects then from the real objects drawn, they should write the picture that has been obtained. Learning is arranged from simple or easy things to the more difficult stages, which makes learning fun so that students do not get bored. Students will remember more about the material that is delivered by using Bruner's theory. This is in line with the opinion of Muhsetyo et al. (2011) concerning Bruner's theory, namely sharpening mental development. Students' mental abilities gradually start from simple activities to complex ones. It starts from easy to difficult and from the real to the abstract. These sequences can help students to follow learning more easily. The existence of systematic learning steps according to students' level of thinking, absolutely, make the concept of geometry easier to understand which is proven by the results of the posttest conducted, in line with the research done by Enggaringtyas (2019), it is found that the implementation of Bruner's theory can improve mastery of geometrical concepts and measurements.

The implementation of Bruner's theory in the learning process can be considered as providing a better effect than those who do not apply the Bruner theory. The findings in this study can be concluded that the Bruner's theory affects mathematics learning outcomes. Bruner's theory is one of the effective theories to improve student learning outcomes, in line with the research conducted by Ramadania (2015) stating that Bruner's theory affects student learning outcomes carried out by increasing learning outcomes in the three stages of Bruner's theory namely the enactive, iconic and symbolic. Bruner's theory can be implemented in teaching texts that are oriented to contextual problems as a medium that is easily understood and able to provide opportunities for students to be more active in contributing and interacting in the learning process (Marlina, 2016).

4. CONCLUSION

(1) Bruner's theory has three stages, namely the enactive, iconic and symbolic stages. the steps of learning begin by giving examples of tangible objects to build space. Next, the students' active stages fiddling with real objects. The iconic stage of students constructs through images and uses mathematical symbols.

(2) The learning average of Grade VA students is of 11,900 while the learning average of Grade VB which applies Bruner's theory is of 18,966. Based on the hypothesis testing by using the t-test using SPSS, it obtained tcount = 4,709. These results were then consulted with ttable with degree of freedom df = number of students in the experimental class and control class (30 + 30) - 2 = 58, at a significance level of 5% and obtained ttable = 2,000.

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