The Effect of Learning Hands-on Activity Media on the Mathematical Reasoning Ability of Junior High School Students

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Abstract. The purpose of this study is to analyze the effect of learning hands-on activity media on the mathematical reasoning ability of junior high school students. The approach of this research is quantitative by using the quasi-experimental method. The research design is pretest-posttest with experimental and control class. The subjects of this study were seventth-grade students of the junior high schools in three schools in Bandung, totaling 278 people. The research data was obtained using a mathematical reasoning ability test. The results of study show that; the reasoning ability of students who get hands-on activity media learning is better than students who get conventional learning.

Keywords: Learning Hands-on Activity, Media,Mathematical Reasoning Ability

1 Introduction

Mathematics is an abstract science of space and numbers [1]. Mathematical objects that are abstract in nature are their own difficulties that must be faced by students in learning mathematics. Not only students, teachers also experience obstacles in teaching mathematics related to its abstract nature. Learning in a pleasant atmosphere will be more effective and conceptual understanding increases [2]. In line with this, [3] states that “their levels of mathematics anxiety would decrease as their conceptual understanding of mathematical topics increases”. A pleasant learning atmosphere is created through improved learning that is learning that involves students to experience the learning process themselves not just transfer knowledge from researchers.[4] states that "mathematics should not be given to students as finished products ready for use, but rather as a form of activity in constructing mathematical concepts. Therefore, students are directed to do their own learning process (practice) to find mathematical concepts. Students are directed to practice what is being learned because students learn 10% of what is read, 20% of what is heard, 30% of what is seen, 50% of what is seen and heard, 70% of what is said, and 90 % of what is said and done (Dryden, 2001: 100) [2]. One of the media models that can improve students' understanding and reasoning skills is the hands-on activity media model. The nature of this learning media that can be manipulated is hands-on activity-based media.[5] Hands-on activity is all activities and direct experience of students with objects (living things or inanimate objects), students practice things thoroughly. In line with the above understanding.[6] suggested hands-on science is an approach that involves direct activities and

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experiences with natural phenomena or educational experiences that actively involve students in manipulating objects to gain knowledge and understanding.The problems in this study are " How the effect of learning hands-on activity media on the mathematical reasoning ability of junior high school students?."

2 Methods

The method used in this study is quasi-experimental, because research subjects are not grouped randomly or randomly, but in accordance with conditions in the field [7]. This study uses the Nonequivalent Control Group Design. There are two groups in this study, namely the experimental group and the control group. The experimental group was a class that obtained learning using Learning Hands-on Activity Media and the control group was a class that received scientific learning, according to the 2013 revised 2017 curriculum. The population in this study were all VII grade students of SMP Negeri in Bandung, West Java, Indonesia academic year 2019/2020. Samples were taken by simple random sampling technique, until three schools were obtained, each school was taken in two classes with a total of 162 students. The research design is as follows:

O X O

O O

O	:	Pretest or Posttest Mathematical Reasoning abilities.
X	:	Treatment (Learning Hands-on Activity Media).
----	:	class grouping is not random. [8]

3 Results and Discussion

3.1 Mathematical Reasoning Ability

The first step in the data analysis of the results of this study is a descriptive analysis of students' reasoning abilities for the three learning groups. The results of the calculations can be seen in the following **Table 1**.

Descriptively, it can be explained that the two groups show different average reasoning abilities. Learning groups with media hands-on activity are on average higher compared to conventional learning. However, both groups have the same tendency to spread to the right. This can be seen from the negative sign of skewness which means that the scores of all three groups tend towards "high" scores. High here is very relative, because when viewed from the average of the two groups and the Maximum Score is ideally 10, then both of them still show the ability of reasoning that is not yet optimal. When viewed from the data distribution, the group of students with conventional learning is more spread out than the group of students with hands-on activity media learning. Seeing the ideal maximum score of reasoning is 10, with the distribution close to 2 and the slope tends to the right, then there is a possibility that the distribution of the two groups does not spread normally.

Table 1. Student Reasoning Capability Statistics

LEARNING GROUP		Statistic	Std. Error
Media hands-on activity	Mean	4.2593	.16646
	Std. Deviation	1.49815	
	Minimum	1.00	
	Maximum	8.00	
	Skewness	-.046	.267
	Kurtosis	-.407	.529
Konvensinal	Mean	3.4074	.16922
	Std. Deviation	1.52297	
	Minimum	.00	
	Maximum	7.00	
	Skewness	-.135	.267
	Kurtosis	-.499	.529

3.2 Comparative Test Results of Reasoning Ability

Subsequent analysis was carried out to test inferential comparison of mathematical reasoning abilities between groups using media hands-on activity and conventional. To choose the statistical test used the first step is to test the distribution distribution assumptions. The results of the calculation are as follows **Table 2**.

Table 2. Normality Distribution Test Results Reasoning Ability

LEARNING GROUP	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
Media hands-on activity	.171	81	.000	.949	81	.003
Konvensional	.182	81	.000	.936	81	.001

The test results above show that both groups in the Kolmogorov-Smirnov and Shapiro-Wilks tests do not meet the assumption of normality. These conditions provide the consequence of selecting a comparison test of mathematical reasoning ability between the two groups using the non parametric statistical test, in this case the Mann-Whitney U test was chosen. This test is seen as the most powerful compared to the tests of the other two non-parametric groups [9]. The results of the calculation are as follows **Table 3**.

Table 3. Comparative Test Results of Reasoning and Conventional Reasoning Capabilities

Test Statistics[a]	Reasoning
Mann-Whitney U	2317.000
Wilcoxon W	5638.000
Z	-3.291
Asymp. Sig. (2-tailed)	.001

The results in the table above conclude that the reasoning ability of students with the use of media hands-on activity is better at the real level of 0,0005 compared to the ability of students with conventional learning. This means that the use of media hands-on activity in learning mathematics, especially geometry, provides a meaningful role in students' reasoning abilities.

4 Discussion

The results showed that students with learning using Hands-on-activity media were better than students using conventional learning. This is possible because through learning to use Hands-on-activity media students can build knowledge in their own way through geometrical activities given flat. This is in line with the opinion of Sabandar [10] which states that adequate opportunities and equipment need to be provided so that students can observe, explore, try and find geometrical principles through informal activities to then proceed with formal activities and apply what they learn. Learning is carried out on the material flat build using Hands-on-activity is done in groups, in this case the teacher gives students the opportunity to develop their actual abilities. Students who find it difficult to develop their abilities, ask other friends who already understand first. If this does not work, the teacher provides scaffolding to help the student. Meanwhile, through discussions with classmates or asking the teacher and discussed in class together the potential abilities of students are more developed so that students' understanding of mathematics is even deeper. One of the foundations that can be used to achieve these goals is the Zone of Proximal Development (ZPD) from Vygotsky [11], which states that learning can evoke a variety of stored mental processes that can only be operated when someone interacts with adults or collaborate with friends. Based on Bruner's learning theory [12] explains that knowledge can be internalized in the mind, so that knowledge can be learned in three stages, namely:

1. Enactive Stage At this stage knowledge is actively learned using concrete objects or real situations
2. Iconic Stage At this stage knowledge is presented in the form of visual images or images that illustrate the concrete activities contained in the enactive stage.
3. Symbolic Stage At this stage knowledge is presented in the form of symbols

Learning examples prove the area of the trapezoid. The teacher gives an example of how to prove the area of a trapezium with the rectangular approach as follows **Figure 1-5**:

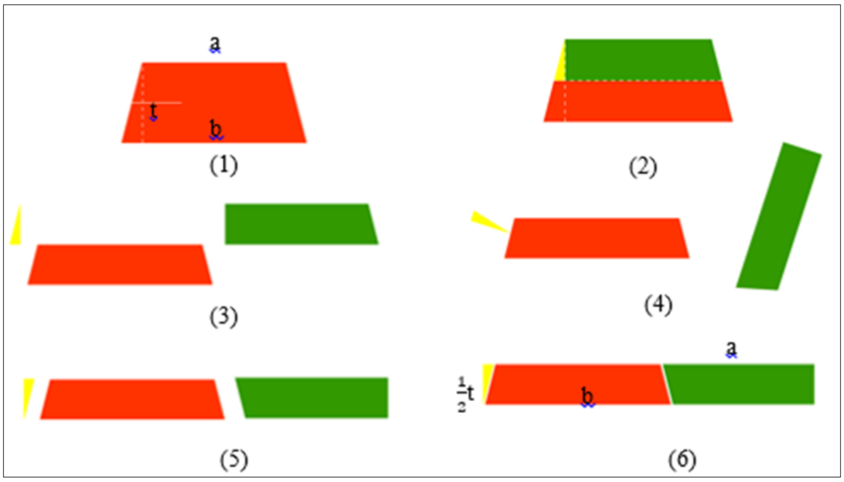

Fig. 1. students prove the area of a trapezium with the rectangular approach

So the area of the trapezoid = the area of the rectangle
= length x width
= (a + b) x $\frac{1}{2}$ t
= $\frac{1}{2}$ t (a + b)

Students construct trapezoidal areas other than those exemplified by the teacher, the following results of student work.

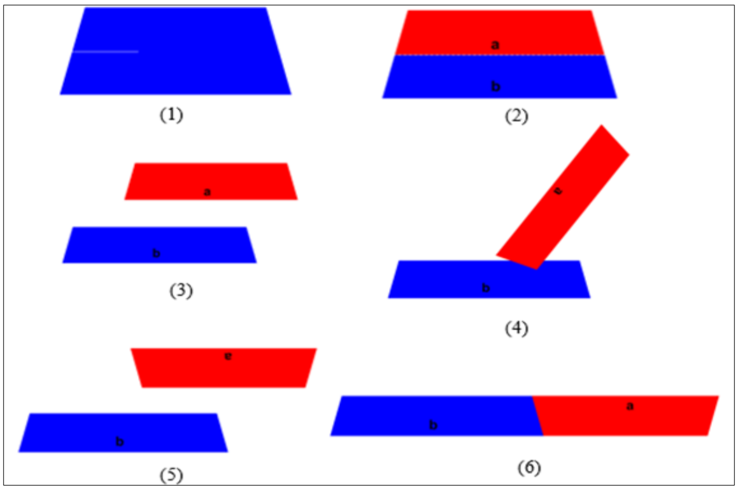

Fig. 2. Steps Students construct trapezoidal areas

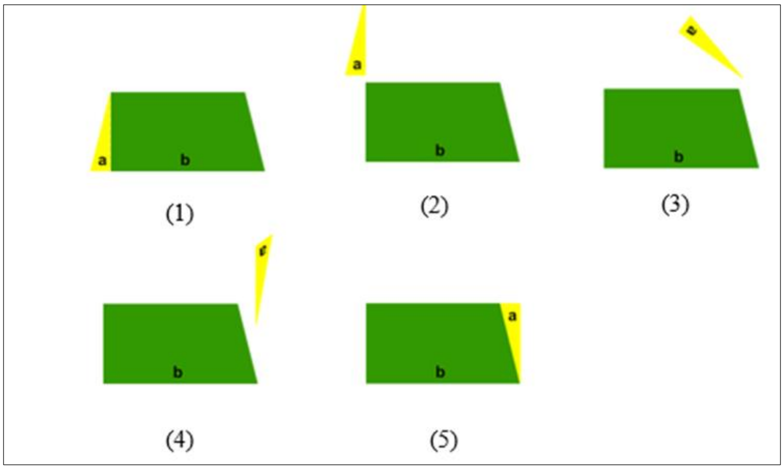

Fig. 3. Steps Students construct trapezoidal areas

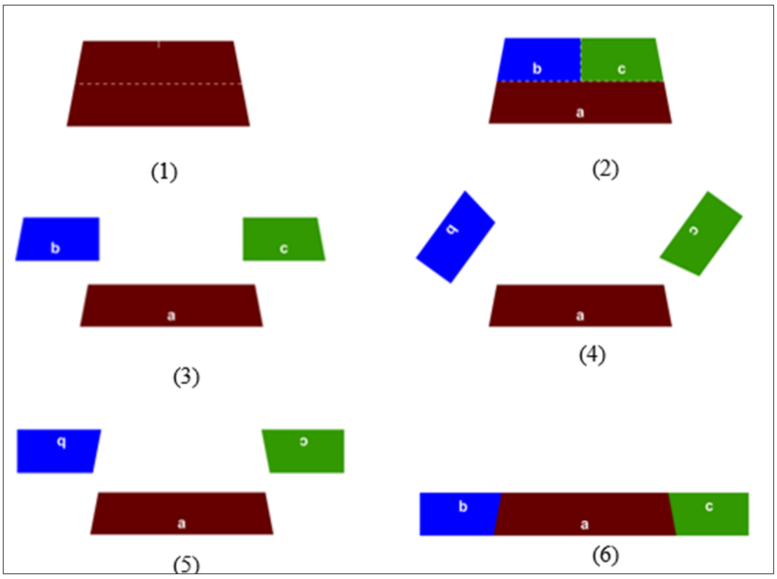

Fig. 4. Steps Students construct trapezoidal areas

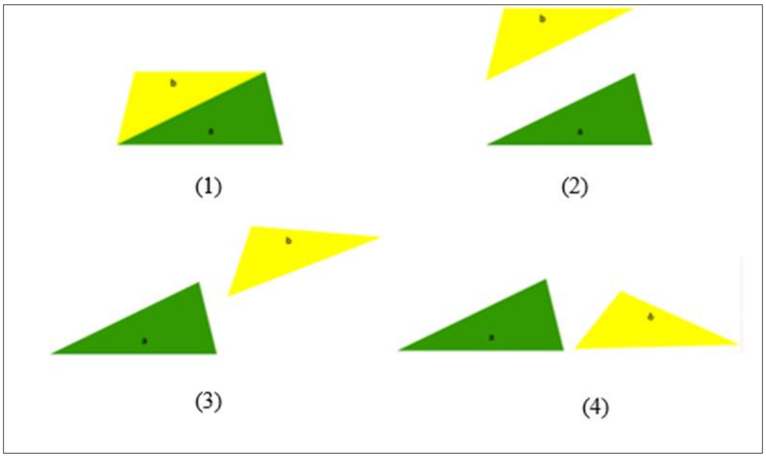

Fig. 5. Steps Students construct trapezoidal areas

5 Conclusion

Based on the results of the research and discussion above it can be concluded:

1. Students' reasoning abilities with the use of teaching aids are better than those of students with conventional learning
2. Students can construct understanding of concepts based on their abilities. This means that learning with Hands-on-activity media has a considerable influence on students' reasoning abilities.

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