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THE USE OF OPEN-ENDED LEARNING MODELS IN TERMS OF STUDENTS' MATHEMATICAL CREATIVE THINKING ABILITY

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Abstract

This research aimed to find out the differences of the improvement of students mathematical creative thinking skill using open-ended. This research used quasi experiment method whith pretest-posttest control group. The subjects of this research were 60 students at class VII in one of the MTs in Bandar Lampung city. There are two classess in this study namely the experimental class consisted of 30 students getting open-ended learning models and the second control class consisted of student getting scientific approach. The instrument of this study used student creative thinking skill test, based on mathematical creative thinking indicator. The result of this study showed all of improvement of mathematical creative thinking students ability getting open-ended learning model was not better then students getting scientific approach.

Keywords: *Mathematical Creative Thinking; Open-Ended Learning Model*

1. INTRODUCTION

Mathematics is a universal science that is useful for human life and also underlies modern development, and has an important role in various disciplines and advances human thinking [1]. Mathematics subjects exist from elementary school, junior high school, upper secondary to college in order to equip students with the ability to think logically, analytically, systematically, critically, innovatively, and creatively and work together. In the process of learning mathematics in the classroom, the teacher does not play a role only as a transfer of knowledge in teaching. But it must be able to develop or

create a student mindset in learning. The mindset is students' creative thinking in learning mathematics.

Based on the results of observations made by Nuraini [2], obtained that students' creative thinking ability is low, this can be seen from the symptoms, namely: (1) students still find difficult to do questions that are different from the form of examples given by the teacher, (2) in doing the questions, students still focused on one formula and have not been able to find and solve problems in alternative ways other than the examples given by the teacher, (3) in doing the questions, some students still do not apply using detailed steps, (4) students lack the confidence and courage to ask questions or express their opinions on the problems given by the teacher so that this can reduce the creativity of students. Based on this, it can be suspected that the mathematics learning process is less comfortable [2]. A preliminary study conducted at MTs Al Hikmah Kedaton Bandar Lampung stated that the achievement of creative thinking of MTs Al Hikmah students was relatively low based on the results of the trial of students' mathematical creative thinking ability tests.

Based on the results of research conducted by Nuraini [2] the degree of improvement of students' mathematical creative thinking ability in the class is 11.16%, the average score of the creative thinking ability of the experimental class is 49.87 and the control class is 41.45. The students' mathematical creative thinking ability is categorized as moderate so that it is suspected that it can be improved by using different learning models and learning materials from previous research. The experimental class is a class that receives open-ended treatment in the learning process in the classroom, while the control class is a class that does not receive treatment in the learning process in the classroom, namely adjusting to existing learning in school.

Creative thinking is a process that produces new ideas. According to Supardi [3] creative thinking is an individual's skill in using his thought process to generate new, constructive, and good

ideas, based on rational concepts, perceptions, and individual intuition. So that in everyday life can increase human resources who are more creative. Referring to the notion of creative thinking, it can be said that creative thinking is so important for students in learning mathematics [2].

The importance of creative thinking for students, namely, the first, by being creative, a person can actualize himself to increase and develop self-confidence. The second, creative thinking is the ability to see various possible solutions to a problem. The third, students carry out creative activities that are not only beneficial for themselves and the environment but also provide satisfaction to individuals. The fourth, it can improve the quality of life by means of creative thinking [3].

To improve and develop students' creative thinking skills, the efforts made are to develop interesting and diverse learning activities, utilize and improve a conducive environment in supporting the development of students' creativity. So, one of them by creating a learning atmosphere and managing classes that can build students' creative thinking that can lead students into creative and independent learning situations. In this case the teacher's role is as a facilitator and motivator of students to build students' mathematical knowledge independently. The learning model that is thought to be able to improve students' mathematical creative thinking ability is the open-ended learning model.

Open-ended is a learning model that usually begins by giving students problems. The problem in question is an open problem that provides opportunities for students to be able to formulate the problem with multiple correct answers. The purpose of open-ended is to help develop students' creative activities and mathematical thinking patterns through simultaneous problem solving. Thus, the problem referred to in open-ended is not to get an answer but rather to emphasize how to arrive at an answer.

Open-ended presents an opportunity for students to investigate various strategies and ways that they believe are in accordance with the ability to elaborate problems with the aim that students' mathematical creative thinking abilities develop optimally and at the same time the creative activities of each student are communicated through the learning process. So that the main core in learning that applies open-ended is a learning that builds interactive activities between mathematics and students so that it invites students to answer problems through various strategies.

2. RESEARCH METHODS

Research purposes

This study aims to determine the improvement of students' mathematical creative thinking skills in the experimental class by using an open-ended learning model and the control class using a scientific approach.

Research subject

The subjects in this study were all the seventh grade students at MTs Al Hikmah Kedaton Bandar Lampung for the 2018/2019 academic year.

Research methods

The research method is a quasi-experiment research. Research subjects are used in circumstances that make it impossible to control or manipulate relevant variables because they can interfere with the learning schedule in schools and groups that already exist naturally. Quasi-experiment research is used to involve the experimental class and class control. This study used a pretest–posttest control group research design [4].

Data collection technique

In this study, the authors collected data obtained from the pretest and posttest of students' mathematical creative thinking abilities in the experimental class and the control class. Pretest data was obtained from the value before the treatment was held. While the posttest data obtained from the value after treatment on the subject of social arithmetic.

Research Instrument Development

The test instrument used in this study was in the form of students' mathematical creative thinking ability test questions given at the pretest and posttest. This test instrument was given to the experimental class and the control class on the subject of social arithmetic where the tests given to both classes were the same. Guidelines for giving students' mathematical creative thinking ability test scores can be seen in Table 1.

Table 1 Mathematical Creative Thinking Ability Test Score

No	Assessment Aspect	Assessment rubric	Skore
1	Fluent Thinking Skills	Not giving an answer or giving the wrong answer	0
		Giving one unfinished answer	1
		Give one correct and correct answer	2
		Give two answers with one of the answers is not correct	3
		Give two or more correct answers	4
2	Flexible Thinking Skills	Not giving an answer or giving an answer in one or more ways but wrong	0
		Give an answer in one way and there is an error in the calculation so that the result is wrong	1
		Give answers in one way and correctly.	2
		Giving answers in more than one different way, one way is correct but the other way is not finished.	3
		Give answers in more than	4

			one different and correct way.	
3	Originality Authenticity	or	Does not provide an answer or a solution	0
			Give answers in a way that is often used	1
			Giving answers in their own way but not understandable	2
			Giving answers in their own way, has been directed but there is an error in the calculation	3
			Give answers in your own way and correctly	4

Adaptation from [5].

Instrument Validity

Testing the validity of this test uses product moment correlation [6]. Then the results of the Validity calculation for each item are calculated with the help of the International Business Machine (IBM) Statistical Product and Service Solutions (SPSS) Version 20 program in Table 2.

Table 2 Validity Results for Each Item
Students' Mathematical Creative Thinking Ability

Question Points	r count	r table	Classification	Interpretation
1	0,444	0,361	Currently	Valid
2	0,336	0,361	Low	Invalid
3	0,497	0,361	Currently	Valid
4	0,440	0,361	Currently	Valid
5	0,133	0,361	Very low	Invalid
6	0,686	0,361	Tall	Valid
7	0,507	0,361	Currently	Valid
8	0,677	0,361	Tall	Valid
9	-0,023	0,361	Very low	Invalid

Reliability

To test the reliability of this instrument, Cronbach's alpha formula is used. Reliability calculations were carried out with the help of the IBM SPSS 20 program. The result of the reliability calculation is 0.521 which indicates the item is reliable.

Distinguishing Power

Distinguishing power is used to determine the ability of a question to distinguish between high-ability students and low-ability students. The following is the discriminatory power index for the test or essay question [6]. The calculation of discriminatory power of questions using the help of IBM SPSS Version 20 can be seen in the following table 3.

Table 3 Results of Distinguishing Ability Mathematical Creative Thinking Siswa

Item Question	D	Classification
1	0,444	good
2	0,336	good
3	0,497	good
4	0,440	good
5	0,133	Bad
6	0,686	good
7	0,507	good
8	0,677	good
9	-0,023	Bad

Difficulty Level

The difficulty level of the item states the proportion of the number of students who correctly answered the item to all test participants. The complete calculation of the difficulty level with the help of Microsoft Excel 2007 can be seen in table 4.

Table 4 Results of the Difficulty Level of Students' Mathematical Creative Thinking Ability Questions

Item Question	P	Classification
1	0,455	Currently
2	0,244	Hard
3	0,522	Currently
4	0,222	Hard
5	0,011	Hard
6	0,566	Currently
7	0,266	Hard
8	0,255	Hard
9	0,033	Hard

Based on Table 4, it can be seen that the questions consist of 6 questions with difficult classification and 3 questions with moderate classification. For the purposes of this study, of the nine questions tested, only six questions were used, namely questions number 1, 3, 4, 6, 7, 8. The selection of the six questions was based on calculation, validity, discriminating power, and the level of difficulty of each item. question.

Data analysis

N-Gain

Normalized Gain (N-Gain) with the formula according to Meltzer in Istianah [8].

Data Normality Test

The calculation of the normality test of the data in this study using the help of IBM SPSS Version 20, the calculation of the normality test was carried out using the Kolmogrov-Smirnov.

The formulation of the hypothesis for testing the normality of the data is as follows:

H_0 : data comes from a normally distributed population

H_1 : data comes from a population that is not normally distributed

Test Criteria:

if Sig > 0,05 data is normally distributed

if Sig < 0,05 data is not normally distributed

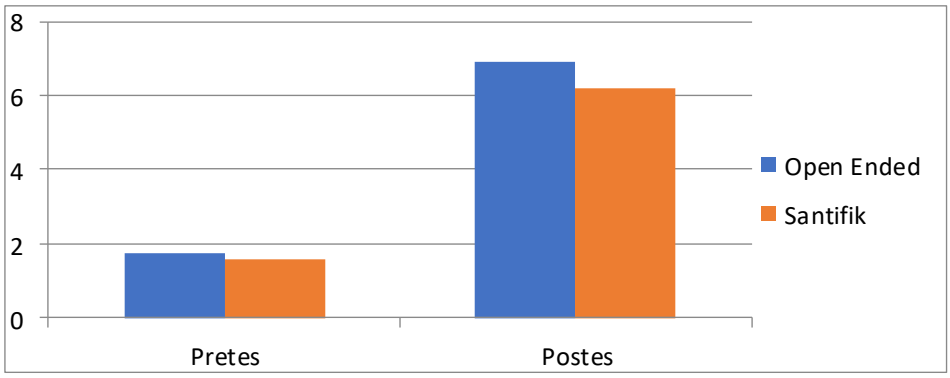
Non-Parametric Test

The non-parametric method is a method that applies to data that are not normally distributed. The non-parametric test in this study was the Mann-Whitney (U test) for a large sample with a significance level. steps in the Mann-Whitney U test.

3. RESULTS AND DISCUSSION

Research result

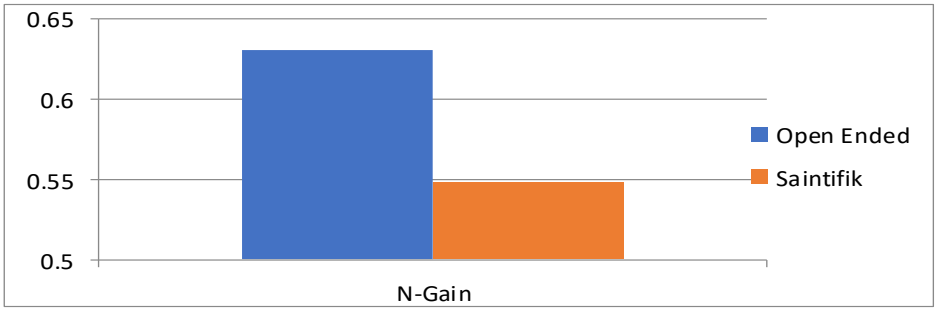
Improving students' mathematical creative thinking skills can be seen in the following graph 1.



Graph 1 Students' Mathematical Creative Thinking Ability

Based on Graph 1, the average mathematical creative thinking ability pretest of experimental and control class students is 1.77 and 1.60, respectively. Meanwhile, the average posttest class that received learning with an open-ended learning model was 6.93 and the class that received learning with a scientific approach was 6.20.

For the average N-Gain mathematical creative thinking ability of students in the experimental and control groups as a whole, it can be seen in graph 2.



Graph 2 N-Gain Students' Mathematical Creative Thinking Ability

Based on Graph 2, the N-Gain of students' mathematical creative thinking abilities for the experimental class who received learning

with an open-ended learning model and the control class that received learning with a scientific approach were 0.630 and 0.548 both included in the medium category. Based on Graph 2, the N-Gain of students' mathematical creative thinking abilities for the experimental class who received learning with an open-ended learning model and the control class that received learning with a scientific approach were 0.630 and 0.548 both included in the medium category.

Discussion

Based on the description of the research results, it can be seen that in both learning with an open-ended learning model and a scientific approach, students' mathematical creative thinking skills have increased even though not significantly, but from the results of data analysis and statistical tests, it is stated that the increase in students' mathematical creative thinking skills who receive learning with an open-ended learning model is not better than students who get learning with a scientific approach.

The inability to increase students' mathematical creative thinking skills is indicated by students not being familiar with learning using open-ended worksheets which require students to be able to solve problems with many variations of answers. This is based on Pavlov's theory in Suherman revealing the concept of habit (conditioning) in teaching and learning activities so that students learn well, it must be accustomed [9]. Based on this theory, so that students learn well, they must be familiarized with the use of a learning model so that it can be suspected that one of the causes of the unattainable increase in students' mathematical creative thinking skills is that students are not accustomed to learning using open-ended worksheets, because in general students are accustomed to the same learning that given by the teacher, the teacher gives examples and students write down the answers to the questions given in the same way that the teacher gives.

The situation or atmosphere of the school environment that is less supportive is suspected to be the cause of the inability to increase students' mathematical creative thinking skills. This is in line with the Gestalt Theory in Suherman suggesting external factors that influence student learning conditions, namely the implementation of student learning activities must pay attention to students' intellectual readiness, set the classroom atmosphere so that students are ready to learn [9]. Based on this theory, the classroom atmosphere is an inhibiting factor in increasing students' mathematical creative thinking skills, the position of the class adjacent to the process of building a new classroom which makes the learning process disrupted by the sounds of construction tools and construction work is suspected to be the cause of the poor condition and atmosphere of the school environment. less supportive.

This is in line with Djadir and Sahid suggesting an indication of not being able to apply open ended to social arithmetic material, namely, students are not familiar with learning using worksheets so that students need a lot of time to get mathematical concepts or principles related to social arithmetic material, time used in the learning process is not representative of the activities to be carried out, so the time to solve the problem is very limited [10]. Furthermore, Ansori and Sutrisna suggested that the increase in creative thinking in social arithmetic material was not achieved because students were not able to solve problems because students did not understand the problem commands and students' abilities were low in presenting a number of different ways of solving a problem [11]. These two opinions are in line with those stated by Yunianta in Olson stating the obstacles in increasing creative thinking, namely, habits or traditions, limited time, environment, fear of failure, and complacency [12].

4. CONCLUSIONS AND RECOMMENDATIONS

Conclusions

This research is related to social arithmetic material for class VII students at one MTs in Bandar Lampung City for the 2018/2019 academic year. Based on the results of data analysis and discussion of research results, it can be concluded that the increase in students' mathematical creative thinking skills is not significant with an average increase of 0.630 and is classified as moderate. So it can be said that the improvement of students' mathematical creative thinking skills who receive learning with an open-ended learning model is no better than students who receive learning with a scientific approach.

Recommendations

Open-ended learning model in mathematics learning, as an alternative learning model that can improve students' mathematical creative thinking skills. In teaching certain topics using open ended, teachers need to prepare and spend more time so that students' creative thinking skills can be improved. For similar research or further research, it is necessary to know in advance the prerequisite concepts of students and the learning approaches that have been received by students so that the results are maximized, it is recommended that further research examines learning with an open-ended approach to the subject of social arithmetic.

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