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The Effect of Problem Centered Learning (PCL) Approach towards Critical Thinking Skills of Class XI MAS Tanah Datar District

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Abstract

The mathematics learning outcomes of MAS students in Tanah Datar Regency are still relatively low. This is because students who enter private schools are students who do not pass the selection in public schools, besides learning is still centered on the teacher and the lack of critical thinking skills of students is one of the obstacles that affect the low student learning outcomes. One of the efforts is made to overcome this problem is to apply the PCL approach to learning. This study aims to determine the effect of the PCL approach on students' critical thinking skills, especially in line and series material. The study was conducted on two classes which were used as the experimental class and the control class. In the experimental class the treatment of learning was given by applying the PCL approach while the control class was given treatment with conventional learning. The research data was obtained from the results of the initial ability test (pre-test) given before the sequences and series subject matter was started and the final test (post-test) was given after the PCL treatment was carried out, while the data analysis was performed using non-parametric tests because the data was not normally distributed and has a non-homogeneous variance. The results of data analysis showed that there was the influence of the PCL approach to critical thinking skills of students class XI of MAS Salimpaung. The critical thinking of students with PCL approach was better than the critical thinking of students taught with conventional learning in class XI MAS Salimpaung.

Keywords*: Sequences and series, Approach PCL, Critical Thinking Skills*

Abstrak

Hasil belajar matematika siswa MAS di Kabupaten Tanah Datar masih relatif rendah. Hal ini terjadi karena siswa yang masuk ke sekolah swasta adalah siswa yang tidak lolos ke sekolah negeri. Disamping pembelajaran masih terpusat kepada guru dan keterbatasan kemampuan berpikir kritis siswa yang berakibat rendahnya hasil belajar siswa. Salah satu cara untuk mengatasi masalah ini adalah penggunaan pendekatan PCL. Tujuan dari penelitian ini adalah untuk menentukan pengaruh penggunaan pendekatan PCL pada kemampuan berpikir kritis siswa, khususnya dalam materi barisan dan deret. Penelitian ini merupakan penelitian eksperimen dengan dua kelas yaitu kelas eksperimen dan kelas kontrol. Kelas eksperimen di ajar dengan pendekatan PCL sedangkan kelas kontrol dengan pembelajaran konvensional. Data penelitian diperoleh dari hasil tes awal dan tes akhir yang diberikan setelah eksperimen. Data di analisis dengan menggunakan tes non parametrik karena data tidak berdistribusi normal dan tidak homogen. Hasil analisis data menunjukkan bahwa terdapat pengaruh pendekatan PCL terhadap kemampuan berpikir kritis siswa kelas XI MAS Salimpaung. Kemampuan berpikir kritis siswa dengan pendekatan PCL lebih baik dari pembelajaran konvensional.

Kata kunci: Barisan dan Deret, pendekatan PCL, Berpikir Kritis

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INTRODUCTION

Mathematics is able to improve thinking critical skills in understanding the problems of science and technology. It can improve students' ability to analyze problems, synthesize and even evaluate any information that has been collected. It is expected when students are able to solve mathematical problems, students are also to be able to think critically in solving other problems. The main purpose of students attending school is to shape the ability of students to think critically and mathematics is one of the subjects that is able to form and teach critical thinking skills to students (Slavin, 2011).

Critical thinking skills are useful in analyzing a mathematical problem. This is what causes the need for students to be equipped with critical thinking skills so that students are able to evaluate every argument that appears on a particular problem.critical thinking ability said to exist in a student if students are considered to have been able to: (1) distinguish which verifiable facts and claimed values, (2) determine the accuracy of a factual statement, (3) identify ambiguous arguments or claims, (4) determine reliable sources, identify written and unwritten assumptions, (5) identify logically or not a mistake, (6) detect something biased, (7) realize the consistency of logical thinking, (8) determine the extent of the strength of a claim or argument, (9) distinguish relevant or not an information and claim (Baker, Rudd, & Pomeroy, 2001).

The characteristics of people who have the ability to think critically are having high accuracy and not too quick to accept opinions from others. People who think critically will see whether the truth is entirely or partially true and sometimes even true (Liberna, 2012). Someone who has critical thinking skills will remain active both in understanding and in analyzing every information obtained. This can be seen by increasing the ability of students to provide explanations of simple problems, understanding of the problem and the way students analyze the seen information and convey problem solving with their own language so that it is easy to understand (Risnawati, 2008). The completion of math problems of students in Indonesia for higher order thinking skills (higher order thinking) is still relatively weak, which in general can be concluded that Indonesian Students for this aspect of ability are still weak. This is based on the reality found in the field that there are still many mathematics study teachers who are not yet aware of the demands on students to have critical thinking skills so that students have a strong basis for learning mathematics (Fauzan & Yerizon, 2013).

Private schools are schools that need special attention, students who attend Private Islamic Senior High School in general are students who do not pass the selection to enter public schools in Tanah Datar district and students who enter purely into this school are

still categorized as low. This can be seen from the number of students attending one of the private madrasas in Tanah Datar District, namely MAS (Private Islamic Senior High School) Salimpaung which amounted to 86 students, besides the reason students entered MAS (Private Islamic Senior High School) Salimpaung due to the economy of weak parents and requires students to work home from school. This causes the quality and student learning outcomes to be still relatively low, a similar incident also occurs in other Private Islamic Senior High Schoolin Tanah Datar District.

The low quality and learning outcomes obtained by students, can be seen from the National Examination value of Private Islamic Senior High School data in Tanah Datar District. The average values 46.30. This illustrates that the mathematical abilities of MAS (Private Islamic Senior High School) students in Tanah Datar Regency are still relatively low. It can be seen from none of the madrassas that get the standard average score of 75 for math subjects.

Based on the observations of researchers at MAS (Private Islamic Senior High School) Tanah Datar Regency, information was obtained about the difficulties experienced by some students in learning mathematics, among them, the students were not maximally digging up information in learning because teachers still dominated the learning activities. The learning activities carried out by the teacher in general are to provide definitions, to ask students to memorize formulas and provide some examples of questions then ask students to work on the given practice questions. This is the reason why students are not able to think more critically in solving the questions given by the teacher if the editorial questions are changed. In addition, in the learning process, students only wait and receive explanations from the teacher and the demands on students are merely able to solve the questions correctly and get satisfactory grades.

Besides that, the experience of the researcher as a mathematics teacher at the MAS (Private Islamic Senior High School) Salimpaung that researchers have made improvements to the quality of learning during the learning process in the classroom. Researchers have used several learning methods during the learning process in the classroom such as: question and answer, discussion, peer tutoring and group learning, but the learning outcomes obtained are still not optimal. Based on the tests of students' critical thinking skills at the MAS (Private Islamic Senior High School) Salimpaung can be seen in table 1 below.

Table 1. Values of Critical Thinking Ability Test for Students of Class XI in MAS Salimpaung

Early Critical Thinking Ability of Students	
Indicator	**Percentage (%)**
Clarifying questions, answers, and arguments	60,00
Analyze, collect and compile information needed	10,89
Evaluate	7,67
Referencing	30,66
Percentage Average**(%)**	**27,31**

Based on Table 1 above it can be seen that students' critical thinking skills are still relatively low. The same thing was said by several previous researchers who said that students' critical thinking skills were still low so further research was needed, including (Amalia, Duskri, & Ahmad, 2015; Choi, Lindquist, & Song, 2014; Hidayat, Susilaningsih, & Kurniawan, 2018; Oktriani, Fauzan, & Ellizar, 2018; Ozturk, Muslu, & Dicle, 2008; Rodzalan & Saat, 2015; Tanujaya, 2014).

Besides that, based on the results of interviews with researchers on several students of class XI MAS Salimpaung District, Tanah Datar District, information was obtained that when solving math problems students were still difficult to analyze questions and did not understand how to solve problems, namely questions to test students' critical thinking skills . Students assume math lessons are full of formulas and calculations, so it is difficult to memorize the steps to solve the problem. Mathematics learning is still simple, not using the right learning approach so as to improve students' critical thinking skills. There are still many students experiencing difficulties in the process of learning mathematics and are less responsible for the training given. So that makes mathematics as a subject that less attractive to most students. Students always consider math lessons to be full of formulas and calculations, and make students have not been able to interpret the usefulness of mathematics in their daily lives. Students are still not able to develop critical thinking skills optimally in learning mathematics, so student learning outcomes are relatively low.

In addition, to construct and improve knowledge in learning, students must have good interactions in group and class discussions. Prior knowledge of students becomes the basis for students to interact ideas in their minds, this initial ability becomes an important step in the learning process because the teacher can know the extent of the students' initial ability level before learning with a strategy, approach and learning method.

Based on the conditions that have been stated, it requires a learning that is able to improve optimally the critical thinking skills of students. Learning that is able to improve students' critical thinking skills is one of them is problem centered learning. Here students are trained to identify a problem, analyze it, reconstruct an argument, conduct an evaluation so students can solve the problem right and correctly. This PCL approach gives students the opportunity to build their knowledge so that students are able to think critically when analyzing a problem, identifying, evaluating and constructing an argument when facing a given problem. Building students' self-knowledge such as giving reasons and explanations, being consistent with explanations and being able to plant and reflect on other knowledge is the goal of PCL learning (Wheatley, 1993). In the learning process with the PCL approach students construct knowledge in themselves, students interact with their group friends which results in students becoming more active and critical thinking to always experiment in solving mathematical problems faced especially in activities that benefit their lives.

Learning through the PCL approach aims to make students get a broad opportunity to move potentially in mathematics learning. Learning with the PCL approach is able to increase children's participation and students are given the opportunity to have capacity activities (Yunas, 2013). Students' critical thinking skills can be trained in dealing with questions that use the process of thinking, asking and communicating with their group friends and with the teacher, so that students are able to solve mathematical problems. This certainly starts from the teacher providing a situation that focuses on the problems faced by students to the level of inquiry, investigation and problem solving. In learning with the PCL approach the teacher must pay attention to three important steps in learning, namely doing assignments, group activities and class discussions (sharing) (Wheatley, 1993).

RESEARCH METHODS

The type of this research when viewed from the problem under study is quasi-experimental research (quasy experiment). The population of this study was the class XI in MAS (Private Islamic Senior High School) Tanah Datar Regency where each school had homogeneous learning. The researcher used the Purposive Sampling technique to determine the school, the selected school was MAS (Private Islamic Senior High School) Salimpaung with certain considerations and paid attention to specific characteristics to solve the problem, namely the consideration of researchers teaching and its special characteristics was homogeneous with other MAS (Private Islamic Senior High School)

in Tanah Datar District (Sugiyono, 2013). To determine the experimental class and the control class, the researcher used the Random Sampling technique so that the XI IS class was selected as the experimental class and XI IPK as the control class.

This research uses the Randomized Control Group Only Design design, seen in Table 2 which is presented below.

Table 2. Research Design

Class	Treatment	Test
Eksperimental	P	T
Control	-	T

The researcher used two instruments, namely the initial ability test and the final ability test of students which included indicators of the two abilities studied in the learning process. The test in this research uses questions in the form of essays with subject matter in the sequence and series. The initial ability test instrument and the final ability test of the students used are 6 essay questions to test students' critical thinking skills.

The questions given were the same questions designed by the researcher and first validated by 5 validators and conducted a trial at the MAS (Private Islamic Senior High School) Barulak school in Tanjung Baru, Tanah Datar District. After that, a validity analysis, problem differentiation analysis, difficulty index and reliability of questions were carried out. Based on the results of the analysis it was concluded that the initial ability test questions and the final ability test of students used to test students' critical thinking skills could be used as a data collection tool.

The data analysis technique used is the normality test, homogeneity test and hypothesis testing of the initial ability test results and the final ability test of the experimental class and control class to test students' critical thinking skills. Testing the hypothesis to see the effect of the PCL approach to critical thinking skills of class XI MAS (Private Islamic Senior High School) Salimpaung students using the u test. U test is used on students' critical thinking skills because data is not normally distributed and not homogeneous.

RESULTS AND DISCUSSION

After carrying out a series of research, it was continued with data analysis and discussion. Data collected is data to test students 'critical thinking skills as seen in Table

3 about the average value, highest value, lowest value, standard deviation of the final test of students' critical thinking skills as follows:

Table 3. Average Value, Highest Value, Lowest Value, Standard Deviation of Critical Thinking Ability

Data Deskription	Final Test of Critical Thinking Ability	
	Experiment Class	Control Class
$\overline{X}$	6.92	3.40
S	3.861	3.882
N	13	15
X max	12	7
X min	2	0

Before testing the hypothesis statistically, the normality test was first carried out with SPSS software which used the Kolmogorov-Smirnov test to see whether the data was normally distributed or not and homogeneity test with SPSS software that used the Levene test to see whether the data variance was homogeneous or not . The criteria in the test are H_0 accepted if the value of Sig. > real level ($\alpha = 0.05$) and H_0 are rejected if the opposite happens.

Table 4. Normality Test with SPSS using Kolmogorov-Smirnov Experiment Class and Control Class

Tests of Normality				
	Class	Kolmogorov-Smirnov[a]		
		Statistic	df	Sig.
Results Learn Students	pretest eksperiment (PCL)	,262	13	,015
	postesteksperiment (PCL)	,213	13	,108
	pretest control (Conventional)	,228	15	,035
	postestcontrol (Conventional)	,175	15	,200*

Based on the table above the researchers used SPSS software to test the normality of critical thinking skills. Significant value of experimental class pre-test data and control class pre-test data is smaller than 0.05 level, for experimental class post-test data and control class post-test data is greater than 0.05 level, it can be concluded that H_0 is rejected which means that data is not normally distributed.

Table 5. Homogeneity Test with SPSS Using Levene Experiment Class and Control Class

		Levene Statistic	df1	df2	Sig.
Result Learn Students	Based on Mean	6,920	1	26	,014
	Based on Median	2,406	1	26	,133
	Based on Median and with adjusted df	2,406	1	19,221	,137
	Based on trimmed mean	6,843	1	26	,015

Based on the results of the homogeneity test calculation for students' critical thinking skills, it was found that the significant value (sig.) Based on the mean of the output data was 0.014 which means that it was smaller than the real level ($\alpha = 0.05$), so it can be concluded that the post-variance data the experimental class test and control class post-test data for students' critical thinking abilities were not homogeneous. This hypothesis test was carried out to see whether or not there was any influence of learning using the PCL approach to critical thinking skills of the Salimpaung XI class students using data from the pre-test and post-test students' critical thinking skills carried out in the experimental class are as follows.

Hypothesis testing is calculated with the help of SPSS software that uses the Wilcoxon test and the SPSS results are shown in the following table:

Table 6. Wilcoxon Test of Critical Thinking Ability

Test Statistics[a]		
	Post-Test Eksperiment - Pre-test Eksperiment	Post-Test Control - Pre-tesControl
Z	-2,949[b]	-2,884[b]
Asymp. Sig. (2-tailed)	,003	,004

Ranks				
		N	Mean Rank	Sum of Ranks
Post-Test Eksperiment - Pre-test Eksperiment	Negative Ranks	0[a]	,00	,00
	Positive Ranks	11[b]	6,00	66,00
	Ties	2[c]		
	Total	13		
Post-Test Kontrol - Pre-tesControl)	Negative Ranks	1[d]	2,50	2,50
	Positive Ranks	11[e]	6,86	75,50
	Ties	3[f]		
	Total	15		

From the ranks table in the experimental class pre-test and post-test it can be seen that the negative ranks or the difference (negative) between the pre-test and post-test are 0 both in the N, Mean Ranks and Sum of Ranks values. A value of 0 indicates no decrease (reduction) from the pre-test value to the post-test value. In Positive Ranks or the difference (positive) it is known that between the pre-test and post-test the experimental class shows a value of 11 (in N) which means that there are 11 students experiencing an increase in the value from the pre-test to the post-test value. Mean Ranks or an average increase of 6.00, while the number of positive ranks or Sum of Ranks is 66.00. In Ties is the similarity of values obtained in the pre-test and post-test experimental class. The Ranks Table shows that the value is 2, which means there are 2 students who get the same score at the pre-test and post-test.

In table 7 above it is known that the value of Asymp. Sig. (2-tailed) is 0.003 <0.05 (the real level set) then H_0 is rejected or H_1 is accepted. This means that there are significant differences between the mathematics learning outcomes for students' critical thinking skills in the pre-test experimental class data with experimental class post-test data (PCL approach). In addition, the Wilcoxon test also shows that there is an increase in the average value of the experimental class pre-test and experimental class post-test. The cause of the influence of the PCL approach to critical thinking skills in the experimental class is because learning with the PCL approach is able to increase student participation in learning because of students get the opportunity to construct their knowledge and conduct potential learning activities (Jakubowski, 1993). The purpose of PCL is to construct students' knowledge that students can explain and give reasons, have consistency, can reflect and instill into other knowledge (Wheatley, 1993).

The theoretical inspiration for a PCL environment is "constructivism" (von Glasers-feld, 1989). PCL is a learning approach that focuses students' abilities to construct their understanding of mathematical concepts (Jakubowski, 1993). Learning with the PCL approach also provides opportunities for students to be actively involved in learning, students are able to work together in groups and provide opinions as a result of critical thinking about the lessons being studied (Marsigit, 2003). In addition, students can also exchange ideas with group friends with ideas they have to solve the problems given and help other friends in the class by presenting the results of their group discussions. Learning with the PCL approach is a problem-oriented learning approach so students have ideas in constructing important subjects through active participation and being able to reflect on this learning (Wood & Sellers, 1996).

Based on the elaboration, it can be concluded that there is an influence of learning using the PCL approach to students' critical thinking skills in mathematics subject in sequence and lines. The next hypothesis test was carried out to see whether there were differences between the average of two unpaired samples, namely the experimental class average and the control class average for critical thinking skills of the XI MAS Salimpaung class students and to see whether students' critical thinking skills class XI MAS Salimpaung experimental class (PCL learning) is higher than the average critical thinking ability of class XI MAS Salimpaung control class (conventional learning). The hypothesis is as follows: This hypothesis test was calculated with the help of SPSS software using the Mann Whitney Test.

Table 7. Mann Whitney Test U Critical Thinking Ability of Students

Test Statistics[a]	
	Results Learn Students
Mann-Whitney U	43,000
Wilcoxon W	163,000
Z	-2,550
Asymp. Sig. (2-tailed)	,011
Exact Sig. [2*(1-tailed Sig.)]	,011[b]

Ranks				
	Class	N	Mean Rank	Sum of Ranks
Result Learn Students	Post-TestClass Eksperiment (PCL)	13	18,69	243,00
	Post-TestClassControl	15	10,87	163,00
	Total	28		

In Table 7 above, it is known that the sig (2-tailed) value is 0.011 <0.05, then H_0is rejected or H_1 is accepted. This means that the average critical thinking ability of class XI MAS Salimpaung students in the experimental class (PCL approach) is higher than the average critical thinking ability of students in the control class (conventional learning). The table also shows that there are differences in the average value in the experimental class with the average value in the control class.

The cause is that there is a difference in the average critical thinking skills of the MAS XI-class students of Salimpaung between the experimental class and the control class. The PCL approach involves three components, they are assignments, group activities and sharing (Wheatley, 1993). Group work can also provide opportunities for

students to think and find different approaches, train students to accept the opinions of others (Marsigit, 2003).

The PCL approach trains students about three important learning abilities, namely: (a) To find concepts and solve problems including being able to read facts, answer questions and work on assignments / worksheets, (b) To think not just to remember, (c) To can work in small groups, not only compete with others (Kadel, 1992). With the critical thinking skills obtained by students through the PCL approach makes students more active in constructing their knowledge. This can be seen from the enthusiasm of students in working on Student Worksheets (LKPD) given, students are more challenged to think. The LKPD that students work on every meeting is able to guide students to think critically about the steps that lead to the material learned by students. According to (Trianto, 2009), LKPD is a student guide that is used to carry out investigation or problem solving activities.

In the control class with conventional learning, the teacher still teaches in the form of lectures, provides practice questions and asks students to do the exercises in the group and appoints one of the students to work ahead. Learning is still one-way with students waiting for more explanations from the teacher, which results in students becoming lazy in learning their own subject matter. Most students did not want to think critically to solve a given problem and tend to wait for a smart friend to solved it, when the teacher appoints one of the students to work forward what happens is that the student brings a friend's answer book that is smart to copy on the writing board. This was revealed after the researcher asked the student to explain what was done in front of the writing, it turned out that the student was unable to explain it and after being asked where the answer came from it was revealed that the group friend's book was considered smart by his group friends.

Based on the description above it can be concluded that the critical thinking skills of class XI MAS (Private Islamic Senior High School) Salimpaung students in the experimental class (PCL approach) are better than the average students' critical thinking abilities in the control class (conventional learning) for row and series material.

CONCLUSIONS AND SUGGESTIONS

Based on the explanation of the results of the research carried out in the XI class of MAS (Private Islamic Senior High School) in Salimpaung and the discussion can be taken it was concluded that there is a significant effect on critical thinking skills of students class XI of MAS (Private Islamic Senior High School) in Salimpaung after being treated with the PCL approach. The critical thinking ability of XI class of MAS (Private Islamic Senior High School) in Salimpaung students who use the PCL approach in learning is better than students with conventional learning. Thus learning that uses the PCL approach can be used as a solution in the problems of mathematics education, especially to improve students 'mathematics learning outcomes, namely on students' critical thinking skills.

Based on the results of the research obtained, the researcher can put forward the following suggestions for the mathematics teacher MAS (Private Islamic Senior High School) in Salimpaung. As an alternative to improve student learning outcomes in school. For further researchers who are interested, they can continue this research on the other material by including critical thinking skills and mathematical problem solving abilities of students and can develop with other abilities on mathematics subjects.

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