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Realistic Mathematics Education Of Indonesia, Mathematically Disposition, and Mathematically Creative Thinking of Junior High School

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Abstract

The purpose of this study was to examine the effect of Approach Realistic Mathematics Education of Indonesia and mathematically dispositions toward mathematically creative thinking ability of students junior high school. This study was a quasi-experimental study used to reveal a causal relationship by engaging the control group in addition to the experimental group. Subjects ware 72 eighth grade students at 2013/2014. A test was administered to assess mathematically creative thinking ability and questionnaire was used to measure students' mathematically dispositions. Data were analyzed by two ways ANOVA. The results showed that there was significant difference mathematically creative thinking ability between the students taught using approach Realistic Mathematics Education of Indonesia and those taught using conventional method and among groups of students who have a mathematical disposition of high, medium, and low. There was a significant interaction between learning approaches and mathematically disposition towards mathematically creative thinking ability students. That is, mathematically creative thinking ability of students depend on the approach method and students' mathematically dispositions.

Keywords: Realistic Mathematics Education of Indonesia, mathematically disposition, mathematically creative thinking ability, junior high school students

1. Introduction

Based on the 2013 curriculum, graduation competency standards SMP curriculum has three domains namely attitude (affective) domain, knowledge (cognitive), and skills (psychomotor). Domain attitudes include: (1) has a behavior that reflects attitudes; (2) those who believe, noble, self-confident, and responsible in interacting effectively with the social and natural environment; (3) as well as in established itself as a reflection of the nation in the association world. Domain knowledge include: (1) has a procedural and metacognitive knowledge in science, technology, arts, culture, humanities, the concept of nationalism, state, and civilization; (2) related to the cause of phenomena and events that seem eye that covers the causes, alternative solutions, constraints and the final solution. And domain skills include: (1) have the ability to think and follow an effective and creative in the realm of the abstract and the concrete; and (2) related to the development of the learning in schools according to their talents, interests, and abilities (see [3]).

Related to the above standard one junior high school graduation is that students have the ability to think creatively in the abstract and the concrete. The ability to creatively thinking is the highest cognitive thought processes and also as one of the learning objectives of mathematics. Next will arise the question of how a way to find out if students have the ability to think creatively? The answer is to see whether the indicators of students' creative thinking have owned. According Munandar (see [8]) indicator of the ability to think creatively, namely: (1) fluency; (2) flexibility; (3) originality; (4) Elaboration.

Based on the research that has been done on 2013/2014 school year, researchers found that the mathematical creative thinking abilities of students in several high schools (SMP) in Palembang has not reached the expected goals, both in terms of value and the overall average of the mean The average of each indicator mathematical creative thinking abilities. Average-ability junior high school students solve the problems of creative thinking mathematically 40.57 only classified in the low category (see [5]). This is of course concerned about the various parties involved in considering the urgency of mathematics education as one of the most important lessons that must be mastered by every person who wants to achieve success in life (see [6]).

According Sabandar (see [9]), often mathematical problems faced by the students not to be able to find a solution so he needs to have the skills to think that he can find the right way to solve his problems. To drive in a proper way in the problems of students in a math problem, then surely needed an approach to the learning process. Approach to the learning process that is less good will affect the way students learn less well too. How to learn the good will make students less quickly despair if students do not immediately find the solution of mathematical problems doing. Therefore, the teacher needs to try an approach that is different in the learning process, to be able to help students improve the interaction between students and the impact on mathematical creative thinking abilities.

One approach is to start learning learning using real phenomena and applications for students, a problem given the contextual issues. In solving the problem of contextual constructive teacher-led student to understand the concepts students learned, through the rediscovery of concepts and mathematical formulas. Rediscovery of concepts and mathematical formulas done through the investigation. The approach in question is Realistic Mathematics Education approach Indonesia (PMRI). PMRI approach to apply the concept of bottom-up in this case teachers are actively encouraged to take the initiative in implementing PMRI according to the environmental conditions of the place of work. Theoretical foundation in PMRI referenced adapted from theories Mathematics Realistic Education (RME) (see [10]).

PMRI view mathematics as a human activity, so that the learning activities conducted by using a real context and appreciate the ideas of the students in doing mathematics problems. Based on this, PMR developed four basic principles, namely:

a. guided-reinvention;
b. progressive mathematizing;
c. didactical phenomenology as initiated Freudenthal; and
d. self-developed model (see [2]).

During the learning of mathematics is more dominant in the cognitive domain, then it is time we pay attention to other domains, one of which is to embed the affective domain, in this case one of them is a mathematical disposition. Through the paradigm of philosophical foundation, the principles and characteristics, PMRI chance to build students' mathematical dispositions. Mathematical disposition is a desire, awareness,

and a strong dedication to the students to learn and implement a variety of math activities (see [4]).

The purpose of this study was to determine the effect of the independent variables PMRI approach, and mathematical disposition as a moderator variable of the mathematical creative thinking abilities as the dependent variable. The influence can be seen from the difference in the average acquisition mathematical creative thinking abilities in the experimental group compared with the control group.

2. Methods

This study was a quasi-experimental study to uncover the causal connection by means involving the experimental group and the control group. Determination of the experimental group and the control is done by a random group. The design of this study used a factorial design 3 × 2, to determine the influence of the main and interactive effects of treatment variables. The main variables that influence treatment variables include PMRI and conventional learning approaches.

The research was conducted in eighth grade junior high school students of the school year 2013/2014. Subjects numbered 72 students were divided into 36 experimental class students and 36 students of class control. The instruments used there are two tests and questionnaires. Questionnaire instruments used to obtain data on the level of students' mathematical dispositions, while the test instruments used to obtain data on student mathematical creative thinking abilities.

Table 1 Research Design Pattern 3 × 2 factorial

Mathematical disposition	Learning Approach	
	PMRI	Conventional
High	T, P	T, K
Medium	S, P	S, K
Low	R, P	R, K

Description:
P: Group Approach PMRI
K: Conventional learning group
T: High disposition
S: Medium disposition
R: Low disposition

In this study, students' mathematical dispositions are divided into three categories, namely high, medium, and low. The selection of categories based on the average score and standard deviation. If the score obtained by the students is greater than or equal to the average plus standard deviation (≥ mean + standard deviation) in the high category, if the score obtained by the students between the average minus the standard deviation and the mean plus standard deviation (mean - standard deviation <score <mean + standard dev) included in the medium category, and if the score is less

than or equal to the average minus the standard deviation (≤ mean - standard deviation) are included in the category of low.

The data analysis technique used is the analysis of variance (ANOVA) with two ways using the statistical program package SPSS-20 for windows. Prior to ANOVA to test the first hypothesis held that the prerequisite test data normality test and homogeneity test.

3. Results and Discussion

This study uses VIII6 class as a class experiment with obtaining and learning approaches PMRI VIII7 class as the class to obtain conventional learning control. At first the amount of research on the subject and grade VIII6, VIII7 each of 40 students, but there are four students who did not complete follow learning activities each experimental class and control class, then only 36 students who meet the requirements for each class. Total grade students experiment and control class is 72 students.

The results of the study in the form of average mathematical creative thinking abilities of students in each group of students with high mathematical disposition, medium, and low for this class of treatment (PMRI) and the control class (conventional) can be seen in Table 2 below.

Table 2 Comparison of average Mathematically Creative Thinking ability of Students

Dependent Variable: Mathematically Creative Thinking Ability

Learning Approach	mathematical disposition	Mean	Std. Deviation	N
Approach PMRI	High	85,7143	3,74007	7
	Medium	77,8846	11,35104	26
	Low	80,8333	2,88675	3
	Total	79,6528	10,23218	36
Conventional Learning	High	67,5000	10,83974	6
	Medium	70,4167	10,67470	24
	Low	66,6667	6,25833	6
	Total	69,3056	9,99305	36
Total	High	77,3077	12,05290	13
	Medium	74,3000	11,55113	50
	Low	71,3889	8,75992	9
	Total	74,4792	11,31291	72

ANOVA results of two paths using SPSS version 20 with $\alpha = 5\%$, the research data can be seen in Table 3 below.

Tabel 3. Results of Two Ways ANOVA

Tests of Between-Subjects Effects

Dependent Variable: mathematically creative thinking ability

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	2360,803[a]	5	472,161	4,633	,001
Intercept	226622,294	1	226622,294	2223,797	,000
Learning	1784,894	1	1784,894	17,515	,000
Mathematically creative thinking	67,769	2	33,885	,333	,718
Learning * mathematicall creative thinking	332,125	2	166,063	1,630	,204
Error	6725,916	66	101,908		
Total	408481,250	72			
Corrected Total	9086,719	71			

a. R Squared = ,260 (Adjusted R Squared = ,204)

Based on the data and analysis, discussion described respectively in accordance with the purpose of research.

Influence PMRI approach to Creative Thinking Mathematically

In Table 2 it can be seen that the average mathematical creative thinking abilities of students at PMRI approach (without regard to students' mathematical dispositions) is 79.6528 is higher than the average of creative thinking ability of students who received conventional teaching with an average of 69.3056 . Based on the analysis of data can be interpreted that PMRI approach is better than conventional learning. The results of the analysis of data in Table 3 also reinforces this point. In Table 3 column Source "Learning" shows the significance value of 0.000 is smaller than 0.05, which means "there is a significant difference in average creative thinking ability of students who got a mathematical approach that gets PMRI and conventional learning".

The results are consistent with previous studies of this research is Somakim in 2010 suggested that mathematical creative thinking abilities of students who got PMRI approach that gets better than conventional learning. Research results also revealed that PMRI approach can improve students' ability to think creatively mathematical class IX SMP in Palembang. According Danoebroto (see [1]) students showed a positive response to PMRI learning, students learn cooperatively in a heterogeneous group that is diverse math skills, and students more willing to come forward to explain his ideas.

Mathematical Disposition influence on Creative Thinking Mathematically

In Table 2 it can be seen that the average mathematical creative thinking abilities of students at PMRI approach that has a high mathematical disposition (= 85.7143) is higher than the mathematical disposition is (= 77.8846) and low (= 80.8333). Meanwhile the average creative thinking ability of students who received conventional learning disposition that has moderate (= 70.4167) is higher than the high disposition (= 67.5000) and low (= 66.6667). It also strengthened the data analysis results Table 3 which shows the Source column "Mathematical Disposition" shows the significance value 0.718 is greater than 0.05, which means "there is no significant difference in the

average mathematical creative thinking abilities of students due to students' mathematical dispositions" .

These results are also in line with research Kesumawati (see [4]), which suggests that the disposition Improved mathematical approach PMR students getting better than students who received FMD approach in school ranked (high, medium, low). Research results also revealed that students who received more active approach to PMR seek another solution of the given problem and reflection from each step taken, and the more active student ask, do not look anxious, more confident, and passion of higher learning.

Interaction Learning Approach and Disposition Mathematically, with the Creative Thinking Mathematically

In Table 3 can also be viewed source "Learning" Disposition of mathematical" value F = 1.630 with a significance value = 0.204 (sig.> 0.05). Since the significance value greater than 0.05, it can be interpreted that there is no interaction between factors of learning with mathematical disposition. In other words, the provision of treatment in the form of learning does not depend on students' mathematical dispositions toward mathematical creative thinking abilities of students.

In Table 2 can also be seen that the approach to learning with PMRI average of mathematical creative thinking abilities of students who have low mathematical disposition (= 80.8333) is higher than the group being mathematical disposition (= 77.8846). Unlike the conventional learning an average of mathematical creative thinking abilities of students who have a mathematical disposition is (= 70.4167) is higher than the high-disposition groups (= 67.5000) and low (= 66.6667). This shows that if the student has a low mathematical disposition, then learning PMRI approach is more appropriate than the conventional approach. This is in line with research conducted Mahmudi (see [7]) which concluded that the learning factor did not interact with the factor category of Early Mathematics Ability (KAM) to the mathematical disposition. This means, the influence factors on the disposition of mathematical learning depends on the category of the school and vice versa does not depend on the category of KAM. In other words, the effect of learning the strategy of Mathematical Habits of Mind (MHM) based on the mathematical problem of the disposition of each category KAM is similar, but not identical in each school category. In this case, the medium category of school, learning with problem-based MHM strategy significantly affect the mathematical disposition, while the top category of school is not the case. This implies that such learning tends to be more suitable for school student category is for students to develop mathematical disposition.

4. Conclusions and Recommendations

There is a statistically significant difference in average mathematical creative thinking abilities of students who have learning Realistic Mathematics Education approach Indonesia (PMRI) and who received conventional learning. It means learning to PMRI approach gives a better impact on the ability of creative thinking mathematically compared with conventional learning.

There is no significant difference between the mathematical creative thinking abilities groups of students who have a mathematical disposition of high, medium, and low. This means the disposition of mathematically based ranking (high, medium, and low) had no impact on students' mathematical creative thinking abilities.

No significant interaction between teaching approaches and mathematical disposition on the ability of students BKM. This means that the provision of treatment in the form of learning does not depend on students' mathematical dispositions toward mathematical creative thinking abilities of students.

Suggestion for math teachers to create more problems, especially math problems to improve students' mathematically creative thinking abilities. PMRI learning approach as an alternative learning of mathematics that can make students more creative because the students have their own approach PMRI how a mathematical formula or completion of math problems found by the students.

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