Application Of Realistic Mathematic Education to Improve Mathematical Creative Thinking Ability

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Abstract. Creative thinking skills (CTS) are said to be one of the fundamental things in facing current challenges. In addition, students also need this creative thinking ability to solve various mathematical problems. For this reason, an appropriate approach such as Realistic Mathematical Education (RME) is needed to support these skills. The purpose of this study was to determine the effect of applying the RME approach to students' mathematical creative thinking abilities. The research design used was a pretest-posttest control group design. The research sample was 72 people. The research data was collected using a test instrument totaling 5 numbers. Based on the results of data analysis, superiority was found for the experimental class, indicating that the treatment given had a positive influence on students' abilities. This fact contributes to teachers implementing RME in the future, including on other students' abilities.

Keywords: Realistic Mathematical Education (RME) Approach; Mathematical Creative Thinking Ability; Experimental design

1 Introduction

The ability to think creatively, including in the field of mathematics, is very fundamental and important for every individual to have and is part of human culture [1-4]. Creative thinking can help every individual to solve various problems they face in everyday life. Apart from that, by thinking creatively, creativity will emerge. Creativity is a complex model and can mostly be expressed through various intelligences which include linguistic, musical, mathematical, spatial, kinesthetic, interpersonal and even intrapersonal intelligence [5]. In addition, creativity as a process of becoming sensitive to a problem, deficiency, knowledge gap, missing elements, disharmony, and so on; identify difficulties; seek solutions, make conjectures, or formulate hypotheses about the deficiencies; testing and retesting these hypotheses and perhaps modifying and retesting them; and finally communicate the results.

Creativity plays an important role in mathematics learning. In solving mathematical problems, students need high creativity to be able to solve problems that involve mathematical creative thinking skills. With creative thinking skills, students will be able to solve mathematical problems in various alternative ways [6]. Seeing the importance of creative thinking skills in mathematics learning, students' creative thinking abilities need to be explored more deeply and improved. To improve and explore students' creative thinking abilities, a teacher can do several

ICEHHA 2023, December 15-16, Ruteng, Indonesia

DOI 10.4108/eai.15-12-2023.2345633

things, such as changing the paradigm of learning activities that were initially teacher-centered to student-centered learning activities.

One learning model that can be applied by teachers in mathematics learning activities to improve creative thinking skills is the Realistic Mathematics Education (RME) learning approach. RME is a mathematics learning approach that can improve students' understanding of mathematics material because the concept of the material is adapted to the real context that students can imagine [7]. In the RME framework, the problems that become learning situations are not only from the world around students but also from the world of fairy tales [8].

Previous researchers who have implemented RME stated that the RME approach had a positive effect on student motivation and learning achievement [9]. This was also confirmed by Laurens, et al [10] in their research which stated that student learning outcomes in mathematics learning with the RME approach were better than conventional learning. Apart from that, Anzani [11] in his thesis stated that RME is an alternative mathematics learning that can develop students' critical thinking and creative mathematical thinking abilities.

Apart from learning approaches, there are other factors that can influence students in understanding lesson material and improving their thinking abilities, such as the activities carried out by students in learning activities. In learning activities, a teacher needs to pay attention to student learning activities. RME is a learning model that can help students improve their learning activities. The application of RME in learning has been done a lot before. In research by Asmara, et al [12], it was found that the application of RME in mathematics learning can improve mathematical creative thinking abilities when compared to expository learning methods. Apart from that, Utami & Ilyas' research [13] also found that the application of RME in mathematics learning can increase the average student's mathematical creative thinking ability when compared to conventional methods. In this research, researchers will look at the effect of implementing the RME approach in learning activities. The difference between this research and previous research lies in the differences in research subjects and the school environment where the research is conducted.

2 Method and Materials

This research is a quasi-experimental research with a research design using a pretest-posttest control group design. This research involved two classes, namely one experimental class and one control class. Each research class received different treatment but used the same material in implementing the learning process. The experimental class was given RME treatment while the control class was given treatment that usually occurs in schools. This research was conducted in August-November 2022. The research population was class X students at SMK St. Aloysius, numbering 323 people. Meanwhile, the research sample consisted of 72 people, with details of 36 people in the control class and 36 people in the experimental class. The data collection instrument used in this research was a test instrument consisting of 5 questions containing indicators of creative thinking abilities. The questions used are valid and reliable questions. Test questions were given before applying the treatment (pretest) and after applying the treatment (posttest) to the two classes used in research activities. Before testing the research hypothesis, the researcher first tested the analytical assumptions, namely the normality test and homogeneity test.

3 Results and Discussion

3.1 Results

3.1.1 Data on Creative Thinking Ability for Experiment Class and Control Class

The aim of the current research is to obtain a description of the impact of implementing RME on increasing students' CTS. The improvement data was obtained from both classes through pretest and posttest data. Table 1 presents a summary of the TCS test results from both classes.

Table 1. Pretest-Posttest Scores for Students' TCS

Statistics	Control Class		Experimental Class	
	Pretest	***Posttest***	***Pretest***	***Posttest***
Mean	58,83	64,03	58,69	78,19
Varians	39,06	58,77	38,51	72,96
Median	56	65	58	80,5
Modus	56	69	60	70
SD	6,25	7,66	6,21	8,54
Max	69	75	69	90
Min	50	50	50	60

3.1.2 Test Analysis Assumptions

This research involves testing the difference between two means via the t-test. The mean is considered a very good parameter in estimating populations. However, it must be ensured that the sample data is taken from a normally distributed population. This study involved the Kolmogorov-Smirnov test to ensure normality of the data. Table 2 presents the results of the data normality test.

Table 2. Student TCS normality test results

	Experiment		Control	
	pretest	*posttest*	*pretest*	*posttest*
D_{max}	0,170	0,140	0,205	0,134
D_{table}	0,225	0,225	0,225	0,225

When Table 2 is observed it can be seen that the value $D_{max} < D_{table}$, this means that both pretest and posttest data in both classes are normally distributed.

In this research, the N-Gain mean difference test uses the t-test. Because this test is part of parametric statistics, a prerequisite test for data homogeneity must be carried out. Homogeneity testing was carried out with the F test using the SPSS application. Table 3 includes the results of homogeneity testing of the two data samples.

Table 3. Results of homogeneity test of student TCS data

No	Data	F_{count}	F_{table}	Result
1	*pretest*	0,456	0,564	Homogeneous
2	*posttest*	0,347	0,564	Homogeneous

From the illustration of the results in Table 3, it can be seen that the two classes come from a homogeneous population because the value of $F_{count} < F_{table}$.

3.1.3 Hypothesis testing

From the previous stage it becomes a fact that the use of the t-test is in accordance with the previously selected assumptions. Thus, the parameter used to estimate the population in the study is the average N-Gain. The average N-gain of the two samples was then compared to clarify the effect of the treatment, namely the application of RME, on students' TCS. Table 4 presents the results of hypothesis testing of the average N-gain for the two classes.

Table 4. Test the N-gain data hypothesis

	Mean Difference Test		
N-Gain	Significant (1-tailed)	α	Conclusion
	0,0000000032	0,05	H_0 rejected

When Table 4 is observed it is clear that the sig value = 0.0000000032 < α = 0.05. This indicates that the null hypothesis which states that the average N-gain of the two classes is not different, is rejected. Thus, the hypothesis of this research is accepted. So the results of this test clarify the fact that student TCS taught using the RME approach is better than student TCS taught conventionally.

3.2 Discussion

Based on the research results presented, the application of RME has a positive impact on students' mathematical creative thinking abilities. This is in line with previous research that shows RME has a positive impact and increases students' activity, interest and motivation in learning mathematics [14]. The results of N-gain data analysis show that the RME can improve TCS. This is because in the activities and learning process the students are directed to be active, carrying out the process of discovering concepts, collaborating and presenting.Apart from that, RME principles also require students to think creatively in carrying out learning activities, especially when solving contextual problems [15].

Another reason that can support the results of this research is because in applying the RME approach, researchers also pay attention to the goals of students learning mathematics, namely improving the ability to think systematically, logically, creatively, disciplined and collaborate effectively in a modern and contemporary environment. competitive life [12]. So that the implementation of learning activities refers to achieving the goals of mathematics learning itself. Apart from that, learning activities are also carried out referring to the RME principle which focuses on student activities in finding and solving contextual problems. These results are in line with research from [16]–[19] that RME has a positive influence on students' mathematical abilities.

4 Conclusion

This study was conducted to test the effectiveness of RME. The experimental results provide the fact that providing RME in mathematics learning had a positive impact on students' mathematical TCS. The real-world problems and local contexts presented simplify the concept

abstraction process so that students can imagine the content of the material and help them solve mathematical problems creatively.

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