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Mathematical Communication Ability Assessed By Student *Self- efficacy* In Learning The *Two Stay Two Stray* (TSTS) Model on Ability of Process Approach

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Abstract

This study aims to determine the ability of mathematical communication in terms of students *self-efficacy* in learning type *two stay two stray* (TSTS) cooperative approaches with process skills. The method used in this research is mixed method with concurrent embedded design. This research was conducted in class VII SMPN 40 Semarang in the academic year 2017/2018 with class VII F as an experimental class subjected to cooperative learning model type TSTS approached by process skills and class VII G as a control class subjected to the Problem Based Learning model. Data is collected by tests, questionnaires, observation sheets and interviews. Subject taking techniques based on self-efficacy were taken 2 subjects for each category by *random sampling*. The results showed that the description of mathematical communication skills in terms of students' *self-efficacy* varied. This is shown from 7 students with high *self-efficacy* categories obtained mathematical communication skills in the form of 5 students in the high category and 2 students in the moderate category, from 21 students in the category of *self-efficacy* being obtained mathematical communication skills results in the form of 8 students in the high category, 11 students in the medium category, and 2 students in the low category, then 4 students in the low *self-efficacy* category obtained mathematical communication skills in the form of 1 student in the high category, 2 students in the medium category, and 1 student in the low category.

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INTRODUCTION

Mathematics is one of the subjects that must be studied in schools at every level in both formal and non formal education. As a basic science, mathematics today has developed very rapidly, both material and usefulness. According to Sariningsih & Purwasih (2017), with the rapid development of technology, all elements of society are encouraged to master more in the field of technology. Communication skills are needed by students to improve their academic abilities and to deal with various problems in daily life (NCTM, 2000). In addition, the opinion of Saragih & Rahmiyana (2013) which states that mathematical communication skills have an important role in everyday life so that someone can find solutions to their problems so that these problems can be well communicated. Therefore, the ability of mathematical communication is very important for students in expressing ideas or ideas and mathematical thinking in learning activities.

Communication skills in learning mathematics become something very important and needed in the learning process to be able to master mathematics well. Indonesia is one of the countries that participated in the Trends In International Mathematics and Science Study (TIMSS) Survey from year to year showing that the results achieved by Indonesia were still in the low category. Based on the publication of the IEA (The International Association For The Evaluation Of Education Achievement) relating to the 2015 TIMSS results, it is known that Indonesia is ranked 40 out of 45 participating countries with an average mathematical achievement score of 397. Wardhani and Rumiati (2011) TIMSS results low is caused by many factors, one of the causes is Indonesian students are less trained in solving problems related to mathematical communication skills such as questions on TIMSS, students in Indonesia are less trained in solving problems related to contextual questions, reasoning, argumentation (communication) and questions that refer to student creativity. In addition, the contextual application of mathematics, mathematical communication, and reasoning still receive less attention. The Ministry of Education and Culture (2017) states that the TIMSS results are low due to the large amount of test material that is asked at TIMSS not in the Indonesian curriculum. To achieve the appropriate results requires a long process. The process is carried out by managing learning situations, how to receive, organize and connect experiences and also how to respond to a learning method.

Self-efficacy can be one of the factors that can affect students' communication skills in their learning activities. Therefore, it is important for teachers to know how much students' *self-efficacy* towards mathematical communication skills in learning activities. The importance of self-efficacy in improving communication skills in learning in accordance with the results of research (Papa, 2015) states that students who have good *self-efficacy* in the academic field will produce positive things in learning activities and in the environment in which students are located. Research related to communication skills and the influence of different levels of students' *self-efficacy* is research conducted by (Ulya, 2016) which says that: a) students with high *self-efficacy* are able to understand problems, plan problem solving, implement problem solving plans and examine return correctly and completely, b) students with *self-efficacy* are able to understand problems, plan problem solving, carry out problem solving plans but when checking are unable to use other methods, c) students with low *self-efficacy* are able to understand problems and plan solutions the problem correctly but incomplete, less able to carry out the problem

solving plan and in checking back unable to use other methods.

Students prefer mathematics learning that provides opportunities to share knowledge and make them feel useful effectively in group work (Hossain & Tarmizi, 2013). TSTS is one type of cooperative learning that provides opportunities for groups to share knowledge and experiences with other groups, where there are two group members who live and there are two group members who visit. One approach that is integrated with the TSTS type cooperative model is the process skills approach where this approach is an insight or development of intellectual, social, and physical skills that originate from fundamental abilities that in principle already exist in students. Ministry of Education and Culture (Dimyati and Mudjiono, 2015). In general, the process skills approach can train students in developing learning systems that make students effective by developing skills in the process of acquiring knowledge so that students will discover, develop, themselves facts and concepts and foster attitudes and values required in specific learning goals.

The objectives of this study are as follows: (1) knowing the effectiveness of mathematics learning by using cooperative learning model TSTS type with the approach of process skills to mathematical communication skills, (2) knowing mathematics communication skills in terms of students' *self-efficacy*.

METHOD

This study uses a research design that refers to a combination of research (Mixed Methods). According to Creswell (2016) a combination model research is a research approach that involves quantitative and qualitative data collection, combining two forms of data, and the use of different designs, which can involve philosophical assumptions and theoretical frameworks. More specifically, in this study, a combination of research methods and concurrent embedded research models are used. This study uses quantitative methods as primary methods and qualitative methods as secondary methods.

This research was conducted in Semarang 40 State Junior High School with a population of seventh grade students in the 2017/2018 school year. The research subjects were 32 students for the class with cooperative learning model TSTS type with approach to process skills, and 32 students for the class with *Problem Based Learning* (PBL) learning model. Determination of research samples based on cluster random sampling. Sources of data in this study are TKKM answer sheet results, student *self-efficacy* questionnaire results, observations of the mathematics learning process and interview results. Subject taking techniques based on *self-efficacy* were taken 2 subjects for each category by random sampling. Quantitative data were tested using normality test, homogeneity test, average similarity test, average completeness test, classical completeness test, proportion difference test and average difference test. While qualitative data analysis is performed by validating data, making verbal data transcripts, data reduction, data presentation, and data verification.

RESULTS AND DISCUSSION

Quantitative research was conducted to analyze the effectiveness of learning with the cooperative learning model TSTS type approached by process skills. Learning activities carried out in the control class and experimental class, in the learning control class carried out with the PBL model and the experimental class carried out with a cooperative model TSTS type with regard to process skills. Before the research was carried

out, an initial test of mathematical communication skills of Grade VII students was carried out to determine the criteria for completeness of students and sampling based on *cluster random sampling* techniques. The initial ability test is carried out by giving 5 items of mathematical communication ability test items and the material used for the initial ability test questions as a prerequisite is line and angle material.

Based on the preliminary test data mathematical communication skills obtained (1) the average results of students' mathematical communication skills ($\bar{x}$) is 65.31 with a standard deviation (s) of 7.53. Thus the complete limit criteria in this study are $\bar{x} + \frac{1}{4} s$ = 67 s = 67; (2) Sig. normality and homogeneity are 0,200> 0,05 and 0,310> 0.05 so that it can be concluded that the initial data are normally distributed and homogeneous, then the sample class is randomly selected, namely the experimental class in class VII F and the control class in class VII G. After that it is done The average similarity test of initial ability in the two classes obtained by Sig. 0.292> 0.05. This shows that the average initial ability of students' mathematical communication skills in the two classes is not significantly different.

After conducting the research and analyzing the data the research results obtained information that (1) based on the results of calculations with the average completeness test, obtained a significance value (α) = 0,000 <0.05, then declared H0 is rejected. So the average value of mathematics communication skills of experimental class students reaches a minimum completeness of 67; (2) classical completeness test, based on the data obtained, the value itung count = 2.45. The value $Z_{(1/2\ (1-a))} = Z_{(1/2\ (1-0,05))} = Z_{0,475} = 1.96$ because the value of z = 2.45> $Z_{0.475} = 1.96$, then H_0 was rejected. This means that more than 75% of the final results of mathematical communication skills of experimental class students are declared complete and achieve classical completeness; (3) based on the results of the calculation of the average difference test, the significance value obtained (α) = 0,000 <0.05, then stated H0 is rejected. This means that the average mathematical communication skills of students in the class with the cooperative model of the TSTS approach to process skills is more than the average mathematical communication skills of students in the classroom with the Problem Based Learning model; (4) based on the results of the calculation of the proportion difference test, obtained a value of = count = 2.32. Value z_α = z 0.05 = 0.11. Because the value of z = 2.32> z_a = 0.11 then H_0 was rejected. So the proportion of completeness of students' mathematical communication skills taught by the cooperative type TSTS approach to process skills is better than the proportion of completeness of mathematical communication skills of students taught with the PBL model. So it can be concluded that the TSTS type of cooperative learning model approaches effective process skills.

Next is a qualitative analysis of mathematical communication skills in terms of students' *self-efficacy*. Students in the experimental class were given a *self-efficacy* questionnaire to group students by high, medium and low *self-efficacy* categories. Following are the results of the *self-efficacy* questionnaire from 32 students which are presented in Table 1. below:

Tabel 1. Student *Self-efficacy* Questionnaire Results

Categories	Many students
Self-efficacy high (SE-T)	7
Self-efficacy medium (SE-S)	21
Self-efficacy low (SE-R)	4
Total	32

The results showed that learning mathematical communication skills description in terms of diverse *self-efficacy* students. This is shown from 7 students with high *self-efficacy* obtained mathematical communication skills in the form of 5 students in the high category and 2 students in the moderate category. Of the 21 students in the medium *self-efficacy* category, the results of mathematical communication skills in the form of 8 students in the high category, 11 students in the medium category, and 2 students in the low category, then 4 students in the low *self-efficacy* category obtained mathematical communication skills in the form of 1 student high category, 2 students in the medium category, and 1 student in the low category.

The results of mathematical communication skills in terms of *self-efficacy* can be seen that students who have high *self-efficacy* do not necessarily get high mathematical communication skills scores. However there are students with low *self-efficacy* categories with high mathematical communication ability scores than students with high *self-efficacy*. That is because the learning model provided can stimulate students to learn.

Low mathematical communication skills scores are only able to work on indicators expressing mathematical ideas through oral and written in a series of concise and clear, and three other indicators are still experiencing difficulties. The theory supporting this finding is that put forward by Nadia (2017) which reveals that students with low *self-efficacy* have not been able to use all indicators of mathematical representation to the maximum. They have not been able to express mathematical ideas in the form of mathematical representation to find solutions to a problem well. This is in line with research by Hendriana and Kadarisma (2019) which states that *self-efficacy* has a significant effect on mathematical communication skills in junior high school students, and suggests that teachers design learning processes that can improve student *self-efficacy* so that students' communication skills increase.

The score of mathematical communication skills is just a difficulty on the indicator of explaining opinions using mathematical language or using mathematical problem solving with other forms of analysis. Students with moderate *self-efficacy* generally have no difficulty in working on the matter of communication skills. This is in accordance with the theory put forward by Ulya (2016) that students with *self-efficacy* are able to understand problems, plan problem solving, carry out problem solving plans but when checking are unable to use other means, this is in line with what was expressed by Kuswidyanarko, et al (2017) that students with *self-efficacy* are able to achieve a good level of literacy skills.

A high mathematical communication ability score has been able to do all the steps in accordance with the mathematical communication ability indicators. These findings are consistent with the theory put forward by Sarac & Tutak (2017) saying that someone with high *self-efficacy* has the ability to see difficulties easily through many attempts and regard a difficulty as a challenge in dealing with a problem. This is in line with what was stated by Wolters & Rosenthal (2000) students with high levels of *self-efficacy* have high goals, do a lot of effort, survive in the face of difficulties and use learning strategies independently.

CONCLUSION

Based on the results of the analysis and discussion of the results obtained description of students' mathematical communication skills in terms of student *self-efficacy* showed varying results. This means that the learning model of the TSTS type of cooperative approaches effective process skills and has an impact on the results of students' varied mathematical communication abilities. Therefore, the effectiveness of learning remains the focus of learning activities.

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