THE EFFECT OF THE COLLABORATIVE PROBLEM SOLVING ON LEARNING RESULT REVIEWED FROM THE ABILITY OF MATHEMATIC CRITICAL THINKING OF CLASS VII

Rinadin[1]
Program Studi Pendidikan Matematika Universitas Ahmad Dahlan
Jalan Ring Road Selatan, Tamanan, Banguntapan, Bantul Yogyakarta
[1]rinadin57@gmail.com

ABSTRACT

The low learning results of mathematics and the ability of critical thinking mathematically to mathematics in Junior High School (SMP) Muhammadiyah 3 Depok Class VII Sleman District of Academic Year 2019/2020 which is due to identifying, choosing a problem-solving strategy, making alternatives to problem-solving, classification a statement, and making students conclusions still confused, difficult and less thorough in solving math problems. The purpose of this research is to know whether there is and or whether a significant influence (1) model factors learning to the outcome of student mathematics learning, (2) factors factor in mathematical critical thinking students against learning outcomes of mathematics, (3) Interaction between learning models and the ability of critical thinking mathematically to students of student mathematics learning outcomes. The type of research used is the type of experimental research using Factorial Design. The factorial design used is two × two factorial design. The study population was all the SMP Muhammadiyah 3 Depok Class VII Sleman District of Academic Year 2019/2020 with a class VII A sample as the control class and class VII D as an experimental class. Data analysis techniques using ANAVA two lanes with a prerequisite analysis test use the normality test and homogeneity test. The hypothesis test uses variance analysis and is continued with the LSD test. Based on the two-lane analysis test, the first hypothesis influences the learning model of mathematics learning outcomes in SMP Muhammadiyah 3 Depok Class VII Sleman District of Academic Year 2019/2020. The second hypothesis shows an influence of critical mathematical thinking ability to study the mathematics results in SMP Muhammadiyah 3 Depok Class VII Sleman District of Academic Year 2019/2020. The third hypothesis shows the influence of interaction between learning models and mathematical critical thinking abilities. Based on the LSD test calculation, the learning model of Collaborative Problem Solving (CPS) combined with high mathematical critical thinking is most influential in mathematics students SMP Muhammadiyah 3 Depok Class VII Sleman District of Academic Year 2019/2020.

Keywords: Collaborative Problem Solving, Critical Thinking Mathematically Ability, Learning Outcomes

INTRODUCTION

Government efforts to improve Indonesia's quality of education have been carried out continuously, seen in several curriculum changes and developments. Law Number 20 of 2003 concerning the National Education System can guarantee the improvement of education quality. One of the efforts made is through improving the quality of learning.

The results of the 2018 research conducted by PISA (Program for International Students Assessment) in science, reading, and mathematics tests for 15-year-olds stated that out of 79 countries that participated and joined the OECD (The Organization for Economic Co-operation and Development), Indonesia's position for science is ranked 71, for reading is at 74 and for mathematics is at 73. The study results for mathematics ability, only 28% of Indonesian students achieved proficiency level 2, where the OECD average is 76%. Indonesia's low ranking in mathematics at PISA 2018 also indicates that the ability to think critically (critical thinking) is categorized as low, so it needs to be improved. According to Ennis (in Siswono, 2018: 7), critical thinking is "a process that aims to make reasonable decisions about something that is believed and carried out." According to Ennis (in Siswono, 2018: 138), indicators that contain critical thinking related to learning materials, namely, giving simple explanations, building basic

skills, concluding, providing further explanations, arranging strategies and tactics. These ability indicators can enable students to think critically in solving problems.

SMP Muhammadiyah 3 Depok is a private school in Sleman Regency, Yogyakarta Special Region. SMP Muhammadiyah 3 Depok has four class VII, namely class VII A, VII B, VII C, and VII D. Observations of grade VII A, VII B, VII C, and VII D students were conducted on the 8th while interviews with mathematics subject teachers conducted by researchers on October 9, 2019. According to the results of observations of class VII A, VII B, VII C, and VII D students conducted by researchers, there were several problems in the learning process, namely students' attention to teacher explanations when teaching was very lacking. Several students are less active in asking questions to the teacher during the learning process. When the teacher gives wrong statements, the students are still confused in clarifying whether the statement is true or false, not to justify wrong statements. When the teacher gives examples of more difficult questions than the example questions previously, students were still confused, and some students did not respond at all to do the problem.

While the results of interviews conducted by researchers to mathematics subject teacher Halimah Sa'diyah, M.Pd., obtained information that some students focus more on paying attention to learning during the learning hours, in the beginning, if given a math problem, students tend to ask friends without first identifying the problem, students were still confused in understanding the problem and choosing the given problem-solving strategy, students were also still confused in making alternative problem-solving steps given, and students were not careful in the process of solving mathematical problems. Students were still confused about making conclusions. The results of observations and interviews can be concluded that the students' critical thinking skills are still low in solving math problems.

Mathematics learning outcomes of grade VII students of SMP Muhammadiyah 3 Depok Class VII Sleman District of Academic Year 2019/2020 on the mid-semester assessment results. Of the 142 grade SMP Muhammadiyah 3 Depok Class VII Sleman District of Academic Year 2019/2020, 4 students scored ≥70.00 with a percentage of 2.82%, and 138 students obtained grades <70.00 with a percentage of 97.18%.

Judging from the problems that arise, a suitable learning model is the CPS learning model. According to Widjajanti (2008: 9), the CPS learning model is very suitable for improving mathematical critical thinking skills, problem-solving skills, and students' mathematical communication skills. Using the CPS learning model, students are expected to develop critical thinking skills in learning mathematics and improve students' mathematics learning outcomes.

In this study, the problem was formulated as follows: (1) Does the learning model factor significantly influence the mathematics learning outcomes of seventh-grade students of SMP Muhammadiyah 3 Depok Class VII Sleman District of Academic Year 2019/2020 (2) Does the mathematical critical thinking ability factor significantly influence the mathematics learning outcomes of SMP Muhammadiyah 3 Depok Class VII Sleman District of Academic Year 2019/2020? (3) Does the interaction between the learning model and students' mathematical critical thinking skills have a significant effect on the mathematics learning outcomes of seventh-grade students of SMP Muhammadiyah 3 Depok Class VII Sleman District of Academic Year 2019/2020?

From the main problems that have been formulated above, the objectives of this study are to (1) To find out whether there is a significant influence of the learning model factor on the mathematics learning outcomes of seventh-grade students of SMP Muhammadiyah 3 Depok Class VII Sleman District of Academic Year 2019/2020? (2) To find out whether there is a significant influence on students' mathematical critical thinking ability factors on the mathematics learning outcomes of seventh-grade students of SMP Muhammadiyah 3 Depok Class VII Sleman District of Academic Year 2019/2020? (3) To find out whether there is a significant effect of the interaction between the learning model and students' mathematical critical thinking skills on the mathematics learning outcomes of seventh-grade students of SMP Muhammadiyah 3 Depok Class VII Sleman District of Academic Year 2019/2020?

METHODS

This research was conducted in class SMP Muhammadiyah 3 Depok Class VII Sleman District of Academic Year 2019/2020 with class VII A as the control class and class VII D as the experimental class. Class VII A consists of 34 students, and class VII D consists of 36 students. The research design was conducted in two classes, namely the control class and the experimental class. The research design is described as follows:

Table 1. Research Design

Learning Model (A)	**Mathematical Critical Thinking Ability (B)**	
	Low	High
Collaborative Problem Solving (CPS)	Y_{11}	Y_{12}
Problem Based Learning (PBL)	Y_{21}	Y_{22}

Information:

Y_{11}: Student learning outcomes with mathematical critical thinking skills using the CPS Model

Y_{12}: Student learning outcomes with mathematical critical thinking skills using the CPS Model

Y_{21}: Student learning outcomes with mathematical critical thinking skills using the PBL Model

Y_{22}: Student learning outcomes with mathematical critical thinking skills using the PBL Model

The sampling technique used by researchers is the random sampling technique. The research instrument test used by the researcher was the instrument validation test. The prerequisite analysis test includes the normality test, the homogeneity test of variance, the variance analysis, and the LSD test. The instrument used in this study was a test in the form of a mathematics learning achievement test and a mathematical critical thinking ability test.

RESULTS AND DISCUSSION

The average score of critical thinking skills and the average score of mathematics learning outcomes among students in the experimental and control classes were calculated using the frequency distribution. The following scores were obtained: the average value of the experimental class's mathematical critical thinking ability was 35.94, with the highest score of 87, 50, and the lowest value 0.00. While the average value of the control class's mathematical critical thinking ability was 24.08, with the highest score of 62.50 and the lowest value was 0.00. While the average value of the experimental class mathematics learning outcomes was 54.17, the highest score was 78.57, and the lowest score was 0.00. Simultaneously, the average value of the control class mathematics learning outcomes is 49.79, with the highest score, 85.71, and the lowest value 0.00. The analysis can be demonstrated by testing the normality and homogeneity test as a prerequisite before testing the hypothesis.

The normality test is used to determine whether the value of students' mathematical critical thinking skills in mathematics learning and mathematics learning outcomes in the experimental class and control class usually is distributed or not. The normality test uses Chi-Square. The results of the normality test are presented in the following table:

Table 2. Summary of Normality Testing

No	Testing	χ^2_{count}	χ^2_{table}	Significance level	df	Info
1	Mathematical critical thinking skills experimental class	5,9831	11,0705	5%	5	Normal
2	Control class mathematical critical thinking skills	9,9305	11,0705	5%	5	Normal
3	Results of learning experimental mathematics class	10,3094	11,0705	5%	5	Normal
4	Mathematics learning outcomes of the control class	6,3447	11,0705	5%	5	Normal

After the normality test, the homogeneity test is then carried out. The homogeneity test is used to determine whether the variance of the value of mathematical critical thinking skills and the value of mathematics learning outcomes in the experimental and control classes is homogeneous or not homogeneous using the F-test. The summary of the results of the homogeneity test of the value of critical mathematical thinking skills can be seen in the following table:

Table 3. Summary of Homogeneity Test Results of Mathematical Critical Thinking Ability

F_{count}	$F_{0,025(35,33)}$	Significant Level	Information
1,9435	1,9886	5%	Homogeneous

Based on the calculation, the value of F_{count}= 1.9435 is obtained. At the F distribution value with a significant level of 5% and degrees of freedom for large samples 35 and small samples 33. Obtained $F_{\frac{\alpha}{2}(n_1-1)(n_2-1)}$= 1.9886, consequently $F_{count} < F_{0,025(35,33)}$ then H_0 is accepted, which means that the two classes have the same mathematical critical thinking ability value variance (having homogeneous variance). The summary of the results of the homogeneity test of students' mathematics learning outcomes can be seen in the following table:

Table 4. Summary of the Homogeneity of the Score of Mathematics Learning Outcomes

F_{count}	$F_{0,025(33,35)}$	Significant Level	Information
1,2774	1,9749	5%	Homogeneous

Based on the calculation, the value of F_{count}= 1.2774 is obtained. At the F distribution value with a significant level of 5% and degrees of freedom for the large sample 33 and the small sample 35. Obtained $F_{\frac{\alpha}{2}(n_1-1)(n_2-1)}$= 1.9749, consequently $F_{count} < F_{0,025(33,35)}$ then H_0 is accepted, which means that both classes have the same variance in mathematics learning outcomes (have homogeneous variances).

After the homogeneity test was carried out, then the hypothesis testing was continued. The first hypothesis, because $F_{abs}(A)$= 5.1806 and $F_{0,05;1;66}$= 3.9863 then $F_{abs}(A) > F_{0,05;1;66}$ so that $H_{0,1}$ is rejected, which means that there is an influence of the learning model factor on mathematics learning outcomes of SMP Muhammadiyah 3 Depok Class VII Sleman District of Academic Year 2019/2020. The second hypothesis, because of $F_{abs}(B)$= 23.4968 and $F_{0,05;1;66}$= 3.9863 then $F_{abs}(B) > F_{0,05;1;66}$ so that $H_{0,2}$ is rejected, which means that there is an influence of the mathematical critical thinking ability factor on mathematics learning outcomes of SMP Muhammadiyah 3 Depok Class VII Sleman District of Academic Year 2019/2020. The third hypothesis, because of $F_{abs}(AB)$= 4.6649 and $F_{0,05;1;66}$= 3.9863 then $F_{abs}(AB) > F_{0,05;1;66}$ so that $H_{0,3}$ is rejected, which means that there is an influence of the interaction between the learning model factor and the ability to think mathematically critical thinking on mathematics learning outcomes of SMP Muhammadiyah 3 Depok Class VII Sleman District of Academic Year 2019/2020.

The three hypotheses determine the existence of 3 influences, namely the influence of the learning model factor on mathematics learning outcomes in students, the mathematical critical thinking ability factor on mathematics learning outcomes in students, and the interaction between learning models and critical thinking skills on mathematics learning outcomes in students so that it requires an average test average.

After testing the hypothesis, the LSD test is performed. The LSD test was conducted to determine which one had a better effect on students' mathematics learning outcomes using learning model factors and mathematical critical thinking skills. The results of the LSD test calculations can be seen in the following table:

Table 5. Summary of Calculations and LSD Test Results

Case	$\lvert\bar{y}_i - \bar{y}_j\rvert$	LSD	Result	Description
$\mu_1 - \mu_2$	26,5626	10,7133	$\mu_1 > \mu_2$	Significant Effect
$\mu_1 - \mu_3$	16,8155	9,0544	$\mu_1 > \mu_3$	Significant Effect
$\mu_1 - \mu_4$	27,0032	10,4350	$\mu_1 > \mu_4$	Significant Effect
$\mu_2 - \mu_3$	9,7470	10,9654	$\mu_2 < \mu_3$	Not Affective
$\mu_2 - \mu_4$	0,4407	12,1304	$\mu_2 < \mu_4$	Not Affective
$\mu_3 - \mu_4$	10,1877	10,6936	$\mu_3 < \mu_4$	Not Affective

Based on the results of the LSD test in the table above, it can be concluded as follows: So, from the results above, it can be seen that μ_1 (CPS Learning Model with High Mathematical Critical Thinking Ability) has the most influence on the mathematics learning outcomes of SMP Muhammadiyah 3 Depok Class VII Sleman District of Academic Year 2019/2020.

CONCLUSION

Based on the results Based on data analysis, hypothesis testing, and the discussion that has been described, it can be concluded that the research results are as follows: (1) Based on the two-way analysis test, the first hypothesis is obtained $F_{abs}(A)$= 5.1806 and $F_{0,05;1;66}$ = 3.9863 at a significant level of 5% with degrees of freedom = 1 then $F_{abs}(A) > F_{0,05;1;66}$ so that $H_{11}$is rejected, which means that there is an effect of the learning model on mathematics learning outcomes in students of SMP Muhammadiyah 3 Depok Class VII Sleman District of Academic Year 2019/2020. (2) The second hypothesis is obtained $F_{abs}(B))$ = 23.4968 and $F_{0,05;1;66}$= 3.9863 at the 5% significant level with degrees of freedom = 1 then $F_{abs}(B) > F_{0,05;1;66}$so that H_{12} is rejected, which means that there is an effect of mathematical critical thinking skills on mathematics learning outcomes in students of SMP Muhammadiyah 3 Depok Class VII Sleman District of Academic Year 2019/2020. (3) The third hypothesis is obtained $F_{abs}(AB)$= 4.6649 and $F_{0,05;1;66}$= 3.9863 at a significant level of 5% with degrees of freedom = 1 then $F_{abs}(AB) > F_{0,05;1;66}$ so that $H_{13}$is rejected, which means that there is an influence of the interaction between learning models and mathematical critical thinking skills on mathematics learning outcomes in students of SMP Muhammadiyah 3 Depok Class VII Sleman District of Academic Year 2019/2020.

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