

Research Article

The Increasing Students' Problem-Solving Abilities and Social Attitudes Using the Reciprocal Learning Model

Lena Rosdiana Pangaribuan¹, Hasratuddin², Bornok Sinaga³

¹ Universitas HKBP Nommensen (UHN), Medan, Sumatera Utara, Indonesia

² Universitas Negeri Medan, Medan, Sumatera Utara, Indonesia

*Corresponding Author: lenapangaribuan@uhn.ac.id | Phone: +6281397971231

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ABSTRACT

This research is a Classroom Action Research carried out in the Husni Thamrin school field with research subjects XI-IPA grade students the object of research is the application of models of reciprocal learning to increase mathematical problem solving and social attitude of students. This research consists of 2 cycles, each consisting of 2 meetings. The analysis data on cycle I indicated that (1) the average test scores for problem solving are 68,0 or 73% of the number of students who take the test can solve problems fairly minimal category and 27% had levels below the category of problem solving ability sufficient, (2) The value of obtaining students' social attitudes is 2,0 including the bad category (3) current activity levels of students do not meet the ideal percentage of time specified, (4) there are 93,4% of total students taking learning to respond positively to the components and learning activities. In the second cycle, the results obtained : (1) the average test scores for problem solving abilities were 73,0 or 86,6% of the number of students taking the test can solve problems fairly minimal category and 13,4% had levels below the category of problem solving ability sufficient, (2) The value of obtaining students social attitudes is 3,50 including the excellent category, (3) current activity levels of students who meet the ideal percentage of the time, (4) there are 96,67% of the students gave a positive response to the components of learning activities. Based on the results of cycles I and II can be concluded that the implementation of reciprocal learning models can increase the problem-solving ability and social attitude of students.

Keywords: Problem Solving; Social Attitude; Attitude Teaching; Reciprocal Learning Model; Students Learning

1. INTRODUCTION

The development of Science and Technology which has been increasingly developing recently cannot be separated from the creativity of reliable human resources. The right means to increase the creativity of human resources is through education, whether through formal education that can be carried out by the community, namely education in schools starting from elementary, middle and high school levels. School is a place to develop human resources that are in line with developments in science and technology. Learning process so far it has always been teacher-centred. When implementing the learning process, it is often the teacher carrying out teaching in a one-way model, this means that teachers are more active in teaching, compared to the students. Students' desires and activities are not visible, students look lacking enthusiastic about the learning process. This can be caused by several factors, in including: (1) students pay less attention to the teacher explaining the material during the process learning progresses and considers the lesson uninteresting or even boring, (2) student activities are not visible when studying because they consider mathematics learning only mathematical formulas, and (3) lack of teacher creativity in providing learning model to create a pleasant atmosphere during the process learning takes place. The teacher's understanding, comprehension and views on the learning model can be achieved influencing students' roles and activities in learning.

Teacher activities in teaching and student activities in learning really depend on the teacher's understanding of learning models. Teaching is not just a process of imparting knowledge knowledge, but rather contains a broader and more complex meaning, namely occurrence communication and interaction between students and teachers. Mathematics teaching in schools needs to have an emphasis that is relevant to everyday life. In this way, the mathematics lessons learned will be more meaningful and students can apply them in their daily lives. Therefore, educators need to prepare targeted programs so that students gain meaningful learning experiences. Mathematics teaching in schools is experiencing

changes, including focusing on changes from the teacher's situation to the student's learning situation. In order for this situation to be achieved, teachers must use various teaching strategies flexibly. According to Soeherman (2013), no matter how appropriate and good the mathematics teaching materials that are determined do not necessarily guarantee that educational goals will be achieved, and one important factor in achieving those goals is a teaching and learning process that places more emphasis on optimal student involvement.

The difficulties experienced by students in learning mathematics can originate from within the student or originate from the student. For example, some of the causes of difficulties in learning mathematics experienced by students are that the learning atmosphere is less pleasant for students or even the way the material is presented does not optimize the role of students, the teacher does not activate the role of students in learning mathematics. The teacher conducts learning through lectures and a little question and answer, that is, the teacher presents theories/concepts as well as examples of questions and their solutions, while the students just listen, take notes, and model the solutions to the questions given, then the students complete the same practice questions given by the teacher. With the conditions of learning activities described above, the teacher plays the main role in learning and is the main source of knowledge for students, while students only act as recipients of information or knowledge. This can result in students being less motivated to actively explore or find out the knowledge they want to learn. In other words, students are less likely to carry out knowledge construction activities, students will also be less able to develop creative activities and the ability to convey information or ideas listed in the mathematics learning objectives. In the mathematics learning process at school, a teacher plays a very important role, including determining students' social attitudes. As explained by Ma & Kishor (1997), a mathematics teacher must understand the relationship between students' attitudes towards mathematics and their achievements in learning mathematics as a very big thing. The same thing was also said by Minggi (2020) in his research that attitudes toward learning mathematics at school have a positive influence on the mathematics learning achievement of students in class VIII of Islamic-oriented junior high schools in the city of Makassar.

An interesting learning model that can encourage students to participate actively in teaching and learning activities. Active learning is a learning that invites students to be more active during the learning process taking place. Students are required to be subjects in learning. One learning model that can be modeled during learning what takes place is reciprocal teaching. Reciprocal teaching is one model of learning that has the benefit of achieving learning objectives through activities and independent learning and students can explain their findings to other parties. Trianto (2009) states that the reciprocal teaching-learning model is a learning model implemented so that learning objectives are achieved quickly, an independent learning process and students can present the results of discussions in front of the class and is a learning strategy based on the principles of asking questions, train students to develop the metacognitive skills taught. Reciprocal teaching or reverse learning is a learning model which is designed to provide benefits so that learning objectives are achieved and provide skills to students as a substitute for a capable teacher imparting the knowledge he has to other students in one class. Teaching procedures or approaches that use learning models This reciprocal teaching provides students' understanding of strategies specific to general learning and can help students understand the content of the material mathematics lessons well. Based on the description above, the researcher proposed research with the title improving mathematical problem-solving abilities and social attitudes in the reciprocal learning model.

2. RESEARCH METHOD

By the problem to be researched, this type of research is classified as classroom action research which aims to improve the quality of the process and outcomes of mathematics learning related to increasing students' ability to solve problems and students' social attitudes by implementing reciprocal learning. The research location is Husni Thamrin Private High School, Medan. Several reasons for the researcher having this school as a research site are: (1) there has never been any similar research conducted at that school, (2) the researcher is a teacher at the research site, (3) the researcher wants to apply a new learning paradigm where teachers have always applied conventional learning. The subjects in this research were 30 students from class XI – Science at Husni Thamrin Medan Private High School. The reason the researcher chose this class was that based on the results of the test conducted by the researcher in the initial research regarding problem solving abilities, from the 30 students who took the test, information was obtained that 20 students were unable to solve story problems based on HOTS questions. Thus, it can be concluded that the students' mathematical problem-solving abilities in this class are still relatively low. The object observed in this research is student activity in implementing classroom learning with problem solving strategies by applying reciprocal learning to derivative material in class XI - Science, semester 2 of the 2023/2024 academic year.

This research is categorized as classroom action research which begins with the development of tools in the form of Learning Implementation Plans (RPP), Student Books (BS), and Student Activity Sheets (LAS). The instruments in this research are problem solving ability tests and student social attitude questionnaires. Considering that planning learning tools and instruments takes a long time and the research schedule must follow the schedule given by the school, the researcher planned learning tools and test instruments for 2 cycles. Following this type of research, this research has 4 implementation stages for each cycle, namely (1) the planning stage, (2) the implementation stage, (3) the observation stage, and (4) the reflection stage. The mechanism and design of this research are as follows:

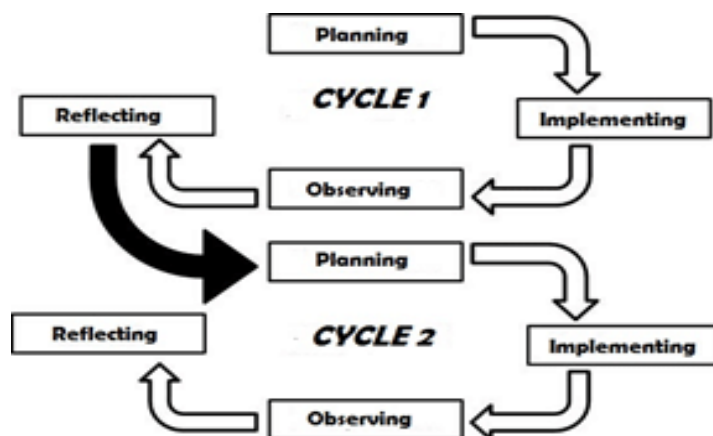


Figure 1. Classroom Action Research cycle, adapted from Kurt Lewin

The problem-solving ability test instrument is used to determine the level of students' abilities in solving mathematical problems related to everyday life. To provide a problem-solving test score in this research, the researcher adopted the problem-solving scoring proposed by Schoen and Omchmke (in Utari, 1993: 16) as follows in the [Table 1](#).

Table 1. Problem Solving Ability Scoring Guidelines

Score	Understand the Problem	Create a Solution Plan	Doing Calculations	Checking the Results Again
0	Misinterpreted or completely wrong	No plans, making irrelevant plans	Didn't do the calculations	There was no examination or no other information
1	Misinterpreting some of the questions, resulting in the condition of the questions	Making a solution plan that cannot be implemented, so that it cannot be implemented	Carry out the correct procedures and may produce the correct answer but miscalculate	There was an inspection but it was not complete
2	Understand the problem in full	Making the right plans but wrong results or no results	Do the right process and get the right results	Inspections are carried out to see the correctness of the process
3	-	Make a correct but incomplete plan	-	-
4	-	Make plans according to procedures and lead to the correct solution	-	-
Maximal Score		Maximal Score: 4	Maximal Score : 3	Maximal Score: 2

The reason for the descriptive test used in this research is because this research aims to reveal students' overall mathematical problem-solving abilities. The test instrument was carried out in 2 stages. The first stage, the student's initial ability test (pretest), is used to determine students' initial knowledge before a learning process occurs. The second stage, the problem-solving ability test (post-test) is used after the reciprocal learning process occurs.

3. RESULTS AND DISCUSSION

3.1 Results

a. Description of the Results of Classroom Action Research in Cycle I

The action in this research is the application of reciprocal learning. The presentation of the research results presents a description of students' abilities in solving students' mathematical problems, students' social attitudes, students' activities in learning, and students' responses to the reciprocal learning model. The results of cycle research I are shown as follows:

1. Results of the Problem-Solving Ability Test

The results of the problem-solving ability test in cycle I can be seen in the Table 2.

Table 2. Mathematical Problem-Solving Ability in Cycle I

No	Value interval	The number of students	Percentage	Assessment Category
1	90 – 100	4	14	Very High
2	80 – 89	6	20	High
3	65 – 79	8	26	Enough
4	55 – 64	5	16	Low
5	0 – 54	7	24	Very Low
Total		30	100	

Classically, there is a level of students' mathematical problem-solving cycle ability I of 60%, because they have not yet reached the planned level of problem-solving ability, namely $\geq 85\%$, so this research will be continued in cycle II.

2. Social Attitude

Social attitude data was obtained through two instruments, first from observation sheets by observers and second obtained from questionnaires (assessments from students). Indicators of social attitudes in this research are responsibility, cooperation, tolerance, and politeness. The results of students' social attitudes in cycle I can be seen in the following table:

Table 3. Acquisition of Students' Social Attitudes in Cycle I

No	Aspects of social attitudes	X _a	X ₀	X
1	Responsibility	2,76	2,85	2,80
2	Cooperation	2,72	2,68	2,70
3	Tolerance	3,00	3,36	3,18
4	Polite	2,88	3,20	3,04
Average				2.93

X_a = Average Results of the Social Attitude Questionnaire

X₀ = Average acquisition of social attitude observations

X = Average social attitudes of students

3. Results of the Student Activity Observations

The results of observations of student activities in learning at each meeting are expressed as percentages. These results are presented briefly in the Table 4.

Table 4. Level of Student Activity in Cycle I

No	Observation Category	Level of Student Activity at each meeting			Average (%)	Tolerance Limits (%)
		I	II	III		
1	Listen/pay attention to the teacher/friend's explanation	13.75	11.25	16.25	13.75	9% ≤ P ≤ 19%
2	Read/understand the problems in student books/LKS	16,25	18.75	17.00	17.50	5% ≤ P ≤ 15%
3	Writing/Solving problems/finding ways to	18,75	21.25	20.00	20.00	27% ≤ P ≤ 37%

	solve problems					
4	Discuss/ask questions to friends/teachers	15.00	18.75	20.00	17.91	$16\% \leq P \leq 26\%$
5	Presenting results of the work	15.00	20.00	15.00	16.67	$10\% \leq P \leq 20\%$
6	Make conclusions	10.00	11.30	10.00	10.42	$3\% \leq P \leq 13\%$
7	Student behavior that is not relevant to teaching and learning activities	5.00	3.75	3.75	4.17	$0\% \leq P \leq 5\%$

4. Results of the Students' Response

Student response questionnaires in learning activities and to the learning tools developed are filled in by students after reciprocal learning activities are completed. The number of students who filled out the student response questionnaire was 30 student. The proportion of students' answers to each learning component is presented in the [Table 5](#).

Table 5. Percentage of Student Responses to Learning Activities in Cycle I

No	Indicators	Frequency	Percentage
1	Students feelings of enjoyment towards the components:		
	a. Subject matter	30	100.00
	b. Student's Book	29	98.00
	c. Student worksheet	29	98.00
	d. Learning atmosphere in class	29	98.00
	e. Teacher's way of teaching	30	100.00
Average			98.80
2	Students' opinions stated that they were new to the components:		
	a. Subject matter	30	100.00
	b. Student's Book	28	96.00
	c. Student worksheet	28	96.00
	d. Learning atmosphere in class	30	100.00
	e. Teacher's way of teaching	30	100.00
Average			98.40
3	Are you interested in taking part in further studies like the one you are taking now?	28	96.00
4	What do you think about student books and student worksheets (LKS):		
	a. Can you understand the language used in student books/worksheets?	28	96.00
	b. Are you interested in the appearance (writing, illustrations, pictures, and location of the pictures) in student books/LKS?	30	100.00
Average			97.33

5. Results of the Cycle I Reflection

First, by looking at the results in cycle I, students' ability to solve problems is still low or has not met the desired target. So for further learning in the second cycle, corrective actions will be carried out which are expected to improve students' mathematical problem solving abilities. Some of the weaknesses in learning in cycle I include: there are still students who are not active in discussions, there is still a lack of cooperation among group members, students do not dare to express ideas, and there are still students who often excuse themselves for certain reasons.

Alternative corrective actions in the next cycle are:

- Divide groups into groups consisting of high, medium, and low abilities so that students with medium and low abilities are helped by students with high abilities
- Explain to students that the results of each group's work will be presented in front of the class and that's when other students provide input and comments about the results of other groups' work.

Second, in terms of student activities, there are 3 (three) categories of observations regarding student activities that are not yet within the specified tolerance limits. The three activities are reading/understanding problems in student

books/LKS, writing/solving problems/finding ways to solve problems, and student activities that are not relevant to learning. This happens because students are not used to carrying out learning activities by reciprocal learning. Third, students' social attitudes have shown to be within fairly good criteria. The results of this social attitude still need to be improved in the next cycle.

b. Description of the Results of Classroom Action Research in Cycle II

The actions in this research are a follow-up to the results of cycle I reflection. The results of cycle II research are shown as follows:

1. Results of Students' Mathematical Problem-Solving Ability

Implementation of cycle II actions is a continuation of activities after the planning revision stage. The actions in this cycle are an effort to improve students' mathematical problem solving abilities. Apart from that, this action also seeks to make the reciprocal learning process take place effectively. Quantitatively, the level of problem solving ability in the problem solving ability test can be seen in the [Table 6](#).

Table 6. Mathematical Problem Solving Ability in Cycle II

No	Value interval	The number of students	Percentage	Assessment Category
1	90 – 100	8	27	Very High
2	80 – 89	10	30	High
3	65 – 79	8	27	Enough
4	55 – 64	3	10	Low
5	0 – 54	1	3	Very Low
Total		30		100

In cycle II there was an increase in mathematical problem solving ability to 86%. Meanwhile, the planned level of problem solving ability is $\geq 85\%$ of the number of students taking the test who have a minimum score in the sufficient category. By looking at these results, this research stopped in cycle II.

2. Social Attitude

A recapitulation of the acquisition of social attitudes in cycle II of the learning process using the reciprocal learning model can be seen in the [Table 7](#).

Table 7. Acquisition of Students' Social Attitudes in Cycle II

No	Aspects of Social Attitudes	Xa	X0	X
1	Responsibility	3.30	3.73	3.52
2	Cooperation	3.62	3.53	3.58
3	Tolerance	3.23	3.50	3.37
4	Polite	3.62	3.53	3.58
Average				3.50

3. Results of the Student Activity Observations

The results of observations of student activities in learning at each meeting are expressed as percentages. These results are presented briefly in the [Table 8](#).

Table 8. Level of Student Activity in Cycle I

No	Observation Category	Level of Student Activity at each meeting			Average (%)	Tolerance Limits (%)
		I	II	III		
1	Listen/pay attention to the teacher/friend's explanation	15.00	11.25	13.13	13.13	9%≤P≤19%
2	Read/understand the problems in student books/LKS	13.75	8.75	8.25	11.25	5%≤P≤15%
3	Writing/Solving problems/finding ways to solve problems	28.75	30.00	29.38	29.38	27%≤P≤37%
4	Discuss/ask questions to friends/teachers	16.25	21.25	21.75	18.75	16%≤P≤26%
5	Presenting results of the work	16.25	16.25	16.75	16.25	10%≤P≤20%
6	Make conclusions	11.25	7.50	7.25	9.38	3%≤P≤13%
7	Student behavior that is not relevant to teaching and learning activities	3.75	1.25	1.75	2.75	0%≤P≤5%

4. Results of the Student Response

Student response questionnaires in learning activities and to the learning tools developed are filled in by students after reciprocal learning activities are completed. The number of students who filled out the student response questionnaire was 30 student. The proportion of students' answers to each learning component is presented in the **Table 9**.

Table 9. Percentage of Student Responses to Learning Activities in Cycle II

No	Indicators	Frequency	Percentage
1	Students feelings of enjoyment towards the components :	30	100.00
	a. Subject matter	28	96.00
	b. Student's Book	28	96.00
	c. Student worksheet	28	96.00
	d. Learning atmosphere in class	28	96.00
	e. Teacher's way of teaching	30	100.00
Average			97.60
2	Students' opinions stated that they were new to the components:		
	a. Subject matter	30	100.00
	b. Student's Book	29	98.00
	c. Student worksheet	28	96.00
	d. Learning atmosphere in class	30	100.00
	e. Teacher's way of teaching	30	100.00
Average			98.80
3	Are you interested in taking part in further studies like the one you are taking now?	28	96.00
4	What do you think about student books and student worksheets (LKS):		
	a. Can you understand the language used in student books/worksheets?	28	96.00
	b. Are you interested in the appearance (writing, illustrations, pictures and location of the pictures) in student books/LKS?	30	100.00
Average			98.00

The average percentage of student responses from all learning components was 98.00%. Based on the established criteria for achieving effectiveness, student responses are said to be positive if the average percentage of all student response components is greater than or equal to 80%. From the description above, students' responses to the reciprocal learning model have met the effectiveness criteria.

Discussion

Based on the test results of students' mathematical problem solving abilities seen from cycle I and cycle II, it can be concluded that students' mathematical problem solving abilities have increased. This is in line with the opinion of Muda

Sakti (2024) who says that solving mathematical problems is very important so that it becomes the general goal of teaching mathematics, even as the heart of mathematics and as the focus of school mathematics which aims to help develop mathematical thinking. In line with the opinion above, E. Waller (2012) said that problem solving abilities aim to increase students' analytical power so that it is very useful in helping them apply these abilities to various situations.

a. Students' Mathematical Problem Solving Ability

If we look at the average score on students' problem solving ability tests in cycle I of 60%, this is still below the expected category. There are still 20 students out of 30 students who took the test who were in the low assessment category or around 60%. However, in cycle II it was found that the number of students who had scores in the very high category was 8 people or 27%, and those who had scores in the high category were 10 people or 30%. When compared from cycle I to cycle II, there was a significant increase from 60% to 86%. Meanwhile, the planned level of problem solving ability is $\geq 85\%$ of the number of students who take the test have a minimum score in the sufficient category. By looking at these results, this research stopped in cycle II.

b. Social Attitude

The acquisition of social attitudes in cycle I showed that it was within the good enough criteria for the responsibility indicator, namely 2.80, good enough for the cooperation indicator, 2.70, the tolerance indicator showed good criteria, namely 3.18 and good criteria for the politeness indicator, namely 2.90. The overall average result for social attitudes in cycle I was 2.93. These results show that classical social attitudes have quite good criteria. The results of this student's social attitudes based on the model's effectiveness criteria do not meet the effective criteria. The acquisition of social attitudes in cycle II increased. The results show that it is within the very good criteria for the responsibility indicator of 3.52. The cooperation indicator is 3.58, and the tolerance and politeness indicators with the average for each aspect 3.37 and 3.58.

c. Student Activities

When viewed from the perspective of student activity, there is an increase in the level of student active activity, where in cycle I there are 3 categories of student activity observations that are not within the specified tolerance limits, then in cycle II all categories of student active activity observation are already within the specified tolerance limits.

d. Student's response

When viewed in terms of student responses, there was an increase in student responses where the average student response in cycle I was 97.33%, then in cycle II it was 98%. This opinion is based on an analysis of descriptions of student responses where more than 80% of students gave positive responses to each component of reciprocal learning. Based on the research results analyzed descriptively, it can be concluded that reciprocal learning can increase student responses.

4. CONCLUSION

The application of the reciprocal learning model can improve students' mathematical problem-solving abilities after passing Cycle I and Cycle II. From the results of actions in Cycle I, there are still 20 students out of 30 students who took the test who were in the low assessment category or around 60%. However, in cycle II it was found that the number of students who had scores in the very high category was 8 people or 27%, and those who had scores in the high category were 10 people or 30%. The application of the reciprocal learning model can improve students' social attitudes. This can be seen from the results of student questionnaires in Cycle I These results show that classical social attitudes have quite good criteria. The results of this student's social attitudes based on the model's effectiveness criteria do not meet the effective criteria. The acquisition of social attitudes in cycle II increased. The results show that it is within the very good criteria for the responsibility indicator of 3.52. The cooperation indicator is 3.58, and the tolerance and politeness indicators with the average for each aspect 3.37 and 3.58. The application of the reciprocal learning model can increase students' levels of active activity. This can be seen from the results of observations of students' active activities where in cycle I only 4 categories out of 7 categories of observations of students' active activities were within the specified tolerance limits, then in cycle II all categories of observations of students' active activities were within the specified tolerance limits. The application of the reciprocal learning model can increase students' positive responses after passing Cycle I and Cycle II, this can be seen from the average percentage of student responses in Cycle I of 97.33% and in Cycle II of 98%. Student responses to reciprocal learning components and learning activities are positive.

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