Available online at http://journal.um.ac.id/index.php/jps/
ISSN: 2338-9117/EISSN: 2442-3904

Jurnal Pendidikan Sains
Volume 6, Number 4, December 2018, pp. 100–109

Reciprocal Teaching Assisted by GeoGebra to Improve Students Mathematical Communication

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Abstract: This Classroom Action Research (CAR) aims to describe the implementation of the reciprocal teaching learning model assisted by Geogebra to improve the mathematical communication skills of the 11th graders of Vocational students. The researcher conducted this research in two cycles. The results of this study indicate that there is an increase in students' mathematical communication skills from cycle I to cycle II. Reciprocal teaching consists of four stages: summarizing, questioning, predicting and clarifying.

Key Words: reciprocal teaching, GeoGebra, mathematical communication

Abstrak: Penelitian Tindakan Kelas (PTK) ini bertujuan untuk mendeskripsikan implementasi model pembelajaran *reciprocal teaching* berbantuan *Geogebra* yang dapat meningkatkan kemampuan komunikasi matematis peserta didik kelas XI SMK. Peneliti melakukan penelitan ini dalam dua siklus. Hasil penelitian ini menunjukkan bahwa kemampuan komunikasi matematis peserta didik meningkat dari siklus I ke siklus II. *Reciprocal teaching* terdiri dari empat tahap yaitu merangkum (*summarizing*), menanya (*questioning*), memprediksi (*predicting*), dan mengklarifikasi (*clarifying*).

Kata kunci: reciprocal teaching, GeoGebra, komunikasi matematis

INTRODUCTION

Communication is a crucial part of Mathematics learning since it is one of the standard processes in Mathematics education (NCTM, 2000). Abd Qohar (2011) states that communication in learning Mathematics is very important to develop. Communication is a fundamental process in learning mathematics for students because students can think about, interpret and expand their mathematical ideas and ideas through the communication process. Cai, Jakabcsin, and Lane (2010) additionally state that communication is an important component in learning and mathematical understanding because communication in Mathematics means that one can use vocabulary, notation, and structure to express and understand ideas and relationships. Through communication, students can express ideas, hold discussions and help students build meaning according to their ideas.

Toh and Kaur (2016) explain that communication is the exchange of thoughts or knowledge between two or more people through speech, visual representation, signal, writing, or behavior. Communication skills in Mathematics learning include writing ability, listening ability, speaking ability, non verbal communication skills and thinking abilities. Mathematical communication is a process of conveying mathematical ideas or arguments both visually, in writing and orally using words, diagrams, graphics, symbols and numbers.

Based on the results of interviews with teachers and researchers' initial observations, the mathematical communication skills of the students of Al-Amin Gresik Vocational School were still weak. After analyzing the initial observations, the researchers concluded that students did several kinds of written mathematical communication weaknesses in solving linear program material questions, namely weaknesses in understanding mathematical ideas, weaknesses expressing ideas, weaknesses using mathematical notation and weaknesses using mathematical model repre-

Article received 14/01/2018; Approved 13/10/2018

sentations. Students have not been able to express mathematical ideas properly. This is possible because the learning method applied by the teacher has not been maximized thus the mathematical communication skills of students cannot be developed. Based on interviews conducted by researchers with teaching teachers, teachers rarely apply cooperative learning models. Teachers are usually active in learning by lecturing and then giving practice exercises, students only listen to explanations and do the exercises given by the teacher.

Teachers can use cooperative learning models to provide more opportunity for students in learning. With such learning model, students can also develop mathematical communication skills. The available learning model is Reciprocal teaching learning model which has four stages, summarizing, asking (questioning), making advanced questions (predicting) and clarifying (Palincsar & Brown, 1984). Doolittle, Hicks, Triplett, Nichols, and Young (2006) state that reciprocal teaching has three main components, namely (a) learning with good reading comprehension strategies, (b) discussions between students and teachers and other students in order to understand the material being taught, and (c) students explain the material to their friends and play the role of teacher.

In current global society setting, teachers are expected to be able to utilize technology and information in learning material to students (Kusano et al., 2013). There are many benefits to using technology in learning. The use of technology helps students visualize abstract ideas and makes them easy to find reliable information (Qing Li, 2003). Teachers can use technology as a learning medium, one of which is to use a computer. Teachers can use computer software for learning mathematics. Geogebra software is one of the computer software that can be used in implementing mathematics learning. GeoGebra software is available for calculus, algebra, and geometry learning.

GeoGebra can help the spatial abilities of students to see transformation through the sense of sight, and facilitate mathematical communication skills to facilitate students in communicating the various transformations they see (Yuliardi & Nurjanah, 2017). Teachers can use GeoGebra to create learning media that can help students understanding concepts. GeoGebra can also be used by teachers or students for exploration, teachers and students can display it in front of the class or just explore themselves with their computers (Jurotun, 2015).

Reciprocal teaching learning assisted by GeoGebra as a whole is carried out as follows. First, at the summarizing stage students are asked to make a summary of the material in the Student Activity Report (LKPD). In the summarizing stage students are also invited to run activities with GeoGebra to understand the material. Second, at the questioning stage, students are asked to make questions related to the material while answering these questions. Third, at the predicting stage, students are asked to make follow-up questions or development questions from questions that have been made along with the answers. In the clarifying stage, the teacher asks one group to make a presentation in front of the class about what their group has discussed while the other group is asked to respond or give questions.

By implementing GeoGebra with reciprocal teaching learning, it is expected to be able to promote students' mathematical communication. Reciprocal teaching is constructivism-based learning that can make students have the opportunity to explore mathematical ideas freely but it is still directed (Abdul Qohar & Sumarmo, 2013). Sholihin (2017) has also applied learning reciprocal teaching models in Eight graders of Junior High School and can improve students' mathematical communication skills. Hence, the purpose of this study is to describe the implementation of the reciprocal teaching learning model assisted by GeoGebra which can improve the mathematical communication skills of the 11th grade students of Al-Amin Gresik Vocational School.

METHOD

This research was a Class Action Research (CAR). It was in several cycles where there were three or four meetings in each cycle. It would be stopped if the research criteria have been met. Each cycle has four stages, namely planning, action, observation, and reflection. The researchers took a role as people who plan and carry out actions. Additionally, we acted as instructors by running the reciprocal teaching learning model assisted by GeoGebra and assisted by teachers of mathematics to to observe the implementation of learning. The data used were instrument validation obtained from the validation sheet, observations of teacher activities which refer to the observation sheet of teacher activities, observations of student activities that can be obtained from the observation sheet of student activities, the results of the final cycle related tests communication skills obtained from the final cycle test, the results of interviews with students, the results of field notes during the research process.

Both qualitative and quantitative data analysis were employed in this present study. During qualitative data anlysis, the data were reduced, presented, and drawn for conclusion. Qualitative data analysis was conducted for field notes data during the implementation and the results of interviews with students. While quantitative data analysis was used for observations of teacher activities, observation of student activities and the score of the final test cycle. Then, we calculated the average percentage to determine the criteria in the observation data of the activities of students and the results of observations of teacher activities. The percentage 0-20 means very poor, the percentage 21-40 means poor, the percentage 41-60 means sufficient, the percentage 61-80 means good and the percentage 81-100 means very good. The indicators in this study towards improving the mathematical communication skills of students through the application of reciprocal teaching models are (1) minimumly good criteria for teacher activities observation; (2) minimumly good criteria for students activities observation; (3) Minimum Completion Criteria (KKM) score 75 in a minimum of 80% of the entire students participating in this study. If one of these criteria has not been fulfilled, the next cycle will be carried out.

RESULTS

Two cycles of research were conducted. Each cyle must proceed four stages; planning, acting, observing, and reflecting.

Cycle 1

Planning

At the very beginning, planning stage aimed at preparing every single needs during CAR implementation. It prepared schedule of implementation, students' group arrangement, learning instrument along with its validation, research instrument along with its validation, room for implementation, devices, and observer to assist researcher in observing students and teacher activities.

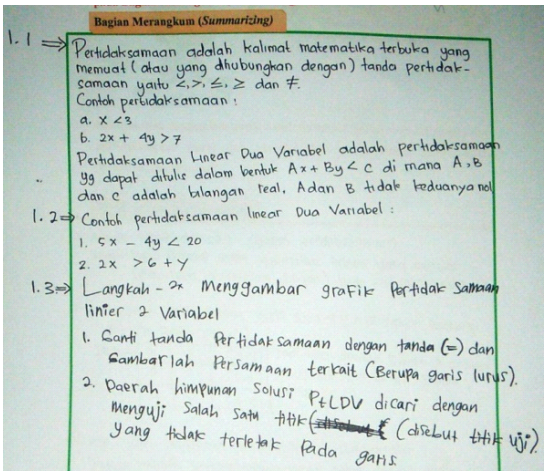
Implementation

The reciprocal teaching learning model assisted by GeoGebra in the first cycle was carried out for four meetings as follows 07, 10, 14, and 17 September 2018. We conducted three times of learning with a time allocation of 2 × 45 minutes. Next, the researcher also adminsitered a test at the end of the cycle to find out the communication skills of the students. The implementation of the action begins with the opening of learning by greeting, asking for news and checking the attendance of students. At the first meeting, the researcher explained about the carried out classroom action research. Following, the researcher encouraged students by giving questions about what will be discussed at the meeting. Then, the researchers asked students to join according to the determined group distribution and distribute Student Worksheets (LKPD). Importantly, the researcher explained the steps for reciprocal teaching and procedures for using Student Worksheets (LKPD).

At the core learning, four stages of reciprocal teaching were conducted as follows: summarizing, questioning, predicting, and clarifying. When summarizing, students were asked to write a summary on their students worksheet. As a facilitator, the researchers direct the process of discussion and assist students in case they found any difficulty. Additionally, some exercises were given to assist students in understanding the concept. In this moment, GeoGebra was utilized during learning based on students worksheet. The following is the summary of student from one of the group.

In Figure 1, students made a summary of the topic learned in their worksheet by writing an understanding of inequality topic and its example, understanding and example of two variables linear inequality, and steps in drawing of two variables linear inequality graphs.

Second, at the questioning stage, students were asked to write questions and their answers on the question sheet. The researcher looked around to each group

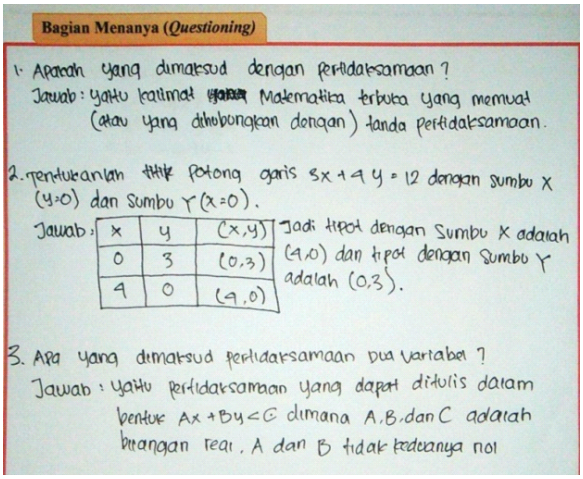

Bagian Merangkum (*Summarizing*)

1.1 ⇒ Pertidaksamaan adalah kalimat matematika terbuka yang memuat (atau yang dihubungkan dengan) tanda pertidaksamaan yaitu <, >, ≤, ≥ dan ≠.
Contoh pertidaksamaan :
a. x < 3
b. 2x + 4y > 7
Pertidaksamaan Linear Dua Variabel adalah pertidaksamaan yg dapat ditulis dalam bentuk Ax + By < c di mana A, B dan c adalah bilangan real. Adan B tidak keduanya nol

1.2 ⇒ Contoh pertidaksamaan linear Dua Variabel :
1. 5x − 4y < 20
2. 2x > 6 + y

1.3 ⇒ Langkah - 2x Menggambar grafik Pertidak Samaan linier 2 Variabel
1. Ganti tanda Pertidaksamaan dengan tanda (=) dan Gambarlah Persamaan terkait (Berupa garis lurus).
2. Daerah himpunan Solusi PtLDV dicari dengan Menguji Salah Satu titik (Disebut titik uji) yang tidak terletak Pada garis

Figure 1. Student's Summary from One Learning Group


Bagian Menanya (*Questioning*)

1. Apakah yang dimaksud dengan pertidaksamaan?
Jawab: yaitu kalimat Matematika terbuka yang memuat (atau yang dihubungkan dengan) tanda pertidaksamaan.

2. Tentukanlah titik potong garis $5x+4y=12$ dengan sumbu X ($y=0$) dan sumbu Y ($x=0$).
Jawab:

x	y	(x,y)
0	3	(0,3)
4	0	(4,0)

Jadi titpot dengan Sumbu X adalah (4,0) dan titpot dengan Sumbu Y adalah (0,3).

3. Apa yang dimaksud pertidaksamaan dua variabel?
Jawab: yaitu pertidaksamaan yang dapat ditulis dalam bentuk $Ax+By<C$ dimana A,B,dan C adalah bilangan real, A dan B tidak keduanya nol

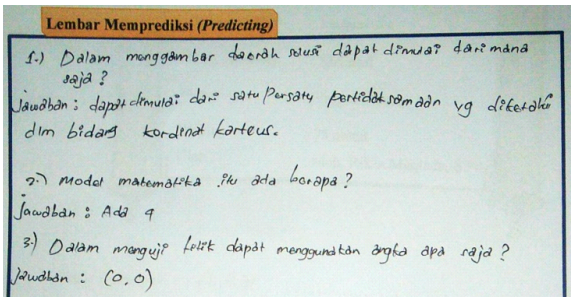
Figure 2. Student's Work during Questioning Stage

and asked if there were difficulties in making questions. Figure 2 is the result of working on one of the groups at the questioning stage.

In Figure 2, it can be seen that students make questions from important points in the material while answering these questions. Students write three questions, namely about the notion of inequality, determining intersection points and understanding the different inequalities of two variables.

Third, at the predicting stage the researcher asked each group to make further questions from the questions they have made in the questioning stage. At this stage some groups are confused to make further questions. The researcher explained that follow-up questions can be made by continuing the questions that were made in the questioning stage or creating new questions whose answers were not found in the student worksheet. The researcher approached each group and asked about the difficulties they had and helped overcome the difficulties. The workmanship of one group at the time of the predictive stage can be seen in Figure 3.

In Figure 3, students wrote three follow-up questions. These three questions are follow-up questions


Lembar Memprediksi (*Predicting*)

1.) Dalam menggambar daerah solusi dapat dimulai dari mana saja?
Jawaban: dapat dimulai dari satu persatu pertidaksamaan yg diketahui dlm bidang kordinat kartesius.

2.) Model matematika itu ada berapa?
Jawaban: Ada 4

3.) Dalam menguji titik dapat menggunakan angka apa saja?
Jawaban: (0,0)

Figure 3. Student's Work in Predicting Stage

from the questions that have been made in the questioning stage. The first question reads "In drawing from the solution area where can you start?" This question is a follow-up question from the question "how to draw a solution area?". Students have been able to make follow-up questions and answer them but this question is too easy. The second question reads "How many mathematical models?". The second question is a follow-up question from the question "What is a mathematical model?". Students tried to make follow-up questions but are less precise in answering them. Students answered that the mathematical model must consist of four inequalities. Students thought that the mathematical model must consist of four inequalities since some examples in the student worksheet present it so. The third question reads "In testing the point, can you use any number?". The question in question is the possibility of testing points, can use any point. Students' answers were inappropriate because students answer point (0,0). Students should answer to determine the solution area to test points using any point, but it would be easier if using point (0,0).

Fourth, at the clarifying stage, representatives of advanced groups presented the results of their discussions and acted as teachers who explain the material to their friends. Other groups listened to and responded to the presentation group, while the researchers acted as facilitators. The researcher invited presentations to groups who felt they were ready to advance in front of the class. After the presentation, the other groups were given the opportunity to ask questions or provide responses related to the presentation. After the clarifying stage was complete, the group presenting and the group providing the response or question were given an award in the form of praise and applause.

At the end of the activity, the researcher guided students to draw conclusions from what has been taught at the meeting. In addition, the researchers provided reflections in the form of short questions about the material. Next the researcher notified the students about the material of the next meeting and closes the meeting with greetings.

Observation

The stages of observation in this research were carried out in conjunction with the stages of acting. Observation of actions was carried out by two observers in charge of observing (1) the suitability between the learning plan and its implementation in class; (2) student activities, and (3) teacher activities. The fol-

lowing are observations of teacher activities in the first meeting to the third meeting

Based on Table 1, it is known that the average percentage of teacher activity in the first meeting was 75%, the second meeting was 83.3% and the third meeting was 88.3%. From these data, the implementation of teacher activities increases at each meeting. In addition, teacher activities in the three meetings in cycle one received very good criteria because the aver-age activity of teacher cycles reached 82.2%. This means that researchers have implemented the recipro-cal teaching learning model very well in cycle I.

In the first cycle, the two observers also observed the activities of students and referred to the observation sheet of the activities of students. The following is the observation of the activities of students in the first cycle.

Based on Table 2, the average percentage of stu-dent activities in the first cycle was 78.3% with the details of the first meeting was reaching 75%, the second meeting was reaching 78.3% and the third meeting was reaching 81.6%. This shows that students have carried out learning in accordance with the reciprocal teaching learning model well in cycle I.

Furthermore, after scoring on the final test results carried out at the third meeting, namely on Monday, September 17, 2018, it was found that there were 10 students who were declared complete getting scores above 75 out of a total of 16 students taking the final test. In other words, it can be said that students who complete as many as 10 students and those who have not completed as many as 6 students. Then the percentage of students who completed in the first cycle were 62.5% and the percentage of students who did not complete were 37.5%.

Reflection

In the reflection phase, the criteria for the success in the first cycle will be discussed whether it has been achieved or not. The success criteria that have been determined by the researcher are both average score of the observation of the teacher's and students activities achieving a minimum criteria. Another criterion is 80% of students who take the final test in the first cycle reach the Minimum Standard Score of at least 75. The following is a reflection table for the implementation of actions in cycle I.

Based on Table 3, the classical completeness of the final test in the first cycle does not meet the success criteria. Hence, the success criteria for the research in the first cycle have not been achieved. Therefore, the action research will be carried out in the next cycle by making improvements to some of the shortcomings that occur in cycle I. There are some shortcomings that occur during the implementation of the first cycle of learning, whether done by students or carried out by the teacher. The following is a table of

Table 1. Observation Results of Teacher Activities on Cycle I

No	Observer	Percentage (%)		
		First Meeting	Second Meeting	Third Meeting
1	Observer I	70	83,3	86,6
2	Observer II	80	83,3	90
	Avg of Each Meeting	**75**	**83,3**	**88,3**
	Avg of Cycle I		**82,2**	

Table 2. Observation Results of Student Activities on Cycle I

No	Observer	Percentage (%)		
		First Meeting	Second Meeting	Third Meeting
1	Observer I	73,3	76,6	80
2	Observer II	76,6	80	83,3
	Avg of Each Meeting	**75**	**78,3**	**81.6**
	Avg of Cycle I		**78,3**	

Table 3. Learning Implementation Reflection on Cycle I

No	Criteria	Score	Remark
1	Teacher Activities	82,2 % (Very Good)	Achieved
2	Student Activities	78,3 % (Good)	Achieved
3	Final Test Achievement	62,5%	Unachieved

Table 4. Cycle I Shortcomings and Improvement Planning for Cycle II

No	Shortcoming	Improvement
1	The researcher has not guided students in the discussion at the stage of summarizing, asking and predicting	Provides an approach to students and encourages them to be more confident in expressing their opinions or asking questions
2	Few students responded or gave questions during clarifying stage	Requires each group to give questions / respond to the presenting group
3	The researcher has not been able to carry out the summarizing, summarizing and predicting stages according to the planned time	Reinforces the students if the time is over, it must be followed by the next stage
4	CPU was placed on the table which provided small space for students to freely discuss	Request permission from the school to temporarily change computer arrangements during the study
5	Some students operated the Corel Draw and Mozilla Firefox applications	Monitor each student more during learning
6	The researcher combined the section sheet summarizing, questioning and predicting one piece with the material in the worksheet thus students were not comfortable when writing summaries and making questions while turning the worksheet pages around.	Separating the sheet summarizes, asks and predicts with the worksheet
7	Some groups did not work on worksheet exercises since they spent most of time allocation to understand and summarize	Provide guided answers to practice
8	The projector suddenly turned off when learning takes place	Check and prepare the projector before use
9	Some groups did not understand the material but only read by skimming, which is a high-speed reading technique to look for important things from a reading	Direct each student to discuss to understand the material
10	Group distribution was less heterogenous	Make a new group division according to the final test results of the first cycle

shortcomings, and plans for improvement in cycle II (Table 4).

Cycle II

Planning

The planning stage in the second cycle was almost the same as the planning carried out in cycle I. At the planning stage, the researcher prepared everything for implementation including compiling learning devices and research instruments as well as preparing the implementation of actions which include determining the schedule and research on group formation.

Implementation

The researcher carried out the second cycle with three meetings: twice the implementation of learning and the final test of the second cycle. The action in the second cycle was held on the 24th, 28th of September 2018 and October 1, 2018. At the same time, it also aimed at correcting the shortcomings made in the previous cycle. What had been carried by in the second cycle was identical with the first one. During the summarizing, questioning and predicting stages, the researchers highly focused on encouraging students to discuss with their groups. Additionally, we tried to arrange time according to the planning thus the learning will be according to what has been designed. In the clarifying stage the researcher requires each group to give questions or respond to the presenting group. In addition, the researchers separated summarizing, asking and predicting sheets from student worksheet. Thus, students did not need to flip the worksheet over when making summaries, questions and follow-up questions.

Observation

Observation of actions in cycle II was carried out by two observers together with the implementation of the action. The task of the observer was to observe the activities of students and teachers when the learning takes place in the classroom. As a reference in observing whether the activities of students and teachers were was in accordance with the plan, observers were provided with student observation sheets and teacher observation sheets. The following is the result of observation of teacher activities in cycle II.

Observation of actions in cycle II was carried out by two observers together with the implementation. The task of the observer is to observe the activities of students and teachers when the learning takes place in the classroom. As a reference in observing whether the activities of students and teachers are in accordance with the plan, observers are provided with student observation sheets and teacher observation sheets. The following is the result of observation of teacher activities in cycle II (Table 5).

Table 5. Observation Results of Teacher Activities on Cycle II

No	Observer	Meeting	
		First Meeting	Second Meeting
1	Observer I	93.3	93.3
2	Observer II	93.3	96.7
	Avg of Each Meeting	**93.3**	**95**
	Avg of Cycle II	**94,2**	

From Table 5, the average percentage of teacher activity in the second cycle from the first meeting to the second meeting was increased as occurred in the first cycle, from 93.3% to 95%. If it is observed again, the average percentage of teacher activity in the first cycle to the second cycle also increased, from 82.2% to 94.2%. Increase in average teacher activity in cycle I to cycle II by 12%. This means that deficiencies that occur in the first cycle have been corrected by researchers when carrying out actions in cycle II. In addition, the average teacher activity in the second cycle was in the very good category, reaching 94.2%. This means that in the second cycle the reciprocal teaching learning model was very well implemented by researchers.

In the second cycle, in addition to observing the activities of the teacher the observer also observed the activities carried out by the students during the learning process. The result of observing the activities of students in cycle II can be seen in Table 6.

In the Table 6, the average percentage of student activities reached 93.3%, 91.7% at the first meeting and 95% at the second meeting. If it is noted, there has also been an increase in the average from cycle I to cycle II by 15%, from 78.3% to 93.3%. It means the implementation of learning cycle II researchers have made improvements to shortcommings that occur in cycle I. In addition, the average activity of students in the second cycle included was very good. This means that students have done the learning with a model of reciprocal teaching assisted by GeoGebra very well.

Table 6. Observation Results of Student Activities on Cycle II

No	Observer	Meeting	
		First Meeting	Second Meeting
1	Observer I	90	93.3
2	Observer II	93.3	96.7
	Avg of Each Meeting	**91.7**	**95**
	Avg of Cycle II	**93.3**	

The final cycle II test was conducted on Monday, October 1, 2018 and it was attended by 16 students. After scoring, it was found that there were 14 students who scored above 75. This means that there were 14 students who had scored above the Minimum Standard Criteria and only two students still did not meet the Minimum Standard. The percentage of students who scored above the Minimum Standard in the second cycle was 87.5% and the percentage of students under Minimum Standard was 12.5%.

Reflection

The reflection on the second cycle aimed to see whether the success criteria determined by the researcher have been fulfilled or not. The following is a reflection table of learning implementation in cycle II (Table 7).

In Table 7, student activities and classical completeness of the final test in the second cycle have fulfilled the criteria of this research. In other words, the implementation of learning in the second cycle has met the criteria of success of the study, therefore learning the reciprocal teaching model to improve mathematical communication of students does not need to be continued to the next cycle.

Table 7. Learning Implementation Reflection on Cycle I and Cycle II

Criteria	Score		Remark
	Cycle I	Cycle II	
Teacher Activities	82% (Very Good)	94,2 % (Very Good)	Achieved (Improved)
Student Activities	72% (Good)	93,3% (Very Good)	Achieved (Improved)
Final Test Achievement	62,5%	87,5%	Achieved (Improved)

DISCUSSION

Reciprocal Teaching Assisted by GeoGebra Implementation

During this research, the learning was implemented by conducting four stages of reciprocal teaching; summarizing, questioning, predicting, and clarifying which is in accordance with what is conveyed by Palincsar and Brown (1984). At the summarizing stage, students were asked to make a summary by writing important information in the reading. According to Blazer (2007), summarizing provides an opportunity for students to identify, describe, and integrate important information in the text. At the beginning of learning, students seem unable to discuss and work with friends in their groups. The researcher reminds students to be able to discuss with their group friends. According to Sanjaya (2006), the teacher must remind that every student must be able to interact, communicate, convey ideas and contribute to the success of the group.

When making summary, students were also asked to open the GeoGebra application on each group's computer. Each group conducts activities using GeoGebra software following the instructions in the worksheet. Students seemed enthusiastic about learning to use the GeoGebra application because this was their first experience learning mathematics using applications. The benefits of using ICT are explained by Kemp (2014) that the use of ICTs will offer a variety of new experiences for learning mathematics that are different from the experience of learning with books and traditional learning methods. Activities using GeoGebra at the first meeting of the first cycle, students included several linear equation and inequalities. In this activity, students can understand the different graphs of equations and inequalities. According to Hohenwarter and Fuchs (2004), the benefits of GeoGebra are as a tool for demonstration and visualization and can also be used as a tool to construct knowledge or concepts. In the second meeting of the first cycle and the first and second meetings of the second cycle, students were invited to check the correctness of the graph in student worksheet. Students could prove the correctness of the graph displayed in the example in the student worksheet using GeoGebra. This is in line with the opinion of Marlina (2017) that one of the uses of GeoGebra is that it can be used to evaluate and check the truth of a graph whether it is correct or not. In the GeoGebra activity meeting of the third cycle, students were invited to enter an equation and other equations which are simplifications of the previous equation. In this activity, students can understand that the equations are simplified so the graph is similar. This is in line with Marlina (2017), the other benefits of GeoGebra are making it easier for students to observe and express the properties possessed by geometric objects. After students understand the material, students completed the exercises and did GeoGebra activities, students wrote a summary on the summary sheet.

The second stage in reciprocal teaching learning is questioning. Each group was asked to make several questions related to the material given while answering these questions. Students must first understand and identify which parts are still not understood by students. Next, they questioned what is missing within their understanding. By making questions, students can deliver material that is still not understood. Qohar (2009) states that by making questions, students will have the opportunity to put things that have not been understood or that still need further explanation in written form. Tierney and Readence (2005) add that by making questions, students will be able to improve the understanding of the text or material they have read.

When predicting, each group was asked to estimate what the author would discuss next in the text. Students can make follow-up questions from questions that have been made at the Questioning stage. By making advanced questions, students can have better understanding since students must relate the new knowledge they get in reading to what they already knew. Oczkus (2013) states that the predicting stage can encourage students to try to understand the material being taught. Predicting activities are considered the most difficult activities for most students compared to other stages of reciprocal teaching. Students find it difficult to make follow-up questions from the questions made in the questioning stage. This is in accordance with Adityawan (2017) that the reciprocal teaching stage that is most difficult to be implemented by students is the predictive stage (Predicting). In the predicting stage, the teacher is expected to be able to guide students in making follow-up questions because according to Darmadi (2012) when students are experiencing difficulties, the teacher must provide guidance in an appropriate way to students.

Furthermore, the last step in reciprocal teaching learning is clarifying. One group was asked to present the results of their group discussion. The clarifying stage in the first cycle did not run smoothly because

the students were still not confident to appear in front of their friends and ask questions about the presentation. In response to this, the researchers highly encouraged them to present in front of the class. The researchers appointed several groups to provide questions or responses to the presentation group. According to Nurhalisah (2010), if there are students who are less enthusiastic in class discussions, the teacher should pay attention to them. These students can be given the opportunity to ask questions to observe and respond to their friends. With this clarifying activity, students can practice to convey their ideas and discuss responding to what their friends have to say. Supinah (2008) states that conducting class discussions, advanced groups conveyed what their groups discussed while the other groups gave responses or questions responding to the results of their presentations. The presentation of students can help students to communicate mathematical ideas and the results of their discussions thus they can be understood by other students. Sanjaya (2016) adds that by conducting group discussions in learning students can exchange information and opinions, correct or evaluate things that are less precise and discuss their answers.

Improving Student's Mathematical CommunicationAbility

Students' mathematical communication ability is indicated in the final test in each cycle. The test questions provided are in the form of a description of two questions where the assessment is associated with predetermined mathematical communication indicators. The final score of the test results is the number of scores obtained by students then divided by the maximum number of scores that can be obtained and multiplied by 100. Students who take the final test are declared to pass if they get a score above Minimum Standard Criteria of at least 75. While classical completeness is at least 80 % of the total number of students declared complete.

After evaluating the final test of the students, both class average score and classical completeness from cycle I to cycle II had increased. The class average increased by 6.35 from the one in the first cycle of 79.33 increasing to 85.68 in the second cycle. Furthermore, seen from the classical completeness of the final test results, it was found that in the first cycle of 62.5%, it increased 25% to 87.5% in the second cycle, the number of students who scored above the Minimum Standard Criteria. Thus, the researchers concluded that there was an increase in mathematical communication ability of XI Graders of Vocational High School from cycle I to cycle II.

In addition to final test, teacher and students activities contribute to the success criteria of this research. Both teacher and students activites are considered good. Teacher activities from Cycle I to Cycle II increased from 82.2% to 94.2%. Students activities as well, from Cycle I to Cycle II increased from 78.3% to 93.3%. Both teacher and students activities are considered good. This further affirms that both activities contribute to research accomplishment.

CONCLUSION

Based on the results and discussion, the reciprocal teaching learning model assisted by GeoGebra can improve mathematical communication skills of XI graders of SMK Al-Amin Gresik. The learning consist of four stages. (1) Summarizing, the teacher asks each group to discuss the material and exercise available in student worksheet. Students are directed when making summary to help students understanding the material. Then, students were asked to open the GeoGebra software on the computers of each group. Furthermore, students carried out activities using the GeoGebra application in accordance with the activity instructions in the worksheet. The teacher guided the discussion of students and helps students if there are difficulties. The teacher also reminded students to write a summary on the sheet provided. (2) Questioning, each group was asked to question the material available in worksheet. At the same time, they were required to provide an answer on the questioning sheet. Teacher should be present during the process of discussion to ensure how it is going and to provide assistance when needed by students. Students can generate questions based on the summary they are writting. (3) Predicting stage, the teacher instructs each group to make follow-up questions or development questions from the questions that have been made and answer those questions on the predicting sheet. At this stage, the teacher observed and checked the work of students in making follow-up questions and assisted them when encountering difficulties. (4) Clarifying stage, the teacher asked all groups to submit the student worksheet they have worked on. The teacher asked one group to come forward to present what has been discussed by their group. After presenting, the teacher opened a question and answer session by inviting other groups. The presenting group and the

group providing responses will be regarded at the end of the session.

Some points of suggestion were made as follows: (1) the teacher present is important during the process of learning to check the work and provide assistance, (2) when making summary, it is important for teacher to encourage students to comprehend the topic first before write an summary, (3) as well in questioning, it is important to encourage students to discuss with their group, (4) it is important to encourage and motivate students when making prediction and promote self-confidence when asking for a question. (5) Last but not least, when presenting the results of group discussion in clarifying stage, teacher should be able to encourage student's confidence in presenting in front of the class as well as responding to the presentation.

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