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Improving Student's Mathematical Communication Ability through Think Talk Write Learning Model on Geometry Materials

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Abstract: This study aimed at investigating the students' mathematical communication abilities on geometry materials through Think Talk Write (TTW) learning model. The type of research was Classroom Action Research (CAR) with data collection instruments are test of mathematical communication skill, lecturer observation sheets, and student observation sheets. This research was given to 31 first-year students of Malang State University in the academic year 2019/2020. This classroom action research stopped at cycle II. Based on the research results obtained, the percentage of students' mathematical communication abilities in the first cycle had an average value of 68.097% while that in the second cycle had an average value of 82.000%. The average increase from cycle I to cycle II was 13.903%. Based on the results of the study, it can be concluded that Think Talk Write (TTW) learning model by providing material reinforcement in the form of written summaries as material reinforcement at the end of learning can improve mathematical communication skills of first-level students on geometry materials

Keywords : Mathematical communication; Learning model; think-talk-write; geometry

Introduction

Communication is an aspect that needs to be learned in the learning process at school. One of them is learning communication in mathematics or what is often called mathematical communication. Someone who has mathematical communication ability can communicate ideas, reasoning and can compile mathematical evidence using complete sentences, symbols, tables, diagrams, or other media to clarify the situation or problem. NCTM (2000) states that the ability of mathematical communication is one of the standard processes in mathematics. Mathematical communication is a way for someone to share ideas and explain their understanding of mathematics.

Mathematical communication ability is important to be possessed by students (Qohar & Sumarmo, 2013; Dimmel & Herbst, 2017; Kabael, 2012; Sfard, 2012; Tinungki, 2015; Uptegrove, 2015). Communication in learning mathematics provides students the opportunity to share ideas,

thoughts, assumption, and mathematical solutions in order to obtain a better understanding of mathematics (Viseu & Oliveira, 2012). Anthony (2009) in his research offers ten principles of effective education approaches, one of which is student's mathematical communication ability. Students are expected to be able to organize and process mathematical thinking through communication, communicate mathematical thinking coherently and clearly to others, analyze and evaluate mathematical thinking to learn the strategies of others, and can use mathematical language to express mathematical ideas appropriately (Kennedy, Tipps , & Johnson, 2008). Communication needs to be owned by prospective teachers because teachers as the facilitators in the learning process so that the ability is important to improve the ability of students (Mauigoa-Tekene, 2006).

Mathematical communication is important, but students' mathematical communication abilities are still low (Klochkova, 2016; Rahman, 2012; Glava, 2015). Researchers conducted a preliminary study to prospective first-grade teacher students by giving geometry problems to measure mathematical communication abilities including the following.

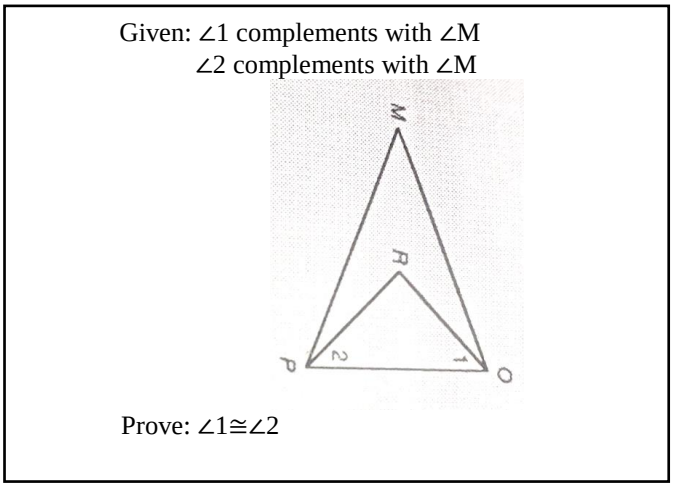

Figure 1. Preliminary study test questions to measure mathematical communication ability of material geometry

The observation question asked students to prove that angle 1 was congruent to angle 2. Previously students had been given definitions and related theorems. Following is the answer of one of the students (FK) in the observation.

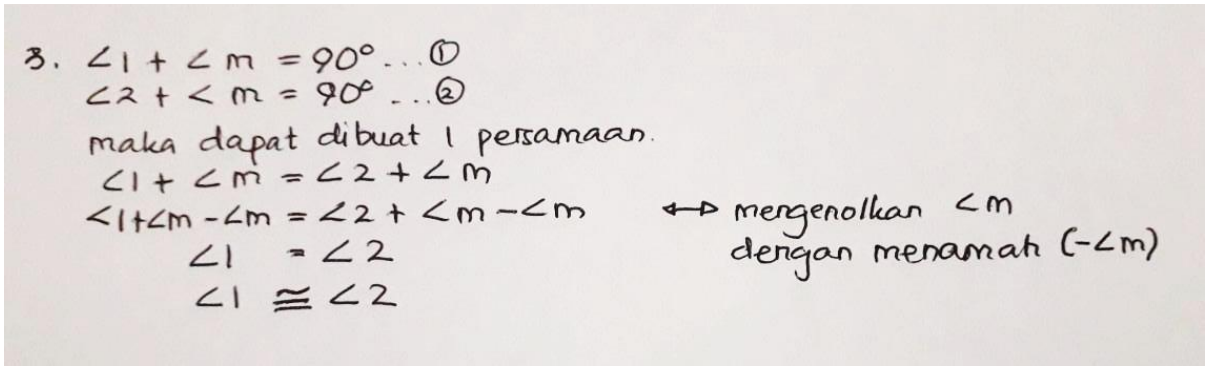

Figure 2. Preliminary study test question for mathematical communication ability of geometry material

FK mentioned that ∠1 + ∠m = 90 ° and ∠2 + ∠m = 90 °. FK wrote statements without giving reasons that were appropriate to theorems and definitions. The idea given by FK was not based on good reason. The student had not been able to communicate the definitions and theorems that had been studied previously to answer the questions given.

The previous research states that to improve students' mathematical communication abilities, a learning model is needed. One learning model that can improve mathematical communication is Think Talk Write (TTW) learning model, (Elida, 2012; Hendriana, 2014; Kurniaman, 2018; Nuraeni, 2018; Rahman, 2012; Suminar, 2018; Winayawati, 2012; Rojas-Drummond, 2016). The TTW learning model is a cooperative learning model that was first introduced by Huinker and Laughin in 1996. The stages of TTW learning model are think, talk, and write. Think is the stage of students thinking individually, talk stage is when students communicate ideas through discussion, and write is the stage where students conclude the material learned by writing as a reflection of their ideas, (Listiana, 2016). Based on the description above, the formulation of the problem in this study is how to improve students' mathematical communication skills through Think Talk Write (TTW) learning model on geometry materials.

Method

This research is a classroom action research. The purpose of this study was to improve students' mathematical communication abilities through Think Talk Write (TTW) learning model on geometry materials. The research subjects were first-year students of mathematics education at State University of Malang in the 2019/2020 academic year. The number of students as subjects were 31 students. The study was conducted in October 2019.

This class action research started from the first cycle and ended if the score of the mathematical communication ability of students under study has reached an average score of 75. The instruments used as data collectors were tests of mathematical communication abilities, lecturer observation sheets, student observation sheets, and notes during the research process. Each cycle had 4 stages, namely the planning phase, the implementation phase, the observation phase, and the reflection phase. The planning phase consisted of determining the actions to be carried to solve the problem, arranging the Semester Learning Plan, arranging mathematical communication abilities test questions, arranging lecturer and student observation sheets. The implementation phase was giving an opening greeting, praying before the learning activities, checking the attendance of students, conveying the lesson plan, dividing students into groups, students learned geometry material through group discussions, students wrote important notes of group discussion results, one student presented the results of their group discussions in front of the class, and students made conclusions about the material they had learned. The observation phase was the stage of evaluating the activities of implementing actions while the reflection phase was the analysis phase of the learning process to find out the improvement in mathematical communication abilities in the learning process.

Result and Discussion

a. Cycle I

The first cycle was carried out with the aim of implementing classroom actions using Think Talk Write (TTW) learning model.

1. Planning Phase

At the planning phase an assessment of the problems found in learning was carried out. At this planning phase the activities carried out were: (a) determining the actions to be taken to solve the problem, namely the low level of mathematical communication of students, especially in geometry; (b) preparing a learning scenario in the form of semester learning plan; (c) preparing the first cycle test questions; (d) preparing lecturer observation sheets and student observation sheets.

2. Implementation Phase

After the action plan I was arranged, the next step was implementing the action I according to plan. The stages of the researcher were: (a) giving an opening greeting; (b) praying before learning activities; (c) checking student attendance; (d) conveying the learning plan that would be carried out by applying Think Talk Write (TTW) learning model on geometry material according to semester learning plan; (d) dividing students into five groups; (e) students learned geometry material through group discussions; (f) students wrote the important notes on the results of group discussions; (g) one student was randomly appointed through a lottery to present the results of the group discussion to the class; (g) students made conclusions about the material that had been studied.

3. Observation Phase

At this phase, observation of the activities of lecturers and students during the learning process was made. The researchers divided students into five groups to discuss studying material (think). Each group wrote the results of their group discussion on a sheet of paper (write). Students were randomly selected one by one to explain in front of the class about the material being studied (talk). The observation results by the observers were written on the lecturer activity observation sheet and the student activity observation sheet. This research was observed by two observers.

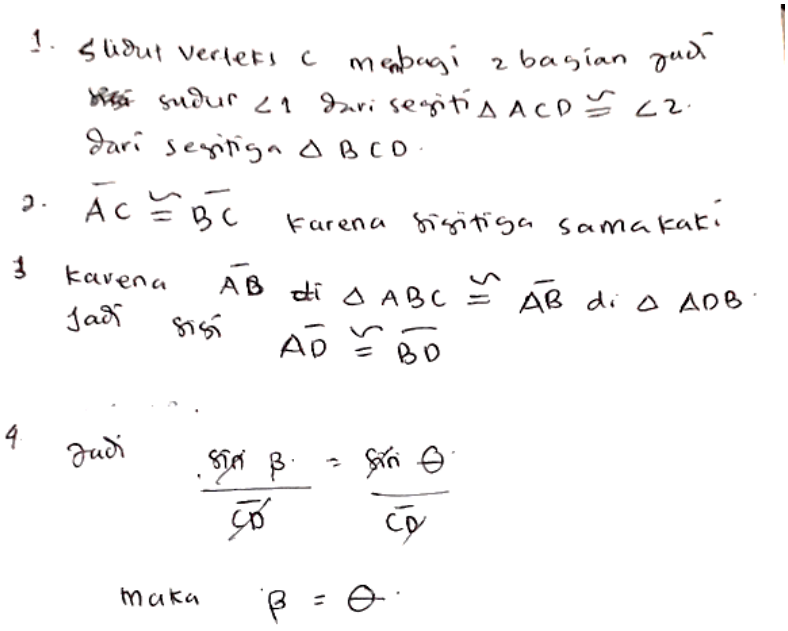

Figure 3 The Answer of one the students in working on test questions in the firts cycle

Figure 3 above is the answer of one of the students in working on the test questions in cycle I. Based on the answers, the students had not given reasons that were in accordance with theorems and definitions. The student's mathematical communication abilities were still lacking.

The complete scores of each student can be seen in table 1. During the learning process, other difficulties experienced by students were found including the fact that there were several groups that had difficulty in understanding the language in the source book being studied and the difficulty in bringing concepts in theory into geometrical form. As a result when the students were appointed to explain the concepts that had been learned in front of the class and when working on test questions, students' mathematical communication abilities were lacking.

4. Reflection Phase

Activities carried out at the reflection stage were analyzing the learning process of the first cycle to find out the increase in students' mathematical communication abilities in learning. The results of the first cycle still did not show the fulfillment of the criteria because the average score of mathematical communication skills in the first cycle was 68.097%. Therefore, it was necessary to carry out action research in the next cycle until the minimum average mathematical communication ability of the student was fulfilled, which was 75.

b. Cycle II

1. Planning Stage

Based on observations of the activities of lecturers and students conducted by the observers, things that needed to be improved during the learning process using the Think Talk Write (TTW) learning model could be identified. Next, an improvement was made. The lecturer concluded the material learned through the display of power point text (ppt). The conclusion through this power point text was displayed by the lecturer after the students concluded together in class discussion. The purpose of providing conclusions was as a confirmation and reinforcement of lecturers in writing about the material being studied.

2. Implementation Stage

The activities in implementation stage carried out by researchers were: (a) greeting the students; (b) praying before learning activities began; (c) checking student attendance; (d) conveying the learning plan that would be carried out by applying Think Talk Write (TTW) learning model on the geometry material according to semester learning plan; (e) dividing students into five groups; (f) students learned geometry material through group discussions; (g) students wrote the important notes of the results of group discussions; (h) one student was randomly appointed through a lottery to present the results of their group discussion in front of the class; (i) students made conclusions about the material they had learned, (j) the lecturer displayed the power point text to reinforce the material that had been learned.

3. Observation Stage

At the observation stage, the observations of the lecturer and student activities in the geometry learning process through Think Talk Write (TTW) learning model were carried out. Based on observations in the second cycle, there were still groups that found difficulties to understand the language in the source book being studied. The lecturer went around to observe and assist the student discussion process. The lecturer provided understanding in easier language for students to understand in groups that were experiencing difficulties. In addition there were also groups that asked about the geometrical meaning of a theorem. Figure 1.4 below is the activity during learning in cycle II. The lecturer went around to help groups who had difficulties during the discussion process in studying the material.

Figure 4. The lecturer is providing assistance to groups that are having difficulty during group discussions

The difference between the first and second cycles was in the process of concluding the material that had been studied. In cycle II, the lecturer provided additional media that served as a reinforcement of the material conclusion made by the previous students and provided stabilization of the material that had been studied. The medium was in the form of a written summary of *power point text*.

4. Reflection Stage

The activity carried out at the reflection stage was observing the learning process that occured during the second cycle. If the learning activities in the second cycle had shown an increase in students' mathematical communication abilities, then the results of reflection could be used to arrange research conclusions. In this second cycle the average score of students was more than 75. Thus, the study was stopped. In this second cycle the average score of mathematical communication abilities obtained by students was 82.000. Based on data analysis, it was known that the mathematical communication abilities of students in geometry materials had improved.

Tabel 1 Scores Lists of Students' Mathematical Communication Abilities in Each Cycle

No.	Student's name	Cycle 1 Assessment (%)	Cycle II Assessment (%)	Increase (%)	Information
1	ASN	65	88	23	increased
2	AA M	65	95	30	increased
3	A BG	68	85	17	increased
4	ASM	60	65	5	increased
5	BSN	93	95	2	increased
6	CWG	90	81	-9	decreased
7	DOCK	88	88	0	increased
8	HAQ	55	73	18	increased
9	HI	70	87	17	increased

10	FKN	65	90	25	increased
11	KPP	70	75	5	increased
12	LFD	80	73	-7	decreased
13	MLK	55	63	8	increased
14	NFR	55	75	20	increased
15	NAS	55	95	40	increased
16	NAA	50	60	10	increased
17	NMH	55	75	20	increased
18	RRAS	60	83	23	increased
19	RBS	70	85	15	increased
20	RSF	75	78	3	increased
21	SYA	82	83	1	increased
22	SMJ	80	94	14	increased
23	TDA	55	90	35	increased
24	VRP	60	90	30	increased
25	YEP	50	81	31	increased
26	YWD	60	65	5	increased
27	CGJ	65	76	11	increased
28	MDJ	55	72	17	increased
29	AVA	90	94	4	increased
30	SAN	80	95	15	increased
31	BDM	90	93	3	increased
	$\sum x_i$	2111	2542		
	$\bar{x}$	68.097	82.000	13.903	
	Increase	$\bar{x}$		13.903	

Based on the above table of 31 students, 29 students (93.548%) of the number of students studied experienced an increase in mathematical communication abilities. The following is a bar diagram of an increase in mathematical communication abilities of the first level students from cycle I to cycle II. The average mathematical communication ability of students in the first cycle was 68.097% and the average in the second cycle was 82%. The increase of students' mathematical communication abilities from cycle I to cycle II was 13.903% with an average increase of each student also 13.903%.

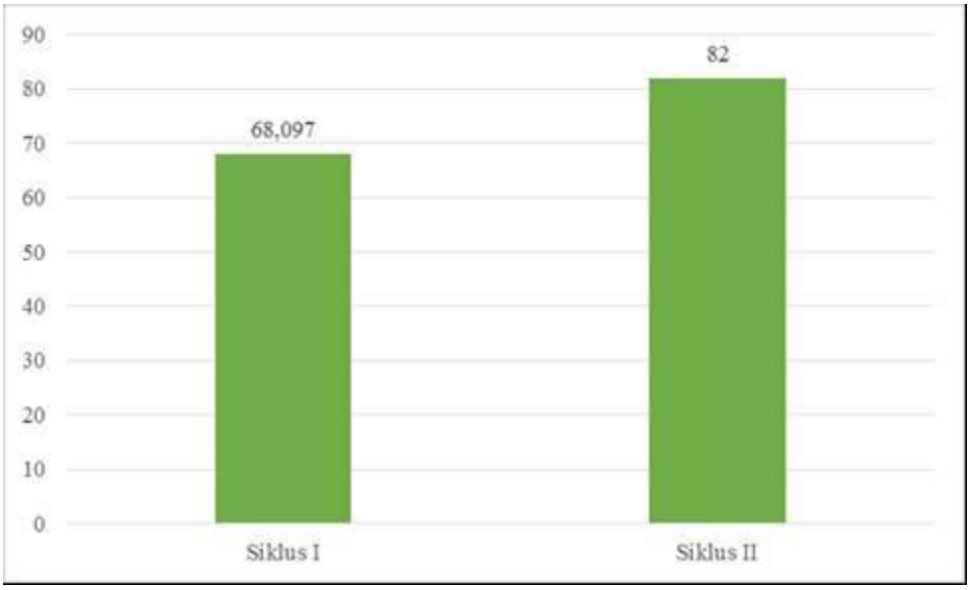

Figure 5. Test Score Average of Students' Mathematical Communication Abilities in Cycle I and II

The increase between cycle I and II was assumed that in the first cycle students were still adjusting to the new learning method namely Think Talk Write (TTW) that was done in this class. Students needed to adjust to their environment. The environment has a role in the learning activities of students, (Henningsen & Stein, 1997). In addition, the researchers added power point text in cycle II, as a medium to conclude the results that were studied. This can increase students' understanding, (Dabbagh & Kitsantas, 2012; Greenhow & Lewin, 2016; Zuana, 2018).

Conclusion

Based on the results of classroom action research, the Think Talk Write (TTW) learning model by providing material reinforcement in the form of written summaries such as power point text as material reinforcement at the end of learning can improve students' mathematical communication abilities. The additional media help as the reinforcement of the conclusions of the material made by previous students and provide confirmation about the material that has been learned. The stages are (a) greeting the students; (b) praying before learning activities begin; (c) checking student attendance; (d) conveying the learning plan that will be carried out by applying the Think Talk Write (TTW) learning model to the geometry material according to semester learning plan; (e) the researcher divides students into groups; (f) students learn geometry material through group discussions; (g) students write important notes on the results of group discussions; (h) one student is randomly appointed through a lottery to present the results of his group's discussion to the front of the class; (i) students make conclusions about the material they have learned, (j) the lecturer displays the power point text as a reinforcement of the material that has been learned.

The results of the study show that of the 31 students studied, 29 students (93.548% of the total number of students studied) experience the increase of mathematical communication abilities. The average mathematical communication ability of students in the first cycle is 68.097% and the average in the second cycle is 82%. The increase in students' mathematical

communication abilities from cycle I to cycle II is 13.903% with an average increase of each student also 13.903%.

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