Mathematical writing ability through Cooperative Learning with Think Talk Write (TTW)

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A R T I C L E I N F O	Abstract
	The objectives of this research are to test the efectiveness of cooperative learning with TTW strategy on mathematical writing ability and to analyze mathematical writing ability of eighth grade students based on self-esteem on cooperative learning with TTW strategy. This research is a mix methode research. The population is eighth grade students of SMP Negeri 1 Jeruklegi Cilacap at the year of academic 2018/2019. The selection of quantitative samples uses cluster random sampling while the qualitative subjects uses purposive sampling. The results showed that cooperative learning with TTW strategy is effective on mathematical writing ability, and students with low self-esteem level generally have mathematical writing ability with low criteria on written text and drawing aspect and moderate on mathematical expression aspect, while students with high self-esteem level have mathematical writing ability with high criteria on all aspects. © 2020 Published by Department of Mathematics, Universitas Negeri Semarang

1. Introduction

Mathematics is an important thing in the development of modern technology. The use of mathematics is very diverse, from simple things in everyday life to complicated things. Mathematics also teaches humans to think logically, systematically, critically, and creatively which is useful in dealing with the problems of everyday life.

Communication ability that middle school students must have in mathematics learning is to organize and incorporate their mathematical thinking through communication, communicating their mathematical thinking clearly, analyze and evaluate their mathematical thinking, and using mathematical language to express mathematical ideas clearly (National Council of Teachers of Mathematics, 2000:268). According to Asikin & Junaedi (2013:204), that mathematical communication has an important role in mathematics learning because it is used as a tool to exploit mathematical ideas and help students' ability in seeing various relationships of mathematical material, tools to measure growth in understanding and reflect mathematical understanding to students, a tool for constructing mathematical knowledge, developing problem solving, increasing reasoning, fostering self-confidence, and enhancing social ability .

According to Baroody, as quoted by Aryani (2010:4), states that there are five aspects in communication activities, namely representing, listening, reading, discussion, and writing.

Plato described writing, as quoted by

Teledahl (2016:3), as a form of communication that can pass time and distance away from the author.

Mathematical writing ability need to be developed in mathematics learning, as Lee (2004:1) argues that being able to write clearly is as important as mathematical ability as being able to solve equations, mastering the ability to write clear mathematical explanations is important for non-mathematicians as well.

Seeing the importance of mathematical writing ability for students, the teacher needs to make an effort so that students achieve maximum results in mastering mathematical writing ability. According to Yuniawatika (2015:72) one of mathematics learning alternative that can improve mathematical writing ability is learning with TTW strategy.

According to Afriyani et al. (2014:49) learning withTTW strategy has the advantage that at the learning stage starts from the involvement of students in thinking or dialogue with themselves after the process of reading the problem, then talk and share ideas (sharing) with friends before writing. This strategy begins with the disclosure of how students think about the completion of a mathematical problem, followed by students communicating the completion they get, and finally through discussion and negotiation, students can rewrite the results of their thinking (Asikin& Junaedi, 2013:106).

An obligation for teachers to be able to design learning that is interactive, inspiring, enjoyable, challenging, and motivates students to participate actively (Happy & Widjajanti, 2014:49). According to Pujiastuti, as quoted by Alamsyah& Turmudi (2016:121), besides cognitive factors there are other factors that take part in influencing student learning outcomes, namely affective factors. One of these affective factors is self- esteem of students in mathematics .

According to Reece et al. as quoted by Setyawati et al. (2017:176) self-esteem is a feeling of someone's sufficiency in many roles that he has done in life, including his role as a child, teenager, even as a student. Students in mathematics learning when writing problem solving must have a sense of adequacy or satisfaction with what they write.

According to Fadillah (2012:35) students with low self-esteem consider themselves weak, unable to do anything, have no ability, tend to feel themselves always failing, not seeing challenges as opportunities, but rather as obstacles, easily giving up before trying, and if it fails, then blame theirself (negatively) or blame others. Fadillah (2012:35) added, on the contrary students with healthy self-esteem will look more optimistic, full of confidence and always be positive about everything, also to the failure they experience, failure is seen as a valuable lesson for moving forward, and able to appreciate themselves and see positive things that can be done for future success.

Based on the background of the problem that has been explained before, the research formulation problems in this research are as follows: (1) whether the cooperative learning model with the TTW strategy is effective against the mathematical writing ability of eighth grade students; (2) how is the description of mathematical writing ability of eighth grade students through cooperative learning with TTW strategy based on self-esteem.

The objectives of this research are as follows: (1) examine the effectiveness of cooperative learning with TTW strategy on the mathematical writing ability of eighth grade students; (2) describe the mathematical writing ability of eighth grade students through cooperative learning with TTW strategy based on self-esteem.

2. Methods

The research conducted is a type of research mixed quantitative and qualitative methods. Quantitative research begins by determining the population and selecting a sample of the existing population. The sample selection is done by cluster sampling technique. The population in this research were all students of eighth grade in SMPN 1 Jeruklegi in the academic year 2018/2019. The samples selected in this research were students of class VII G as an experimental group and class VII F as a control group.

In qualitative research the selection of subjects uses a purposive sampling technique that is by making certain considerations. Subjects selected from the experimental group based on the level of students self-esteem is the low self-esteem level and the healthy self-esteem level. For each level of self-esteem, 3 subjects were chosen to analyze students' mathematical writing abilities. The variables in this research are cooperative learning with the TTW strategy and mathematics learning with the discovery learning model as an independent variable and mathematical writing ability of students at SMP Negeri 1 Jeruklegi as the dependent variable. The material used in this research is surface area of plain side space building.

The experimental design in this research refers to the Pottest Only Control Desaign. In this design there are two groups selected using cluster random sampling technique. The treated group is called the experimental group and the untreated group is called the control group. In the experimental group given cooperative learning with TTW strategy, while the control group was given mathematics learning with discovery learning. To measure mathematical writing ability of students using the test method, in addition to knowing the level of self-esteem students use Rosenberg Self-Esteem Scala, which has been translated by Azwar (2007:185-161). Sources of data in this research are answer sheets for mathematical writing ability tests, self-esteem psychology scales, students' interview results and observations.

Data analysis that is carried out includes the analysis of test kits and analysis of research data. The problem of test that is used for the post test is a matter that has been tested. Data from the trial results are then analyzed. Analysis of the post-test items include the item validity, the tests reliability, the level of difficulty, and the discrimination power of item. Based on analysis, from 4 items which tested all items suitable for use in post-test, the results of this analysis were then validated by experts is mathematics lecturers.

Before the research was carried out, the researcher conducted a normality test, a homogeneity test, and test of similarity of two averages. The data used is data from midterm exam. After students have done the post test, the post test results data were tested using the normality test, homogeneity test, mastery learning test, and test of different of two averages. The results of filling the psychological scale of students' self-esteem conducted by students are then analyzed to classify the students' self-esteem levels, namely low and healthy.

Qualitative data analysis is done by reducing data, presenting data, making conclusions, and verifying data. In reducing data, data is summarized and focused on important things based on students' mathematical writing ability that have low and healthy levels of self-esteem. In presenting data, the data presented is the analysis of students 'mathematical writing ability based on indicators of the mathematical writing ability in the form of descriptions and presented in tabular form. In conclusion and verification of data taken from the results of the reduction and presentation of students' mathematical writing ability data based on students' level of self-esteem, namely low and healthy self-esteem.

3. Results and Discussion

The results in this research are the effectiveness of the cooperative learning with the TTW strategy on the mathematical writing ability of eighth grade students and the mathematical writing ability of eighth grade students through the cooperative learning with the TTW strategy based on self-esteem.

3.1. The Effectiveness of the Cooperative Learning Model with TTW Strategy on the Mathematical Writing Ability of Eighth Grade Students

Based on the results of the initial data analysis in the form of midterm scores even in the 2018/2019 school year it was found that the two sample classes were normally distributed, had a homogeneous variance, and there were no differences in the mean of the two groups. This means that the control class and the experimental class come from the same condition or condition.

In the two classes then given a different treatment, namely in the control class applied *discovery learning,* whereas in the experimental class cooperative learning with *Think Talk Write* strategy. Before learning is carried out, the learning device is first validated by an expert validator. Syllabus and RPP validation results show the two learning tools are valid. Learning is carried out as much as 4 meetings in each class. Researchers carry out learning activities in the two sample classes in accordance with the lesson plan that has been validated, supported by the results of the observation sheet of the teacher's activity showing very good criteria in both classes.

In the learning control class begins with the teacher distributing worksheets to each student. LKS contains learning activities based on the stages of *discovery learning*. The first stage is *stimulation,* where the teacher provides stimulation to students by providing contextual problems and conducting demonstrations using visual aids in the surface area of flat side spaces. The next stage is the *problem statement, the* teacher invites students to determine the material to be learned, ending with the teacher delivering the learning objectives. At the *data collection* stage*,* students gather information by drawing a

network of flat side spaces, and calculating the area of the network at the *data processing* stage. After students find the formula for surface area to build flat side space, then the next step is *verification,* students prove the formula by applying it to solve previous problems. The final stage in this learning is *generalization,* where students and teachers jointly draw conclusions about the surface area formula of flat side space.

In the experimental class the teacher applies cooperative learning with the TTW strategy. The first phase of cooperative learning is to convey goals and motivate students, the teacher conveys the learning objectives to be achieved then convey will give appreciation to students or groups who are active in learning.

The second phase is providing information, information is presented in the form of worksheets that contain concepts and problem solving contextual surface area of the flat side space. After the teacher distributes worksheets to each student, students are first presented with a matter of surface area to build flat side space (*think*), after a few minutes the teacher asks "how do you calculate the area?" so that many students scramble to answer (*talk*), then the teacher and students determine an agreement with the problem solving steps and the formula for the surface area of the flat side space, which ends with the student writing the problem solving (*write*). This activity is supported by the opinion of Ratnawati, as quoted by Mulyadi&Ermawati (2014:167), that one of the strengths of the *Think Talk Write* strategy is that it can help students construct their own knowledge so that their understanding of concepts becomes better.

After students get the concept of the surface area of the flat side space, other information is solving the contextual problem of the surface area of the flat side space. Before entering the next phase, students are given the opportunity to read the problem and write what is known and asked based on the problem and draw pictures that help solve the problem individually (*think*). This activity is based on Piaget's learning theory, because class VIII students aged 12-13 years are at the concrete operational stage towards the formal operational stage, where junior high school students are getting accustomed to using abstract mathematical symbols, pictures or graphics to facilitate the resolution of problems that are of a contextual.

The third phase is organizing students in study groups. The teacher has previously prepared group divisions based on differences in the abilities of group members. Students gather according to group members who have been determined to discuss steps to solve problems in general (*talk*). This activity is based on Vygotsky's learning theory, where in groups students conduct social interactions so cognitive development occurs. In accordance with opinion of Shoimin (2014:215) which says that interacting and discussing with groups will actively involve students in learning and familiarizing students with thinking and communicating with friends.

The fourth phase is guiding the group to work and study. In addition to the benefits gained from discussion activities, researchers also face several obstacles that occur, namely students who have high ability to dominate the discussion so that other students look passive. The problem faced by researchers is in accordance with the opinion of Daryanto (2013:137-138) who said that during class discussions, sometimes dominated by someone, this resulted in other students becoming passive. After the discussion is over, the teacher reminds students to solve the problem by writing down the problem based on the steps of the results of the discussion individually (*write*). This activity is supported by constructivism learning theory at the *writing* stage, students construct their own knowledge as a result of collaboration.

The fifth phase is evaluation, the teacher gives the opportunity to two groups to present the problem solving the results of the discussion, which ends with the teacher's confirmation of the correctness of the answers. The final phase is giving awards, according to what the teacher has said at the beginning of learning, the teacher gives appreciation to students who are active during learning and groups who dare to come forward with praise and applause .

The results of students' mathematical writing ability tests are used as final data. Based on the results of the hypothesis 1 test showed that the mathematical writing ability of the experimental class students achieved classical completeness, namely students who scored ≥ 71 reached more than 75%, as many as 31 students out of 32 students scored ≥ 71. In hypothesis test 2 showed that the average writing ability mathematical students of the experimental class are better than the average mathematical writing ability of the control class students.

Based on the explanation above, it can be concluded that cooperative learning with TTW strategy is effective against the mathematical writing ability of eighth grade students of SMPN 1 Jeruklegi Cilacap. The results of this study are supported by previous studies, including research by Yuniawatika (2015:72) which concludes one alternative to learning mathematics that can improve mathematical writing skills,

namely learning with *Think Talk Write* strategy and research conducted by **Error! Reference source not found.** *et al.* (2009:57-66) which states the mathematical writing ability of junior high school students who obtain mathematics learning with *Think Talk Write* strategy is better than conventional methods.

3.2. *Mathematical Writing Ability of Eighth Grade Students Through Cooperative Learning Models with TTW Strategy Based on Self-Esteem*

The subject of qualitative research is experiments group students that have healthy self-esteem and low self-esteem. There are 32 students in experimental group filling a self-esteem questionnaire. The filling out of the questionnaire was carried out on Monday, April 29, 2019 together with the mathematical writing ability test.

Obtained data from the filling scale of self-esteem of students, there are 10 students with low self-esteem or equal 21,875%and 7 students with healthy or equal 31,25%. While 15 other students or 46,875% others have a score among the fluctuation scores so that it does not need to be classified in the category of low or healthy self-esteem because the score does not need to be diagnosed differently. Therefore, subjects with self-esteem scores were not used in this research because there were only low and healthy levels of self-esteem. Then, the three subjects for each level of self-esteem by taking into account the ability to write mathematical test results in order to do the interview. Obtained subjects with codes SR-1, SR-2, and SR-3 as students with low self-esteem and subjects with codes ST-1, ST-2, and ST-3 as students with healthy self-esteem.

3.2.1. *Mathematical Writing Ability of Students with Low Self-Esteem Levels through Cooperative Learning with TTW Strategy*

Based on the results of the analysis, SR-1 subjects have mathematical writing ability with low criteria for all indicators, namely written text, drawing, and mathematical expressions indicators. Judged from the written text aspect, the subject SR-1 writes an explanation that is correct and logical but incomplete so that there is important information missing, and using mathematical symbols is inappropriate. When interviewed, the SR-1 subjects still had difficulty in understanding the questions, this is because the subjects SR-1 were less thorough in reading the questions. Judged from the drawing aspect, the SR-1 subject is able to draw the picture correctly but does not give information on the image so that the image made is unclear. When interviewed the subject SR-1 in drawing was still confused and was not sure that the picture made was correct. Judged from the mathematical expression aspect, the subject SR-1 writes a mathematical sentence incorrectly but the calculation is correct, as well as writing the formula incorrectly. When interviewed, subjects SR-1 were not sure they could solve the problems in the questions.

Based on the analysis of the subject SR-2 has mathematical writing ability with low criteria for all indicators, namely written text, drawing, and mathematical expressions indicators. Judged from the written text aspect, the subject SR-2 writes a true and logical explanation but is incomplete so there is important information missing, and not using mathematical symbols. When interviewed, the subject SR-2 were confused in understanding the questions and forgot to write down the information needed. Judged from the drawing aspect, the subject SR-2 makes the picture less precise and provides inaccurate information. When interviewed the subject SR-2 made a picture with uncertainty and confusion in giving information. Judged from the mathematical expression aspect, subject SR-2 write mathematical sentences incorrectly and calculations are incorrect, and write the formula correctly. When interviewed, the subject SR-2 were interviewed, they were not sure that the calculations were correct.

Based on the results of the analysis, the subject SR-3 has the mathematical writing ability with low criteria for all indicators, namely written text, drawing, and mathematical expressions indicators. Judged from the written text aspect, the subject SR-3 writes a true and logical explanation but is incomplete so there is important information missing, and not using mathematical symbols. When interviewed, the subject SR-3 had difficulty in understanding the questions. Judged from the drawing aspect, the subject SR-3 makes the picture correct and gives information on the incomplete picture. When interviewed the subject SR-3 was sure the picture was made correct but forgot to give information on the picture. Judged from the mathematical expression aspect, the subject SR-3 writes mathematical sentences correctly and calculations correctly, but do not use mathematical symbols in writing formulas. When interviewed, the subject SR-3 was not sure that the calculations were correct and that he used mathematical symbols.

The findings in this research that students with low self-esteem levels have an attitude of not wanting to take risks and consider themselves lower than others so that when writing what is known students tend to write down all the information contained in the problem without regard to whether the information is useful in solving problems or no, not careful in reading the questions, so forget to write important information about the questions. This is in line with the opinion of Fadillah (2012:35) that students with low self-esteem perceive themselves to be weak, unable to do anything, have no abilities, and tend to feel themselves always failing. Students with low self-esteem make a picture because it fulfills an assignment, not to make it easier to solve a problem so that it makes the picture less precise and does not give information to the picture. This is in line with the opinion of Fadillah (2012:35) that students with low self-esteem see challenges as obstacles rather than opportunities. Students with low self-esteem write problem solving less thoroughly so that tends to result in incorrect calculations. This is in line with the opinion of Fadillah (2012:35) that students with low self-esteem give up easily before trying.

3.2.2. *Mathematical Writing Ability of Students with Healthy Self-Esteem Levels through Cooperative Learning with the TTW Strategy*

Based on the analysis of the subject ST-1 has a high mathematical writing ability on all indicators, namely written text, drawing, and mathematical expressions indicators. Judged from the written text aspect, the subject ST-1 is able to write explanations or information contained in the questions given to the mathematical idea clearly and completely. When interviewed, subject ST-1 had no difficulty in understanding the questions and felt confident that they could solve the questions. Judged from the drawing aspect, the subject ST-1 is able to make a drawing to get up the plain side space correctly and give the right information. When interviewed, the subject ST-1 makes a neat and complete drawing of a plain side room with information to make it easier to do calculations. Judged from the mathematical expression aspect, subject ST-1 is able to write mathematical sentences correctly and calculate correctly, and write formulas correctly. When interviewed, subject ST-1 explained the surface area formula used correctly, and was sure the calculations were carried out correctly.

Based on the analysis of the subject ST-2 has the mathematical writing ability with high criteria on all indicators, namely written text, drawing, and mathematical expressions indicators. Judged from the written text aspect, the subject ST-2 is able to write explanations or information correctly and completely based on the questions given. When interviewed, the subject ST-2 there was no difficulty in understanding the questions and felt confident that they could solve the questions. Judged from the drawing aspect, the subject ST-2 is able to draw pictures correctly and the information given is complete and correct. When interviewed, the subject ST-2 made a neat picture of the building with the aim to make it easier to solve the problem. Judged from the mathematical expression aspect, the subject ST-2 is able to write mathematical sentences correctly and calculate correctly, and write formulas correctly. When interviewed, the subject ST-2 explained the surface area formula and mathematical symbols used correctly, and was sure that the calculations were carried out correctly.

Based on the analysis of the subject ST-3 has the mathematical writing ability with high criteria on all indicators, namely written text, drawing, and mathematical expressions indicators. Judged from the written text aspect, the subject ST-3 is able to write explanations or information correctly and completely based on the questions given. When interviewed, the subject ST-3 had no difficulty in understanding the questions and felt confident that they could solve the questions. Judged from the drawing aspect, the subject ST-3 is able to draw pictures correctly and the information given is complete and correct. When interviewed, the subject ST-3 made a neat picture of the building with the aim to make it easier to solve the problem. Judged from the mathematical expression aspect, the subject ST-3 is able to write mathematical sentences correctly and calculate correctly, and write formulas correctly. When interviewed, the subject ST-3 explained the surface area formula and mathematical symbols used correctly, and was sure that the calculations were carried out correctly.

The findings in this research that subjects with healthy self-esteem level have the attitude to consider themselves able to complete the tasks given so write down all the information needed to solve the problem, this is in line with Lawrence's opinion, as quoted by Happy&Widjajanti (2014:49-50), students with healthy self-esteem tend to be confident in handling the tasks of the teacher. Students with healthy self-esteem in drawing shapes and spaces, giving information in drawing sketches of problems, and making drawings to make it easier to solve problems. This is in line with the opinion of Fadillah (2012:35) that students with

healthy self-esteem are always positive about everything. Students with healthy self-esteem write down problem solving carefully so that the calculation results are always correct. This is in line with the opinion of Fadillah (2012:35) that students with healthy self-esteem are able to appreciate themselves and see positive things that can be done for future success.

4. Conclusion

The conclusions of this research are (1) cooperative learning with TTW strategy effective on students' mathematical writing ability, (2) the eighth grade students in SMPN 1 Jeruklegi with healthy self-esteem are able to write mathematically with high criteria for all aspects of mathematical writing namely written text aspect, drawing aspect, and mathematical expression aspect, and (3) the eighth grade students in SMPN 1 Jeruklegi with low self-esteem are able to write mathematically with low criteria for aspects of written text and drawing aspects, moderate on of mathematical expressions aspects.

Suggestions recommended by researchers as follows: (1) Teachers must be able to create a conducive atmosphere when conducting learning using cooperative learning models with TTW strategy, such as teachers should be able to foster student motivation to discuss in groups, when discussing groups able to guide students so that each group member participates in the discussion, and is able to maintain class order during the discussion, (2) The teacher can consider several things related to mathematical writing ability, such as the level of self-esteem. For students who have low levels of self-esteem, teachers should pay more attention to actively discussing and completing their work, and (3) Teachers in making or developing problems (questions) can consider several things related to aspects of mathematical writing ability.

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