

The Difference on Students' Mathematical Creative Thinking Ability Between Realistic Approach With Conventional in The State Madrasah Tsanawiyah 2 of Medan

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Abstract—The ability of mathematical creative thinking is one of the targets in mathematics learning. Therefore, a relevant learning approach is needed to encourage students to discover concepts of mathematics by constructing their own knowledge through problems on their daily live, improving creative thinking in understanding the information to resolve a problems and one approach that can be applied is a realistic approach. This study aimed to analyze: (1) The difference on students' mathematical creative thinking ability between whom given realistic approach with conventional, and (2) The interaction between learning approach and prior knowledge of mathematics on students' mathematical creative thinking ability. This experiment used pretest-posttest control group design. The population was all students of the eight grade in the State Madrasah Tsanawiyah 2 of Medan and sample were randomly selected of two classes. The statistic testing applied in data analysis was the mean difference test and the interaction test between the learning approach and the prior knowledge of mathematics. The result showed that there is a difference on students' mathematical creative thinking ability between whom given realistic approach with conventional and the mean difference is 4,657. Further, there is no interaction between learning approach with prior knowledge of mathematics on students' mathematical creative thinking abilities. So, the realistic approach can be used as an alternative in learning mathematics to students' mathematical creative thinking ability.

Keywords—realistic, conventional, creative, math

I. INTRODUCTION

Mathematics is one of the subjects that students need to master in the type of formal education or school, because mathematics is a basic science that is widely used in various

fields of life and progress of developed countries dominantly dependent on mathematics. This is in line with Santosa stated progress of developed countries, up to now dependent on mathematics of 60% -80% [1]. "In the session of the national mathematics conference of July 1976, much talk showed the usefulness of mathematics in science and technology up to urban planning" [1]. So, mathematics should be considered in each type and level of education to improve the quality of education.

The reason for the importance of learning mathematics in Permendiknas to equip students the ability to think, one of which is the ability to think creatively. The ability to think creatively can be interpreted as the ability to produce something new and useful. Briggs and Moore stated creative thinking is a pattern of thinking that leads to many directions, characterized by fluency, flexibility, and originality [2]. Thus in mathematics that has abstract objects, to determine the level of criteria creative thinking needs to be shown the components of fluency, flexibility and originality in problem solving. The importance of students' creative thinking ability can be seen from the Minister of National Education number 22 of 2006 stated mathematics learning should be given to students to equip the ability of logical, analytical, systematic, critical, creative and cooperative [3]. In a large number of studies have recognized the importance of creative thinking ability in the journal Wang stated "Creative abilities have been recognized as essential in solving complex individual, social, and global problems through a significant amount of research" [4]. So, creative thinking is one of the abilities that needs to be provided to students through mathematics

courses. The reason for the importance of developing the creative thinking ability of students is that with the ability to think creatively can realize (actualize) himself, the ability to think creatively as the ability to see the various possibilities to solve a problem, creative self-busted not only beneficial but also give satisfaction to individuals, and the ability to think creatively that makes people able to improve the quality of life [5].

In fact, mathematical learning in schools has not focused on students' creative thinking ability. This is in accordance with the journal stated "particularly in mathematics, teachers tend to procedural and more emphasis on learning outcomes" [6]. Guilford with his famous speech in 1950 "gives attention to the problem of creativity in education, stated the development of creativity is neglected in formal education, whereas very meaningful for the development of the child's potential as a whole and for the advancement of science and cultural arts" [5]. In line with Saefuddin stated creative thinking is something that is not considered in the learning of mathematics [7]. During this time the teacher only prioritizes logic and computing ability (counting) so that creativity is considered not something that is important in the process of teaching and learning in the classroom. In learning mathematics also students are not familiarized with contextual problems that can motivate students to think creatively. As a result, the creativity of students is still low.

One of the factors that affect the low learning outcomes of students, especially the ability of students' creative thinking is the approach or learning strategy used by teachers. Among the approaches that can be applied to train students' mathematical creative thinking ability is realistic approach.

A realistic approach is a student-centered approach to learning and material presented from real events in everyday life or imaginable. This is in accordance with Tarigan, "in realistic mathematics learning starting from real problems so that students can engage in meaningful learning processes" [8]. The real problem is then resolved by students using their own sentences or models in the informal step as a step toward formal steps. The reason for the realistic approach used in learning because: 1) Provide a clear understanding and operational to students about the relationship between mathematics with everyday life. 2) With a realistic approach, mathematics is used as a study that can be constructed and developed by the students themselves. 3) Students are given the opportunity to solve problems in various ways not necessarily the same between people with each other. Based on the usefulness of the realistic approach, mathematics is used as a study that can be constructed and developed by the students themselves, it can train students' mathematical creative thinking ability. Further, Munandar stated students are given the opportunity to solve problems in different ways not necessarily in the same way as the other with the notion of creative thinking to provide various possible answers based on information provided with an emphasis on quantity, diversity and originality of answers [2]. Similarly, one of the characteristics of the realistic approach of modeling in

solving mathematical problems is also possible to develop students' creative thinking ability [7]. So, using a realistic approach can develop students' mathematical creative thinking skills. Further, the results of study Fajriah and Asiskawati the students' creative thinking ability using PMR approach is in the high category with the details of each indicator ie the indicator of the fluency is in the high category, the flexibility is in the middle category, and the originality is in the low category [9]. Based on preliminary studies, learning with realistic approach is still rarely implemented in the school where the study.

In addition to using the right learning approach, prior knowledge of mathematics on students' are also one of the factors to achieve successful learning. Adams & Bruce, that "comprehension is the use of prior knowledge to create new knowledge" [10]. The prior knowledge on student is different from that of the other students, in this case it can be classified into three levels: low, medium and high [11]. The hierarchical learning of mathematics requires students to have high prior knowledge of mathematics to succeed in subsequent learning, as Dienes suggests "learning of mathematics is learning which involves a hierarchical structure of higher-level concepts established over basic what has been formed before" [1]. So, students must first understand the prerequisite material so as not to have difficulty in learning the next material. However, prior knowledge of mathematics on students' include those that rarely pay attention to teachers. Supposedly, the prior knowledge of mathematics also needs to be considered teachers to choose the appropriate learning approach applied.

Based on the description, this study aims: 1) To analyze the difference on students' mathematical creative thinking ability between whom given realistic approach with conventional, 2) To analyze the interaction between learning approach and prior knowledge of mathematics on students' mathematical creative thinking ability.

II. METHOD

The type of study used in this study is quasi experiment with study design that used Pretest-Posttest Control Group Design. Arikunto in his book stated "population is the whole subject of study". In this study population is all students of class VIII in the state Madrasah Tsanawiyah 2 of Medan consisting of 9 classes [12]. "The sample is part or representative of the population studied" [12]. The sample was taken randomly from class VIII as many as 2 classes, namely class VIII-2 and class VIII-6 in the state Madrasah Tsanawiyah 2 of Medan, each of which amounted to 35 students. The students of class VIII-2 were selected as experimental class and given the learning realistic approach while the students of class VIII-6 as control class with conventional learning.

In this study, a more comprehensive assessment was carried out by involving prior knowledge of mathematics factors. The prior knowledge of mathematics is the prior knowledge that students have before the experiment is done.

Besides aiming to know the prior knowledge on students before learning, the prior knowledge of mathematics is also used to classify students based on their ability. The prior knowledge of mathematics are grouped into three categories: high, medium and low.

Data analysis used in this study is quantitative data analysis. Quantitative data analysis was used to analyze data of the prior knowledge of mathematics and difference of students' mathematical creative thinking ability. In this study the statistics used are descriptive statistics and inferential statistics. Descriptive statistical analysis is used to analyze the mean, standard deviation, determination of maximum and minimum value of the prior knowledge of mathematics and students' mathematical creative thinking ability. Inferential statistical analysis is used to test the hypothesis so that generalizations in the population can be obtained. Before the first hypothesis test is done prerequisite test which includes normality test and homogeneity test.

III. RESULT AND DISCUSSION

A. Implementation of Learning

Learning with realistic approach begins by conveying learning objectives and then group formation and introduction of realistic learning and its syntax. Many students are 35 and formed 6 groups consisting of 5-6 student groups and consisting of men and women and chaired by class rank. In general, the implementation of learning goes well, but at the beginning of learning is at the first meeting with the realistic approach of students takes a long time to be able to solve the problems given because students are not used to learning with a realistic approach. The location of the students' difficulties in learning with realistic approach at the first meeting is in finding the informal model of the students still not dare to use the results of his own thinking. This is due to students' thinking ability is still not used to be trained. However, students continue to experience a better process in the process of thinking. This is indicated by the students have no doubt to write down the results of his thinking in solving the problem and the students understand the learning process. With the guidance of teachers, most students who are given realistic learning approaches know that some problems not only have one correct answer and the means used to solve problems do not have to be in one way but can be in more one way with the same results and the way they are used solving the problem does not have to be an existing one but the students can find their own settlement. This is in accordance with the advantages of the realistic approach stated by Suwarsono, in the realistic approach the students are given the opportunity to solve the problem in various ways not necessarily the same between people with each other [13].

As a reference to the process of learning, researchers follow the lesson plan that has been prepared in accordance with the syntax of Realistic Approach. First, students are given real problems relating to the their daily live in the form

of the student worksheet. The student worksheet is a series of activities that will be implemented students. Tarigan stated, in realistic mathematics learning starts from a real problem so that students can be involved in the learning process meaningfully [8]. In groups students discuss on student worksheet and create a model of the concept. One of Vygotsky's theories stated students learn to handle tasks learned through interaction with adults or peers [14]. Students are free to create their own model which is considered to solve problems on the student worksheet. The next step, one of the groups presented the results of the group discussion. Other groups may ask and respond to the group's answer. From the various models of the students, the teacher directs the students to the right conclusion, so that concluded a correct concept is model for. This is in accordance with piaget which suggests that mathematical learning emphasizes the activity, experience, and use of active methods, and starts from the concrete and slowly toward the abstract [15]. The ability of teachers in managing learning with a realistic approach is in the good category.

Meanwhile, conventional learning or regular learning is done as usual done by teachers. No special treatment is done in this class, as it is a control class.

B. Differences in students' mathematical creative thinking ability

The ability of mathematical creative thinking is the ability of students to create something new or provide new ideas that can be applied to solve mathematical problems. Semiawan "Creativity is basically includes the ability to create new combinations, or see new relationships between elements or things preexisting" [6]. To develop students' mathematical creative thinking skills in giving mathematical problems to students will be better if it relates to the real life of students. The realistic approach is one of the learning approaches that relate the learning of mathematics to the students' real life. This is expressed by Tarigan stated in learning realistic mathematics starts from a real problem [8]. The aspect of creative thinking ability that will be measured in this study is the ability of students: (1) solve a mathematical problem with varied and correct answers (fluency). (2) solve a problem or a mathematical question with many ways of completion (flexibility). (3) provide a different, unusual and uncommon solution in solving the Originality problem.

Description of students' mathematical creative thinking ability can be seen in the following table.

Table 1. Pretest and Postes Data The Ability of Student Mathematical Creative Thinking

Group	Pretest Score		Postest Score	
	\bar{X}	s	\bar{X}	s
Realistic approach	10,89	1,530	21,31	1,471
Model eliciting activities	10,80	1,677	19,57	2,048
conventional	10,77	1,699	16,66	1,626

Based on table 1, before being given treatment to students have the ability to think mathematically creative does not differ significantly. This can be seen from the average score of pretest experimental class and control class are 10.89 and 10.77 respectively. After being given treatment, the ability to think mathematically creative students who learn with realistic approach to learning averaged higher scores than students who learn with conventional learning. This is indicated by the mean posttest score of the experimental class that is 21.31 while the mean postes score of the control class is 16,66. The difference between the mean posttest scores and the average of the experimental class pretest scores of 10.42 is considerably greater than the difference in mean postes score with the average pretest grade control score of 5.89. This means that students who are learning by realistic approach learning better their creative thinking ability compared to students who are learning with conventional learning. With the ability of researchers in managing learning with good category. So it can be concluded that the cause of differences in the ability of students' mathematical creative thinking is because of the learning approach used by teachers. Where the learning factor with realistic approach affect the ability of students' mathematical creative thinking by 74% and 26% influenced by other factors.

Seen from the indicator of the ability of mathematical creative thinking with learning of realistic approach shows the average of fluency thinking ability is 7.91 higher than the average ability of thinking flexibility is 7.83, and the average ability of originality is 5,57. In accordance with the results of Fajriah and Asiskawati study, the students' creative thinking ability using PMR approach is in the high category with the details of each indicator, ie the indicator of fluency is in the high category, the flexibility is in the medium category, and the originality is in the low category [9]. While the ability to think mathematically with the conventional creative, showed the average ability to think flexibility is 6.54 higher than the average fluency thinking ability is 6.51, and the average ability of the originality is 3.60. Based on the ability of students' mathematical creative thinking based on these indicators there are indicators that still require habituation and full guidance that is on indicators of originality. Most students still solve the problem in a way that is often used, namely the way that obtained during learning. However, some students have been able to find different ways of completing the concepts acquired during the lesson. That is, some students have been able to form new or unique solutions for themselves derived from other concepts or derived from experiences that have been passed.

Further, to see differences in the ability of students' mathematical creative thinking between students who were given a realistic approach to learning with conventional learning used t test. Here is a statistical result with t test.

Table 2. Test t Mean Differences of Student Mathematical Creative Thinking Ability

Independent Samples Test

		t-test for Equality of Means			
		t	df	Sig. (2-tailed)	Mean Difference
Postes	Equal variances assumed	12.567	68	.000	4.657
	Equal variances not assumed	12.567	67.327	.000	4.657

From table 2 above, the significance difference between realistic and conventional approach is 0.000 and less than 0.05, then reject H_0 . So, it can be concluded that there are differences on students' mathematical creative thinking ability between students whom given realistic approach with conventional. Where on student mathematical creative thinking ability whom given realistic approach is better than conventional. The mean difference on student mathematical creative thinking ability whom given realistic approach with conventional is large enough that is 4.657. This is in accordance with Wessels "... creativity is closely related to problem solving in mathematics, and specifically the solving of complex real life problems ..." [16]. Further, Saefudin stated the implementation of PMRI can develop students' creative thinking ability [7]. So it is natural that there are differences on students' mathematical creative thinking ability between students whom given realistic approach with conventional.

C. Interaction between Learning Approach and Prior Knowledge of Mathematics

Based on the results of descriptive analysis, the ability of mathematical creative thinking of students with low knowledge, medium or high ability in the experimental class is all higher than the control class at all levels of prior knowledge. This can be seen from the average ability of students' mathematical creative thinking in the experimental class at low, medium and high level of early, 19,17, 21,35 and 23,33. While for the control class at the level of prior knowledge low, medium and high successive 14,5, 16,63 and 19,4.

Based on the results of inferential statistical analysis with two-way ANOVA test obtained statistical calculation results that the value of the significance of the approach interaction with the prior knowledge of mathematics is 0.426 and greater than 0.05, then H_0 is accepted. So, it can be concluded that there is no significant interaction between the learning approach and the prior knowledge of mathematics on students' mathematical creative thinking ability. More specifically, the interaction between learning approaches with

prior knowledge of mathematics on students' mathematical creative thinking abilities is presented in the following graph.

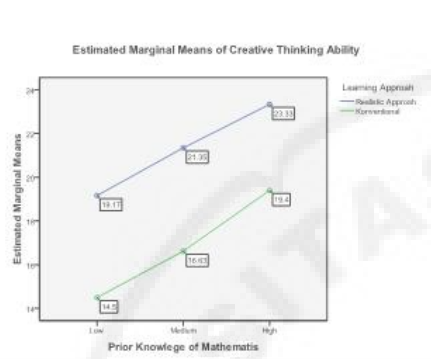


Figure 1. Interaction between Learning Approach and Prior Knowledge of Mathematics

From Figure 1 above, it can be seen that there is no interaction between the learning approach and the students' prior knowledge of mathematics. In other words, it can be concluded that there is no joint influence given the learning approach with prior knowledge of mathematics on students' mathematical creative thinking ability. This means that learning does not have a significantly different effect on students' mathematical creative thinking ability at low, medium or high level of prior knowledge of mathematics. In accordance Kerlinger opinion that "interaction occurs when an independent variable has different effects on a variable bound to various levels of another independent variable" [17]. Can also be said that only the learning approach that gives a significant influence on the ability of students' mathematical creative thinking.

IV. CONCLUSION

Based on the results of data analysis and implementation of study during learning mathematics with realistic and conventional approach with emphasis on the ability of students' mathematical creative thinking, the researchers obtained the following conclusions: 1) there are differences on students' mathematical creative thinking ability between students whom given realistic approaches with conventional, 2) there is no interaction between learning approach with prior knowledge of mathematics on students mathematical creative thinking ability. It also means that the interaction between learning approach and prior knowledge of mathematics does not have a significant effect on the ability of mathematical creative thinking. Differences in the ability of mathematical creative thinking is caused by differences in learning approach used not because of the prior knowledge of mathematics students.

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