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Application of the Reciprocal Teaching Model in Class Xi Mathematics Learning

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Abstrak

Penelitian ini bertujuan untuk mengetahui hasil belajar matematika peserta didik kelas XI pada materi turunan fungsi aljabar yang diberi perlakuan model reciprocal teaching dan hasil belajar peserta didik yang diberi perlakuan model pembelajaran konvensional. Penerapan model reciprocal teaching pada kelas eksperimen diharapkan dapat meningkatkan aktivitas peserta didik dalam pembelajaran. Metode penelitian ini adalah penelitian kuantitatif. Desain yang digunakan adalah desain eksperimental semu dengan jenis non equivalent control group design. Populasi penelitian peserta didik kelas XI SMA Negeri 1 Buluspesantren. Teknik pengambilan sampel dilakukan secara cluster random sampling dan diambil satu kelas eksperimen dan satu kelas kontrol. Instrumen pengumpulan data dalam penelitian ini adalah pretest dan post-test. Uji prasyarat analisis menggunakan metode Lilliefors untuk uji normalitas, uji homogenitas menggunakan metode Bartlett, uji keseimbangan dan uji homogenitas menggunakan uji t. Hasil analisis data dengan uji t menunjukkan bahwa t_obs>t dengan t=1,677 dan t_obs=4,599. Keputusan uji t adalah H_0 ditolak, sebab t_obs terletak di daerah kritik. Dari hasil analisis data, diperoleh kesimpulan bahwa model reciprocal teaching memberikan hasil belajar yang lebih baik daripada model pembelajaran konvensional. Model reciprocal teaching pada kelas eksperimen dapat meningkatkan aktivitas peserta didik dalam pembelajaran.

Kata Kunci: *model reciprocal teaching, model konvensional, hasil belajar*

Abstract

This study aims to determine the mathematics learning outcomes of class XI students on the material of the derivative of algebraic functions treated with the reciprocal teaching model and the learning outcomes of students treated with conventional learning models. Applying the reciprocal teaching model in the experimental class is expected to increase student activity in learning. This research method is quantitative research. The design used is a pseudo-experimental design with a non-equivalent control group design. The study population was students of class XI SMA Negeri 1 Buluspesantren. The sampling technique was carried out by cluster random sampling, and one experimental class and one control class were taken. The data collection instruments in this study were pretest and post-test. Prerequisite test analysis using the Lilliefors method for normality test, homogeneity test using the Bartlett method,

balance test and homogeneity test using the t-test. The results of data analysis with the t-test show that t_obs>t with t = 1.677 and t_obs = 4.599. The t-test decision is H_0 rejected because t_obs is in the criticism area. From the results of the data analysis, it is concluded that the reciprocal teaching model provides better learning outcomes than the conventional learning model. The reciprocal teaching model in the experimental class can increase student activity in learning.

***Keywords**: reciprocal teaching model, conventional model, learning outcomes*

Introduction

Mathematics as a basic science continues to develop in line with the development of other sciences. According to [1], no country can develop scientifically and technologically if it ignores mathematics because mathematics is a subject that allows a person to gain knowledge about understanding and interpreting concepts in science and technology. Based on observations and interviews that researchers conducted in class XI of SMA Negeri 1 Buluspesantren in November 2021, learning mathematics in class XI of SMA Negeri 1 Buluspesantren uses a conventional learning model with an expository method. Implementing conventional learning models tends to be monotonous, with the teacher as the center source of knowledge (teacher centered). Learning with conventional models is considered less motivating for students to participate actively in learning because learning is still teacher-oriented; in its implementation, it does not involve student activity and tends to wait for orders from the teacher.

Learners are less active in communicating their ideas or ideas, so the majority of learners are less able to conclude the meaning of the subject matter [2,3]. As a result, students' learning outcomes are low, and the quality of education is low. This is because learning outcomes affect the improvement of the quality of education. In addition, the cause of low student learning outcomes in mathematics learning is the inappropriate use of learning models applied by teachers in the classroom. The results of the national exam in mathematics at the senior high school level are the lowest scores compared to other exam subjects, with an average for science and social studies majors of 39.37 and 34.35 [4]. Based on the results of the PISA study, Indonesia has consistently ranked in the bottom 10 for about the last ten years [5]. This shows that students' learning outcomes in mathematics are still relatively low.

Learning outcomes mean the results obtained by a person in the form of cognitive, affective, and psychomotor in the teaching and learning process assessed through tests [6]. Learning outcomes are the abilities obtained by children after going through learning activities [7]. Learning outcomes result from students' efforts, skills, and behavior in completing educational tasks set at each level of education in the form of numbers or grades. Based on the various definitions above, it can be concluded that mathematics learning outcomes are changes in a person as a result of learning knowledge obtained from the effects of human thought that underlies the development of science and technology that can be applied in various fields of life that have been arranged based on certain patterns expressed in numerical form.

One way to improve student learning outcomes is to update the conventional learning system to be more developed and apply the appropriate learning model so that students can learn optimally. The learning model by the above problems is the reciprocal teaching-learning model. Through the reciprocal teaching-learning model, students are trained to understand the material and provide explanations to their peers, so experts call this reciprocal teaching peer practice [8]. This learning model is one of the learning

models that can train students to ask questions, discuss actively, and direct students to understand the problem so that it is expected to improve student learning outcomes. Based on the description above, a study focused on applying the reciprocal teaching model to student math learning outcomes at SMA Negeri 1 Buluspesantren. This study aimed to determine the mathematics learning outcomes of grade XI students on the material of the derivative of algebraic functions treated with the reciprocal teaching model better than the learning outcomes of students treated with conventional learning models.

Metods

This type of research is quantitative research with experimental methods [9]. This research design is a non-equivalent control group design. The population in this study was class XI SMA Negeri 1 Buluspesantren which consisted of 5 classes. In this study, researchers used a cluster random sampling technique. Samples were obtained randomly from the five available classes; from the five classes, two classes were taken as research samples. Each of these classes is an experimental class and a control class. The independent variables in this study are learning models categorized into reciprocal teaching models and conventional learning models with expository methods. The dependent variable in this study is the mathematics learning outcomes on the material of the derivative of algebraic functions.

The instrument used in this research is a written test. The tests conducted in this study were pretest and post-test. Before the test is given to the experimental class and control class, it is first validated by a validator and tested on other than the class that will be treated. Then the level of difficulty, distinguishing power, and reliability were calculated. This study uses multiple-choice questions and descriptions to find the reliability of multiple-choice questions (objective-type test instruments) using the KR-20 formula [10].

$$\boldsymbol{r = \left(\frac{n}{n-1}\right).\left(\frac{{s_t}^2 - \sum p_i.q_i}{{s_t}^2}\right)}$$

Keterangan:
r : reliability coefficient
n : the number of items
p_i : the proportion of the number of subjects who answered correctly on item i
q_i : proportion of the number of subjects who answered incorrectly on item i
${s_t}^2$: variance of total scores

The formula for finding the reliability of the description question uses the Cronbach Alpha formula [10].

$$r = \left(\frac{n}{n-1}\right)\left(1 - \frac{\sum {s_i}^2}{{s_t}^2}\right)$$

Keterangan:
r : reliability instrument
n : the number of items
$\sum {s_i}^2$: variance of the score of the i-item
${s_t}^2$: variance of total scores

The pretest value data is the data on students' math learning outcomes before treatment, and the post-test data is the data on students' math learning outcomes after treatment. The pretest and post-test results are used as material to calculate the normality test, homogeneity test, balance test, and hypothesis testing. In this study, the normality test was used with the Lilliefors method. This homogeneity test used the Bartlett method with the Chi-squared test: balance test, and hypothesis test using t-test.

Result and Discussion

The initial data in this study are the pretest results of students. Before the experimental and control classes were treated, a pretest was first given as the students' initial data. For the experimental class of 25 students obtained $\sum X = 1480$ and $\sum X^2 = 90482$ so that the average is obtained $\bar{X} = 59$ and a standard deviation of $s = 10{,}93$. As for the control class, out of 25 students obtained

$\sum X = 1358$, $\sum X^2 = 75408$, $\bar{X} = 54$ and a standard deviation of $s = 8{,}3$. Researchers used post-test score data on algebraic function derivative material to calculate the final stage data. For the experimental class, out of 25 students obtained $\sum X = 1755$, $\sum X^2 = 126695$, $\bar{X} = 70{,}2$ and a standard deviation of $s = 12$. As for the control class, out of 25 students obtained $\sum X = 1550$, $\sum X^2 = 98522$, $\bar{X} = 62$ and a standard deviation of $= 10{,}05$.

Based on the normality test of the experimental class, obtained $L_{maks} = 0,1673$ dan $L_{tabel} = 0,1730$ with significance level 5% and n = 25, so, $L_{maks} < L_{tabel}$ It can be concluded that the experimental class comes from a normally distributed population. While the normality test in the control class is obtained L_{maks} = 0, 1652 and $L_{tabel} = 0,1730$ with significance level 5% and n = 25, so, $L_{maks} < L_{tabel}$ It can be concluded that the control class comes from a normally distributed population. Homogeneity test using initial pretest data obtained $\chi^2{}_{hitung} = 1{,}798$ and $\chi^2{}_{tabel} = 3{,}841$ with significance level 5%, so, $\chi^2{}_{hitung} < \chi^2{}_{tabel}$, so that both classes have the same variance. After the normality and homogeneity of variance tests, a balance test was conducted to determine whether the two lessons to be treated had the same mathematics ability.

Table 1. Summary of Balance Test

Kelas	∑X	n	$\bar{X}$	s	s_p	t_{obs}	t_{tabel}
XI MIPA 2 (Eksperimen)	1480	25	58	10,9	9,7	1,818	2,0106
XI MIPA 1 (Kontrol)	1358	25	54	8,3			

Based on the balance test results, obtained $t_{obs} = 1{,}818$ and $t_{tabel} = 2,0106$ with, $DK = \{t \mid t < -2,0106\ atau\ t\ 2,0106\}$, because, t_{obs} does not lie on DK, then H0 is accepted, so the two classes have the same initial ability.

Based on the normality test after treatment in the experimental class, obtained $L_{maks} = 0,1398$ dan $L_{tabel} = 0,1730$ with significant level 5% and n = 25, so, $L_{maks} < L_{tabel}$ It can be concluded that the experimental class comes from a normally distributed population. While the normality test in the control class is obtained $L_{maks} = 0,0998$ dan $L_{tabel} = 0,1730$ with significant level 5% and n = 25, so, $L_{maks} < L_{tabel}$ It can be concluded that the control class comes from a normally distributed population. Based on the homogeneity test using the final data or post-test scores obtained $\chi^2{}_{hitung} = 0{,}0203$ and $\chi^2{}_{tabel} = 3{,}841$ with significant level 5% so, $\chi^2{}_{hitung} < \chi^2{}_{tabel}$, so both classes have the same variance.

After the normality test, homogeneity of variance test, and the calculation results show that the post-test data of the experimental and control classes are normally distributed and homogeneous, then hypothesis testing is carried out. This research uses the t-test with degrees $n_1 + n_2 - 2$ with a significance level of 5%. To test the balance, t-test was used based on the average difference between the experimental and control classes. The hypothesis test results showed $t_{obs} > t_{tabel}$, so, H_0 was rejected with the conclusion that the reciprocal teaching learning model provided better learning achievement than the conventional learning model. The following is a hypothesis test summary table:

Table 2. Summary of Balance Test

Kelas	∑X	n	$\bar{X}$	s	s_p	t_{obs}	t_{tabel}	conclusion
(Eksperimen)	1755	25	70,2	12	11,07	4,599	1,677	H_0 ditolak
(Kontrol)	1550	25	62	10,5				

The results of this study indicate that the reciprocal teaching model is better than the conventional learning model, because the application of the reciprocal teaching model in the experimental class can increase students' activities in learning activities, and students become more confident in conveying the results of discussions and opinions in learning. This is one of the advantages of reciprocal teaching compared to conventional models that the reciprocal teaching model results in students being more active in participating in

learning activities, increasing student independence, and more easily understanding learning.

In line with the opinion of [11] who said that the advantages of the reciprocal teaching model were proven to be able to significantly influence mathematics learning outcomes, these advantages include: increased activity, sense of responsibility, creativity, and motivation to learn from students, the courage to express ideas and opinions greatly encouraged students to follow better learning. The learning groups formed are heterogeneous, so that students who have more ability can explain to friends who have lower abilities. In accordance with the opinion of [12,13] who said that there was an increase in learner activity in learning activities that used the reciprocal teaching model, so that increased learner activity was a supporting factor in improving learning outcomes.

In addition, the application of the reciprocal teaching model also trains students to think and understand the problem. Learners become trained in understanding the problem when they perform the stages of the reciprocal teaching model, which are contained in the activities of making questions (question generating), working on problems and discussing LKPD (predicting), explaining what has been obtained as the teacher explains (clarifying) and practicing summarizing the material that has been obtained (summarizing). These stages help students to improve their learning outcomes. This is in accordance with the opinion of [14] that the improvement in student learning outcomes is also supported by an increase in student activity during teaching and learning activities and there is an increase in the ability to think and understand problems in students who are subjected to the reciprocal teaching model.

Conclusion and Suggestion

Based on the discussion and results of data analysis, the following are the advantages of reciprocal teaching model compared to conventional models: training students' ability to learn independently, training cooperation with friends, increasing students' activeness and creativity, training students' courage to express their opinions in front of the class, and training students to analyze and solve problems. The reciprocal teaching model is a learning model that causes learner activity to increase. High student learning activities are better than students with low learning activities, so that student learning outcomes increase. This is in accordance with the results of the post-test in the experimental class treated with the reciprocal teaching model which experienced a high increase compared to the control class which was treated with the conventional model, so it can be concluded that the mathematics learning outcomes of class XI students of SMA Negeri 1 Buluspesantren in the 2021/2022 academic year on the subject of derivatives of algebraic functions treated with the reciprocal teaching model are better than the learning outcomes of students treated with conventional learning models.

Based on the conclusions that have been obtained, the authors provide several suggestions, namely the reciprocal teaching model can be used by math teachers as a variety of learning models in the classroom with algebraic function derivative material. This research still has many shortcomings and limitations, so it is hoped that other researchers with similar research can refine and improve this research, for example by adding meetings in learning so that learning with the reciprocal teaching model can take place optimally.

References

[1] Ginga UA, Muhammed B, Usman N. Effect of reciprocal teaching strategy on students performance in word problem leading to simultaneous equations for creativity in basic secondary and tertiary education in Yobe state. Abacus (Mathematics Education Series) 2019;44:250–9.

[2] Stodolsky SS. The subject matters: Classroom activity in math and social studies. University of Chicago Press; 1988.

[3] Wallace RM. Online learning in higher education: A review of research on interactions among teachers and students. Education, Communication & Information 2003;3:241–80.

[4] Nur MA. PENGARUH EFIKASI DIRI TERHADAP PRESTASI BELAJAR MATEMATIKA MELALUI KETERLIBATAN BELAJAR SISWA KELAS XI SMA NEGERI 2 BULUKUMBA. Infinity: Jurnal Matematika Dan Aplikasinya 2021;2:1–10. https://doi.org/10.30605/27458326-54.

[5] Ridzkiyah N, Effendi KNS. Analisis kemampuan literasi matematis siswa sma dalam menyelesaikan soal program for international student assessment (PISA). JIPMat 2021;6:1–13. https://doi.org/10.26877/jipmat.v6i1.8237.

[6] Margono E, Maulidiya D, Hanifah H. ANALISIS HASIL BELAJAR MATEMATIKA SISWA DENGAN PEMBELAJARAN PROBLEM POSING TIPE POST SOLUTION POSING DI KELAS XI SMA NEGERI 2 KOTA BENGKULU. Jurnal Penelitian Pembelajaran Matematika Sekolah (JP2MS) 2019;3:151–6.

[7] Muflihah A. Meningkatkan motivasi dan hasil belajar siswa melalui model pembelajaran index card match pada pelajaran matematika. Jurnal Pendidikan Indonesia 2021;2:152–60. https://doi.org/10.59141/japendi.v2i01.86.

[8] Rinjani DM, Raksun A, Artayasa IP. Penerapan Model Reciprocal Teaching Untuk Meningkatkan Prestasi Belajar Biologi Siswa Kelas X Di SMAN 4 Mataram Tahun Ajaran 2008/2009. Jurnal Pijar Mipa 2010;5.

[9] Sugiyono. Metode Penelitian Kuantitatif, Kualitatif, dan R&D. Bandung: CV. Alfabeta; 2017.

[10] Lestari KE, Yudhanegara MR. Penelitian pendidikan matematika. Bandung: PT Refika Aditama 2015;2.

[11] Widana IW. Pengaruh Model Pembelajaran Reciprocal Teaching terhadap Hasil Belajar Matematika dengan Mengontrol Kemandirian Belajar. Jurnal Emasains: Jurnal Edukasi Matematika Dan Sains 2020;9:2016–223.

[12] Ahmadi MR, Ismail HN, Abdullah MKK. Improving vocabulary learning in foreign language learning through reciprocal teaching strategy. International Journal of Learning and Development 2012;2:186–201.

[13] Mulyono D. The influence of learning model and learning independence on mathematics learning outcomes by controlling students' early ability. International Electronic Journal of Mathematics Education 2017;12:689–708.

[14] Baeti N, Mikrayanti M, Mutmainah M, Silviana D, Sartika D, Muchlis M. Pengaruh Pengunaan Model Reciprocal Teaching terhadap Hasil Belajar Matematika Siswa SMP. Jurnal Pendidikan Tambusai 2021;5:2936–40.