APPLICATION OF COMPUTATIONAL THINKING (CT) TO IMPROVE STUDENT'S MATHEMATIC CREATIVE THINKING ABILITY

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ABSTRAK

Tujuan penelitian ini adalah untuk menganalisis dan membandingkan kemampuan berpikir kreatif matematis antara siswa yang mendapatkan pembelajaran dengan pendekatan *Computational Thinking* (CT) dan pembelajaran konvensional. Metode penelitian yang digunakan adalah *mix method* (kuantitatif dan kualitatif) dengan eksperimen semu (*quasi experiment*). Sampel yang digunakan pada penelitian ini sebanyak 60 siswa yang diambil dari 2 kelas (eksperimen dan kontrol). Pengumpulan data dilakukan setelah proses pembelajaran dengan menggunakan instrumen berupa soal tes. Analisis data kualitatif dilakukan terhadap jawaban 3 siswa dari kelas eksperimen dan 3 siswa dari kelas kontrol. Sedangkan teknik analisis data kuantitatif dengan membandingkan hasil *post-test* menggunakan uji t sampel bebas. Hasil dari penelitian menunjukkan bahwa: 1) kemampuan berpikir kreatif matematis siswa yang mendapatkan pembelajaran konvensional sebesar 60,417 yang masuk kategori tingkat kemampuan berpikir kreatif (TKBK) level 2, 2) kemampuan berpikir kreatif yang mendapatkan pembelajaran dengan pendekatan CT sebesar 84,250 dan masuk kategori TKBK level 4, 3) terdapat perbedaan kemampuan berpikir kreatif yang signifikan antara siswa mendapatkan pembelajaran konvensional dan pendekatan CT. Hal ini ditunjukkan dengan hasil uji t sampel bebas dengan Sig. $0{,}000 < 0{,}05$ yang disimpulkan bahwa pembelajaran dengan pendekatan CT lebih efektif dalam meningkatkan kemampuan berpikir kreatif siswa.

Kata Kunci: *Computational thinking*, berpikir kreatif matematis, segi empat

ABSTRACT

The purpose of this study was to analyze and compare mathematical creative thinking skills between students who received learning using the Computational Thinking (CT) approach and conventional learning. The research method used is a mix method (quantitative and qualitative) with quasi-experimental. The sample used in this study was 60 students taken from 2 classes (experimental and control). The data collection was carried out after the learning process by using an instrument in the form of test questions. Qualitative data analysis was conducted on the answers of 3 students from the experimental class and 3 students from the control class. While the quantitative data analysis technique is to compare the results of the post-test using independent sample t - test. The results of the study show that: 1) the mathematical creative thinking ability of students who receive conventional learning is 60.417 which is included in the category of creative thinking ability (TKBK) level 2, 2) creative thinking ability who gets learning with the CT approach is 84,250 and is included in the TKBK level 4, 3)

there are significant differences in creative thinking skills between students receiving conventional learning and the CT approach. This is indicated by the results of independent sample t - test with Sig. 0.000 < 0.05 which concluded that learning with the CT approach was more effective in improving students' creative thinking skills.
Keywords: *Computational thinking, mathematical creative thinking, rectangular*

INTRODUCTION

Mathematics is a subject that is considered difficult by most students. Several influencing factors are internal and external factors. As for the internal factors in the form of physical or physiological students while external factors can be in the form of family or environment (Nalim, 2021). Mathematics can also be communicated with other approaches so that it can be understood easily and clearly. One of the models or learning approaches is Computational Thinking. Computational Thinking is an approach that invites students to think logically, critically and creatively (Richardo, 2020).

Mathematical creative thinking is currently a thinking concept that is very much needed in learning mathematics, by inviting students to be able to think original or original, making students more meaningful and able to produce thoughts that have many ways in the problem solving process related to the material in mathematics (Al Rasnawati, 2019). In addition, mathematical creative thinking also invites students to be able to think flexibly, smoothly, and in elaboration which can then produce ideas that are in accordance with the direction of the student's mindset (Hikmal Setiawan, 2018).

Based on the results of observations in February 2020 at SMP Negeri 4 Petarukan class VII D in mathematics learning by Mr. M. Fikri Umam, S.Pd in rectangular material still using conventional learning where the learning center is still teacher-centered. Regarding the applied conventional method, making a learning process that only provides examples for students to do things that do not train students to think creatively mathematically makes teaching and learning activities less in line with the

direction of educational development and innovation (Nasution, 2017). Less effective on conventional methods in improving students' mathematical creative thinking skills as evidenced by the results of daily test scores in rectangular material showing 10 students out of 30 students in class VII D do not meet the Minimum Completeness Criteria (KKM).

Based on the background that has been explained, it is necessary to apply Computational Thinking as an effort to improve students' mathematical creative thinking skills on rectangular material. Therefore, researchers are interested in conducting a study entitled Application of Computational Thinking to Improve Students' Mathematical Creative Thinking Ability in Quadrangular Materials at SMP Negeri 4 Petarukan.

The formulation of the problem in this study is 1) How is the level of creative thinking ability of class VII students of SMP Negeri 4 Petarukan in rectangular material with conventional learning 2) How is the level of creative thinking ability of class VII students of SMP Negeri 4 Petarukan in rectangular material with a Computational Thinking learning approach (CT) 3) Is there a significant difference between the level of creative thinking ability that applies the Computational Thinking (CT) learning approach and the level of creative thinking ability that applies conventional learning in rectangular material in class VII at SMP Negeri 4 Petarukan. This study was made to 1) analyze the level of creative thinking ability of class VII students of SMP Negeri 4 Petarukan in rectangular material with conventional learning 2) analyze the level of creative thinking ability of class VII students of SMP Negeri 4 Petarukan in rectangular material with a Computational Thinking (CT) learning approach. 3) analyze whether there is a significant comparison between the level of creative thinking ability that applies the Computational Thinking (CT) learning approach and the level of creative thinking ability that applies conventional learning in rectangular

material in class VII at SMP Negeri 4 Petarukan.

The type of research used is a quasi-experimental and the approach used in this research is a mix method approach. This research was conducted in the seventh grade of State Junior High School 4 Petarukan. The population in this study were all students of class VII A to VII D of SMP Negeri 4 Petarukan, totaling 120 students. The sample in this study was class VII D as the experimental class with a total of 30 students using the Computational Thinking approach and class VII C as the control class with a total of 30 students using the conventional learning model. So the number of samples in this study were 60 students. The sampling technique in this research is purposive sampling technique. Data collection techniques used in this study were test instruments (pre-test and post-test), observation and documentation. The test instruments used in this study are validity and reliability tests. The data analysis technique in this study uses the normality test which is used to determine whether the sample used comes from a normally distributed population or not (Nuryadi, 2017). Homogeneity test is carried out to find out whether the sample comes from a population with the same variance (Sarah, 2018). Independent samples t-test was used to determine the significant difference between creative thinking skills and conventional learning and computational thinking (CT) approaches (Krisanti, 2019).

DISCUSSION

The sample in this study were students of class VII C and VII D of SMP Negeri 4 Petarukan with a total of 30 students each. The data for pre-test and post-test of students' mathematical creative thinking skills using conventional learning and computational thinking approaches can be seen in Table 1. and Table 2. descriptive statistics using SPSS 25 below:

Table 1.
Descriptive Statistics Pre-test and Post-test data control class
Descriptive Statistics

	N	Minimum	Maximum	mean	Std. Deviation
Pre-test Control	30	40.0	72.5	57,000	7.9438
Post-Test Control	30	50.0	75.0	60,417	7.1343
Valid N (listwise)	30				

Source: Processed research data, 2022

Table 2.
Descriptive Statistics Pre-test and Post-test data experimental class
Descriptive Statistics

	N	Minimum	Maximum	mean	Std. Deviation
Pre-test Experiment	30	45.0	72.5	57.167	7.6489
Post-test Experiment	30	75.0	100.0	84,250	6.7002
Valid N (listwise)	30				

Source: Processed research data, 2022

Based on Table 1. above, it can be seen that the minimum pre-test and post-test scores for the control class were 40 and 50, while the maximum results for pre-test and post-test were 72.5 and 75.0 with an average of 57 and 60.417. Meanwhile, in Table 2. above, it can be seen that the minimum pre-test and post-test scores for the experimental class were 45 and 75, while the maximum results for pre-test and post-test were 72.5 and 100 with an average of 57,167 and 84,250.

The normality test for the control and experimental classes can be seen in Tables 3. and 4. as follows:

Table 3.
Pre-test and Post-test Normality Test Data for Control Class
Tests of Normality

		Kolmogorov-Smirnov [a]			Shapiro-Wilk		
	Class	Statistics	Df	Sig.	Statistics	df	Sig.
Value 1	Pretest Control	.133	30	.188	.962	30	.347
	Prettest Control	.143	30	-121	.945	30	-124

a. Lilliefors Significance Correction

Table 4.
Pre-test and Post-test Normality Test Data for Experiment Class
Tests of Normality

		Kolmogorov-Smirnov [a]			Shapiro-Wilk		
	Grade 2	Statistics	Df	Sig.	Statistics	df	Sig.
Value 2	Pre-Test Experiment	.145	30	.109	.960	30	.315
	Post-Test Experiment	.137	30	.157	.941	30	.099

a. Lilliefors Significance Correction

Based on Tables 3. and 4. above, it can be seen that the normality test in this study using the Kolmogorov-Smirnov in conventional learning obtained a pre-test score with sig. 0.188 > 0.05 and post-test with sig. 0.121 > 0.05 then the data is normally distributed . Meanwhile, in conventional learning, the pre-test score with sig. 0.109 > 0.05 and post-test with sig. 0.157 > 0.05 then the data is normally distributed.

Based on the results of the pre-test and post-test of the control and experimental classes, the calculation of the homogeneity test of the results of students' mathematical creative thinking abilities can be seen in the following table.

Table 5.
Data Homogeneity Pre-test and Post-test Conventional Learning
Test of Homogeneity of Variances

		Levene Statistics	df1	df2	Sig.
Value1	Based on Mean	.577	1	58	.451
	Based on Median	.418	1	58	.521
	Based on Median and with adjusted df	.418	1	56,466	.521
	Based on trimmed mean	.621	1	58	.434

Table 6.
Test Data Homogeneity Pre-test and Post-test Experiment Class
Test of Homogeneity of Variances

		Levene Statistics	df1	df2	Sig.
Value2	Based on Mean	.617	1	58	.436
	Based on Median	.431	1	58	.514
	Based on Median and with adjusted df	.431	1	55.149	.514
	Based on trimmed mean	.553	1	58	.460

Based on Tables 5. and 6. above, it can be seen that based on the mean, the significance value is 0.451 > 0.05, so it can be concluded

that the control class comes from populations that have the same or homogeneous variance. Meanwhile, in the experimental class based on the mean, it shows significance 0.436 > 0.05, it can be concluded that the experimental class comes from populations that have the same or homogeneous variance.

Pre-test data for the control class and the experimental class can be seen in the SPSS 25 table as follows:

Table 7.
Test Independent Samples T-Test Pre-test Control Class and Experiment Class

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Pre-Test	Equal variances assumed	.089	.766	-.083	58	.934	-.1667	2.0134
	Equal variances not assumed			-.083	57.917	.934	-.1667	2.0134

Based on Table 7. above, it can be seen the value of sig. 0.934 > 0.05 then H_0 accepted or the initial mathematical creative thinking ability of experimental class and control class students was not significantly different.

In this study, the ability to think creatively mathematically was seen through the results of the students post-test. Student assessments are based on the Creative Mathematical Thinking Ability Level (TKBK) ranging from TKBK 0 (not creative), TKBK 1 (Less Creative), TKBK 2 (creative enough), TKBK 3 (creative), TKBK 4 (very creative). As an overview of the results of research on the ability to think creatively mathematically in the following rectangular material, the post-test answers of the control class students will be shown. This can be seen in the following image.

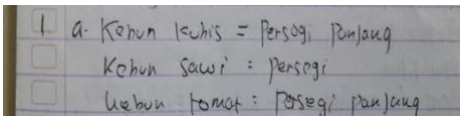

Figure 1.
Post-test result number 1a

Based on Figure 1. above it can be seen that students are able to make solutions to problems even though they are not fluent and not detailed in answering, because the

answers in number 1a are incomplete. At number 1a students reach TKBK 2 which is quite creative.

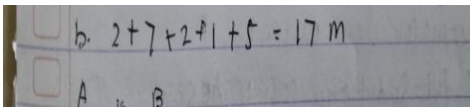

Figure 2.
Post-test results number 1 b

Based on Figure 2. above it can be seen that students are not able to make one answer or create different problems, but the methods used are varied and fluent, so that at number a students reach TKBK 1 which is less creative.

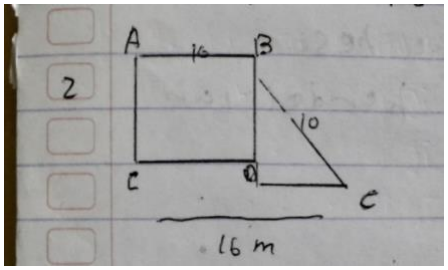

Figure 3.
Post-test result number 2

Based on Figure 3. From the above it can be seen that students are able to make a solution even though the answers produced are incomplete and fluent. In number 2, students reached TKBK 2 which is quite creative.

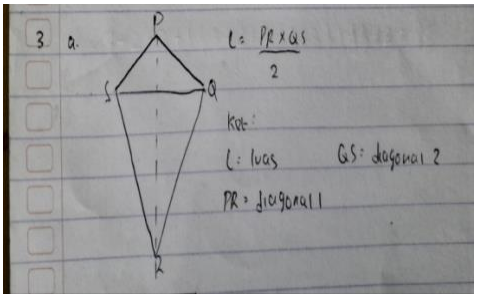

Figure 4.
Post-test results number 3a

Based on Figure 4. From the above it can be seen that students are able to make a solution even though the answers produced are not new and not fluent. At number 3a students reach TKBK 2 which is quite creative.

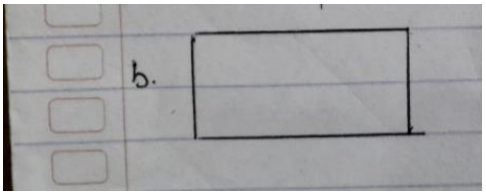

Figure 5.
Post-test results number 3b

Based on Figure 5. above it can be seen that students are not able to make one correct answer but the resulting answer is fluent. In number 3b students reach TKBK 1 which is less creative.

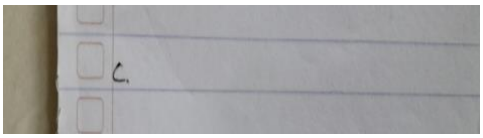

Figure 6.
Post-test result number 3c

Based on Figure 6. above, it can be seen that students are not able to make one alternative answer. In number 3c students reach TKBK 0 which is not creative.

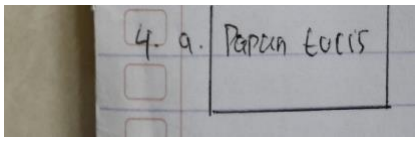

Figure 7.
Post-test result number 4a

Based on Figure 7. above, it can be seen that students are able to solve problems correctly, fluently, with new ideas, and in detail. At number 4a students reach TKBK 3 which is creative.

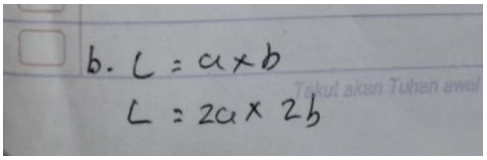

Figure 8.
Post-test result number 4b

Based on Figure 8. above it can be seen that students are able to make solutions but are not fluent and complete so that in number 4b students reach TKBK 2 which is quite creative.

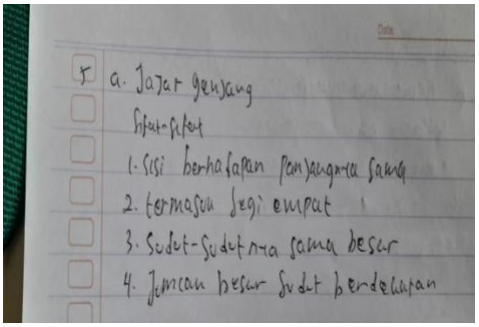

Figure 9.
Post-test results number 5a

Based on Figure 9. From the above it can be seen that students are able to make a new answer with a different solution even though it is not fluent. At number 5a students reach TKBK 3 which is creative.

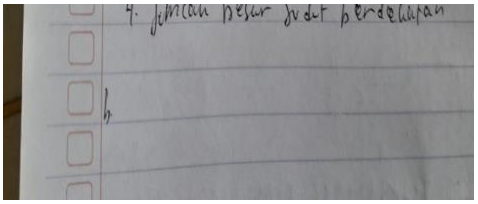

Figure 10.
Post-test results number 5b

Based on Figure 10. From the above it can be seen that students are not able to make an alternative answer or way of solving it. In number 5b students reach TKBK 0 which is not creative.

So it can be seen that the total score of the three control class students amounted to 60 of the maximum TKBK score of 120 with a percentage of 50%.

The general description of the results of the research on the mathematical creative thinking ability of the rectangular material below will show the post-test answers of the experimental class students. This can be seen in the following image.

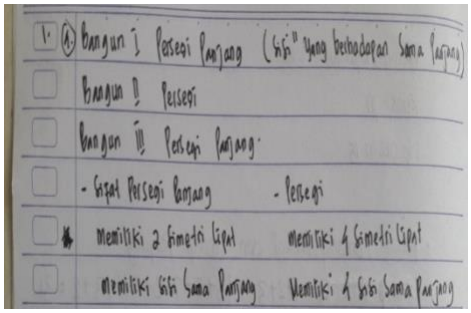

Figure 11.
Post-test result number 1a

Based on Figure 11. From the above it can be seen that students are able to solve a problem with more than one alternative and provide correct, fluent and detailed answers. At number 1a students reach TKBK 4 which is very creative.

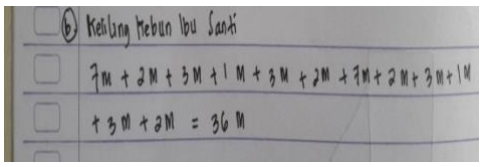

Figure 12.
Post-test results number 1b

Based on figure 12. From the above it can be seen that students are able to solve a problem and provide fluent, detailed and correct answers. In number 1b students reach TKBK 3 which is creative.

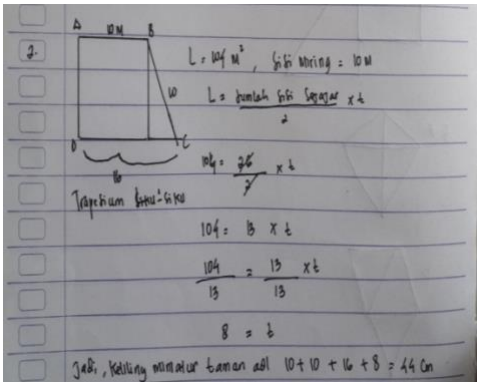

Figure 13.
Post-test result number 2

Based on figure 13. above it can be seen that students are able to solve a problem as well as more than one alternative solution. Provide answers clearly, correctly, fluently, in detail and with various solutions. At number 2 students reached TKBK 4 which is very creative.

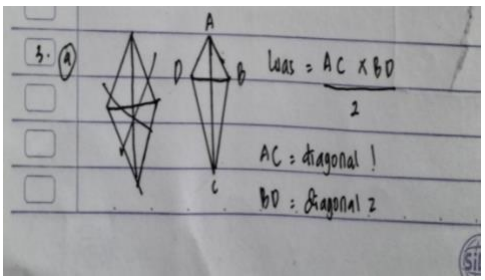

Figure 14.
Post-test results number 3a

Based on figure 14. From the above it can be seen that students are able to make more than one alternative solution. Give answers

clearly, from more than one point of view and correctly. At number 3a, students reach TKBK 4 which is very creative.

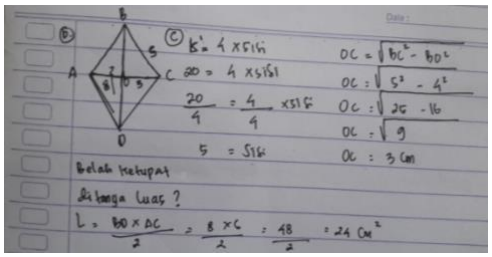

Figure 15.
Post-test results number 3b and 3c

Based on figure 15. above, namely 3b, it can be seen that students are able to solve a problem and have more than one alternative solution. Provide clear, correct, detailed answers. In number 3b students reach TKBK 4 which is very creative. While in number 3c students are able to solve a problem smoothly, in detail, use new ideas and produce correct answers. In number 3c students reach TKBK 4 which is very creative.

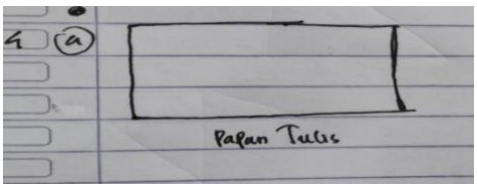

Figure 16.
Post-test result number 4a

Based on Figure 16. From the above it can be seen that students are able to solve problems correctly and smoothly. At number 4a students reach TKBK 3 which is creative.

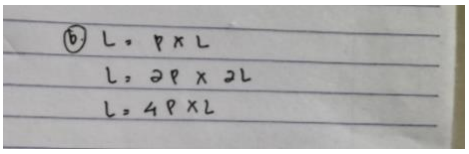

Figure 17.
Post-test result number 4b

Based on Figure 17. above it can be seen that students are able to solve a problem. Give answers clearly, from more than one point of view and correctly. In number 4b students reach TKBK 4 which is very creative.

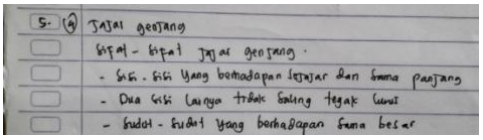

Figure 18.
Post-test results number 5a

Based on figure 18. above it can be seen that students are able to solve a problem as well as more than one alternative solution. Provide answers clearly, correctly, fluently, in detail and with various solutions. At number 5a students reach TKBK 4 which is very creative.

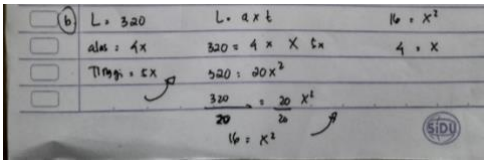

Figure 19.
Post-test results number 5b

Based on figure 19. above it can be seen that students are able to solve a problem as well as more than one alternative solution. Provide clear, correct, detailed answers.

So it can be seen that the total scores of the three control class students amounted to 112 from the total maximum score of TKBK which was 120 with a percentage of 93.333%.

After processing the data, the display of the post-test t-test results can be seen in table 4.20 below:

Table 8.
Test Independent Samples T-Test Post-test Control Class and Experiment Class
Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Post Test	Equal variances assumed	.103	.749	-13,338	58	.000	-23.8333	1.7869
	Equal variances not assumed			-13,338	57.773	.000	-23.8333	1.7869

Based on Table 8. above, it can be seen the value of sig. 0.000 $<$ 0.05 then H_0 rejected and H_a accepted so that it can be concluded that the mathematical creative thinking ability of students who received the Computational Thinking approach was significantly different.

This is in accordance with the research conducted by Kunthi Ratna Kawuri with a thesis entitled Application of Computational Thinking to improve the thinking skills of class X MIA 9 students of SMA Negeri 1 Surakarta on Business and Energy Materials. The results of this study explain that the application of Computational Thinking can improve the thinking skills of class X MIA 9 students at SMA Negeri 1 Surakarta (Kawuri, 2019). It is also in accordance with Jeanette Wing's theory in Ence Surahman which defines Computational Thinking

namely the thinking process needed in formulating problems and solutions, so that these solutions can become effective information processing agents in problem solving. (Surahman, 2021). In this study, it is in accordance with the theory that the application of Computational Thinking can improve the mathematical creative thinking skills of SMP Negeri 4 Petarukan students.

CONCLUSION

The results of students' mathematical creative thinking skills with conventional learning in class VII C of SMP Negeri 4 Petarukan showed an average mathematical creative thinking ability with a post test score of 60,417 and categorized as having a level of mathematical creative thinking ability 2 or creative enough with the percentage of achievement in the mathematical creative thinking aspect by 50%.

The results of mathematical creative thinking skills with the Computational Thinking approach in class VII D of SMP Negeri 4 Petarukan showed an average mathematical creative thinking ability with a post test score of 84.250 and categorized as having a mathematical creative thinking ability level of 4 or very creative with a percentage achievement of aspects mathematical creative thinking by 93.333%.

There is a significant difference between the level of mathematical creative thinking ability that applies the Computational Thinking learning approach and the level of mathematical creative thinking ability that applies conventional learning in rectangular material in class VII at SMP Negeri 4 Petarukan. This is evidenced by the results of the independent samples t-test which states that the significance value is 0.00 0.05 and the absolute value of t count is 13.338 >t <table is 2.048. On the other hand, the average post-test score for the experimental class was 84,250, which was greater than the post-test score for the control class, which was 60,417. This shows that the mathematical creative thinking ability of the experimental class is better than the control class.

For future researchers who are still relevant to this research, it is recommended to develop this research by using other solutions to students' mathematical creative thinking skills in solving math problems.

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