EFFECTIVENESS OF MISSOURI MATHEMATICS PROJECT (MMP) LEARNING APPROACH TO LEARNING TYPE OF TPS AND NHT TYPE ON ABILITY OF MATHEMATICS PROBLEM STUDENTS

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ABSTRACT

This study aims to determine is there a significant difference between the use MMP learning approach to TPS learning with the use MMP learning approach to NHT learning, and which is more effective between that lesson on math problem-solving ability. The population in this study were students of class XI MIPA MAN Yogyakarta III that consists of five classes. The sample in this study consists of two classes, that were XI MIPA 1 as the experimental class and XI MIPA 3 as the control class. The sampling technique used random sampling. The data collection method test and documentation. The research instrument is a problem solving test. Data analysis using t-test two parties and one party, but previously conducted test of normality and homogeneity. Based on the analysis of t-test two parties on mathematics problem-solving ability with a significance level of 5% and 55 degrees of freedom is obtained $t_{count} = 2{,}3029 > t_{table} = 2{,}0055$, indicating that there is a significant difference between the mathematics problem-solving ability using MMP learning approach to TPS learning with the use MMP learning approach to NHT learning, and Based on the analysis of t-test one parties with significance level of 5% and 55 degrees of freedom is obtained $t_{count} = 2{,}3029 > t_{table} = 1{,}6739$ indicates that the MMP learning approach to TPS learning more effective than the MMP learning approach to NHT learning on mathematics problem-solving ability.

Keywords: Effectiveness, MMP, learning of TPS, learning of NHT, mathematics problem-solving ability.

INTRODUCTION

Education is the most important part of life, this means that education is also one of the determining factors for the progress of a nation. Awareness of the importance of education is one of the efforts to improve the quality of human resources so that they can compete in various aspects of life. Mathematics is a subject that is found in all levels of education, starting from primary education to tertiary institutions.

In its development, mathematics learning at school still has problems that cannot be solved. One such problem is the low ability of students to solve problems. The ability to solve problems is one of the goals of learning mathematics in schools that will be achieved both according to the Ministry of Education Regulation Number 22 of 2006 and according to NCTM (2000: 7). This is indicated by the condition where students find it difficult when the teacher gives questions that are not routine. Students feel the questions given are not in accordance with the examples given. So as a result students are confused about solving these problems. Some of the causal factors found include that students lack training, students are less interested in challenges, and students are easily discouraged. This condition is proof that students' problem-solving abilities are still low.

According to Fadjar Shadiq (2014: 104 "Some mathematics education experts state that problems are questions or questions that must be answered or responded to. But they also state that not all questions will automatically become problems. A question will become a problem only if the question shows that there is a challenge (challenge) that cannot be solved by a routine procedure (routine procedure) that has been known by my employer. Polya, G (1973: 5-6) states 4 steps in solving problems namely, Understand the problem (understanding the problem), make a plan (make a plan), Carry out plan (carry out a plan), and look back at the completed solution (check back) Students are considered capable of solving problems properly if students are able to do all four steps well.

Learning that can improve students' problem-solving skills is learning that gives students the opportunity to reproduce exercises or work on projects. Ratumanan (2015: 267) states that when students work on projects given to them, they are faced with a problem situation that must be resolved through an activity of extracting information, investigating, thinking, etc., to complete the project. This will encourage the development of students' abilities faster, better, and wider in scope. One learning approach that provides a lot of practice to students is the Missouri Mathematics Project (MMP) learning approach. Slavin and Cyntia (2007: 31) Good & Grouws suggested that MMP is a program designed to assist teachers effectively in the use of training exercises so that teachers are able to make students get extraordinary benefits/gains in their achievements". According to Good and Grouw (1979: 357), the steps in MMP learning are daily review, development, training with teacher guidance (cooperative learning), seatwork, and closing. A study comparing the use of MMP learning with expository learning shows that MMP learning is more effective than expository learning on mathematics learning outcomes. This is indicated by the average gain in learning outcomes of class students with MMP learning better than the average gain in learning outcomes of class students with expository learning (Alita Nuhayati, 2016).

This MMP learning can be combined in cooperative learning. This is based on the opinion of Setiawan (2008: 37) which states that MMP is usually done together with cooperative learning. Many types of cooperative learning, Hamzah, A and Muhlisrarini (2014: 163-171) mention several types of cooperative learning models including Jigsaw, Number Heads Together (NHT), Student Teams Achievement Division (STAD), Think Pair and Share (TPS), Investigation Group. However, this research is only limited to two types of cooperative learning namely TPS and NHT. A research comparing TPS type cooperative learning with NHT type cooperative learning shows that TPS type cooperative learning is more effective than the NHT type cooperative learning model (Abdul Hadi, 2016).

The purpose of this study is 1) To find out the presence or absence of a significant difference between the mathematical problem-solving abilities of students who are taught using the MMP learning approach in cooperative learning type TPS with students who are taught using the MMP learning approach in NHT type cooperative learning in Class XI students MIPA MAN Yogyakarta III. And 2) To find out whether the MMP approach in TPS type cooperative learning is more effective than the MMP learning approach in NHT type cooperative learning toward mathematical problem-solving abilities in class XI MIPA MAN Yogyakarta III students.

METHODS

This research was conducted at MAN Yogyakarta III in the even semester of the 2016/2017 school year. The type of this research is True Experimental Design with a posttest only control design. The population in this study were students of class XI MIPA in the even semester of MAN Yogyakarta III in the 2016/2017 school year consisting of five classes.

Table 1. Research Population

Class XI	Total students	Average	Standard Deviation
MIPA 1	27	81.74	3.94
MIPA 2	30	80.07	4.47
MIPA 3	30	80.80	3.13
MIPA 4	28	80.46	4.11
MIPA 5	28	80.85	3.85

Sampling in this study was carried out using the Random Sampling technique for population classes because the abilities of the 5 classes were relatively similar. From the sampling obtained class XI MIPA 1 as an experimental class and class XI MIPA 3 as a control class.

The experimental class was treated with the MMP learning approach on TPS type cooperative learning while the control class was treated with the MMP learning approach with NHT type cooperative learning. Before giving an evaluation (posttest) of students in the experimental class and in the control class students, a trial was tested on the problem-solving ability of the test class to determine the validity of the items and the reliability of the test instruments. To test the validity of items used the product-moment correlation formula. Meanwhile, to test the reliability of the test instrument used the Cronbach Alpha formula.

Evaluation of the results of the test questions by students is based on the stages of problem-solving according to Polya, G (1973: 5-6). The steps in solving a problem are as follows, 1) Understand the problem. At this stage students must know the parts or elements that are in the problem, such as what is known and what is asked, 2) make a plan (make a plan). To be able to make plans well, students must have knowledge and a good understanding of the material given by the teacher before, 3) Carry out plan (carry out the plan). At this stage there are two things students must have, namely patience and confidence, and 4) look back at the completed solution (checking again) characteristic at this last stage is students are able to write the conclusions of solving the problem correctly.

The technical analysis of the data in this study used a two-party and one-party t-test. But before the analysis test was carried out, the analysis prerequisite test was carried out, namely a two-party t-test, normality test, and homogeneity test on the date of the initial ability scores of students of Class XI MIPA 1 and XI MIPA 3 which were taken from odd semester report cards. In this study, the normality test method used is the Chi-Square method. While the method used for the homogeneity test is the F test.

RESULTS AND DISCUSSION

Based on the calculation results for the normality test on the data obtained from the experimental class initial ability $\chi^2{}_{count} = 10{,}67283$ and in the control class obtained $\chi^2{}_{count} = 10{,}0668$. With a significance level of 0.05 and degrees of freedom = 5 both in the experimental class and the control class, it shows that $\chi^2{}_{count} \leq \chi^2{}_{table} = 11{,}0705$ then the initial ability value data of both the experimental class and the control class are normally distributed. The calculation results for the homogeneity test are obtained $F_{count} = 1{,}57903$ and $F_{table} = 1{,}93$. Because $F_{count} < F_{table}$ then the variance of students' initial ability values data used as research samples is homogeneous. Calculation results for the two-party t-test data on the students' initial ability scores were obtained $t_{count} = 1{,}0027$ and with a significance level of 0.05 and a degree of freedom 55 is obtained $t_{table} = 2{,}0055$. H_1 accepted if $t_{count} > t_{table} t_{table}$. Because of value $t_{count} = 1{,}0027 < t_{table} = 2{,}0055$ then H_0 is accepted. So it can be concluded that there is no significant difference between students' initial mathematical abilities in the experimental class and the control class.

The instrument used in this study was a matter of testing the ability to solve mathematical problems in the form of a problem description. Test questions were tested on MIPA 2 MAN Yogyakarta III class XII. Based on the results of the validity test, 13 items were declared valid with minimum criteria is enough. A valid test problem is then tested for reliability. Reliability test results are obtained $r_{count} = 0{,}8875$ and $r_{table} = 0{,}374$. Because $r_{count} > r_{table}$, the test instrument is declared reliable.

The next step is to provide learning treatment in both classes. Posttest was given to the experimental class and control class students after both received treatment. Before testing the hypothesis, namely the two-party t-test and the one-party test on the results of the posttest mathematical problem-solving ability, the normality test and homogeneity test on the posttest results are first performed.

Based on the calculation results for the normality test on the data value of the ability of students' problem-solving abilities in the experimental class obtained $\chi^2{}_{count} = 2{,}52954$ dan pada

siswa kelas kontrol diperoleh $\chi^2{}_{count} = 3{,}01973$. With a significance level of 0.05 and degrees of freedom = 5 both in the experimental class and the control class, it shows that $\chi^2{}_{count} \leq \chi^2{}_{table} = 11{,}0705$ then the data value of the testability of mathematical problem solving both in the experimental class students and the normal distributed control class. The calculation results for the homogeneity test are obtained $F_{count} = 1{,}4996$ and $F_{table} = 1{,}93$. Because $F_{count} < F_{table}$ then the data variance in the test scores of students' mathematical problem-solving abilities used as research samples is homogeneous.

Calculation results for the two-party t-test data on the value of students' mathematical problem-solving abilities with a significance level of 0.05 and a degree of freedom of 55 were obtained $t_{count} = 2{,}3029$ and $t_{table} = 2{,}0055$. H_1 accepted if $t_{count} > t_{table}$. Because of value $t_{stat} = 2{,}3029 > t_{table} = 2{,}0055$ then H_1 is accepted. So it can be concluded that there is a significant difference between students' mathematical problem-solving abilities taught using the MMP learning approach in TPS type cooperative learning with those using MMP learning approaches in NHT type cooperative learning in class XI MIPA students in the odd semester of MAN Yogyakarta III in 2016 / academic year 2017.

The difference in students' problem-solving abilities in the two classes is due to differences in the learning process in each treatment. In the learning process that uses the MMP approach to TPS type learning, through the MMP learning approach students understand the material provided during the stages of daily review and independent development. Then through TPS type learning students try to solve the problems that are given individually first and then group with a tablemate to exchange opinions of what has been done individually before being conveyed to the whole class. Through a learning process like this makes students better understand the material. This is seen during class discussions. Students are more enthusiastic to move forward in class, more confident in conveying the results of their work, and in arguing when there are differences in answers or ways of working. Conditions like this make the classroom atmosphere conducive to learning.

Unlike the class that uses the MMP learning approach on NHT type cooperative learning. MMP learning approach in this class also requires students to understand the material provided during the stages of daily review and development independently. Then through NHT type learning, students try to solve the problems given in groups and then students who are appointed to present the results in front of the class. In this class, the discussion process is not going well. This happens because only certain students in a group try to solve the problem given by the teacher. Thus, this condition causes there are still students who have not been able to understand properly how to solve these problems. As a result, when class discussions, students are less enthusiastic when given the opportunity to deliver the results of their group work in front of the class, pointing at each other, even some students still refuse when asked by the teacher (researcher) to advance to the front of the class. In addition, students who did not participate in trying to solve problems during group discussions lacked confidence when asked to present the results of their group work in front of the class. These differences lead to differences in students' mathematical problem-solving abilities between classes using the MMP learning approach with TPS type cooperative learning and those using the NHT type cooperative learning approach.

Calculation results for one-party t-test data on the value of students' mathematical problem-solving abilities with a significance level of 0.05 and degrees of freedom of 55 were obtained $t_{count} = 2{,}3029$ and $t_{table} = 1{,}6739$. H_1 accepted if $t_{count} > t_{table}$. Because of value $t_{stat} = 2{,}3029 > t_{table} = 1{,}6739$ then H_1 is accepted. So it can be concluded that the MMP learning approach in cooperative learning type TPS is more effective than the MMP learning approach in cooperative learning type NHT on the mathematical problem-solving ability of students in class XI MIPA even semester of MAN Yogyakarta III in the 2016/2017 school year.

The MMP learning approach to TPS type cooperative learning emphasizes students to be able to understand the material individually well then to understand each other among their peers. This condition makes communication between teacher and students and between students and students run well and effectively. MMP learning approach makes each student can play an active role in the learning

process. Meanwhile, through TPS type cooperative learning, students can exchange opinions between peers so they can understand each other. MMP learning approach with TPS type cooperative learning makes more meaningful for students because students are required to be able to understand the material delivered by researchers at the beginning of individual lessons, and when working on group assignments do not depend on other friends because the number of students in one group is only 2 students. So if there is no one in the group, students will ask the teacher (researcher). Based on the observations of researchers when using the MMP learning approach on TPS type cooperative learning, learning activities look smooth, students actively ask researchers, students look really understand the material presented, and students look more confident when delivering the results of their work. So when researchers provide seatwork that is done independently at each end of learning, students in this class do not feel difficult because they already understand the material well.

Whereas in the MMP learning approach on NHT type cooperative learning, there are still students who depend on one group's friends. When something is not understood from the material presented, students do not try to ask. Students who do not understand the material well seem to feel there is no responsibility when the group has completed the given task. Conditions like this cause students can not understand the material provided perfectly. Based on the observations of researchers when using the MMP learning approach on NHT type cooperative learning activities look smooth, but the process of discussion between teachers and students and students and students does not run well. Some students look really understand the material presented but some other students are not really sincere in understanding the material. In addition, when students are asked to submit the results of their discussion, only certain students who dare to express their opinions. Students who do not understand the material well become insecure when asked to convey the results of the discussion from the group. As a result, when researchers provide seatwork that must be done individually, there are still many students who feel confused.

The MMP learning approach requires students to be able to learn both individually and in groups. This is based on the MMP learning stages according to Good and Grouw (1979: 357), namely daily review, development, cooperative work, provision of seatwork, and assigning homework. At the daily review, development, seatwork, and home assignment stages, students must be able to learn to understand the material and do the work independently. While at the cooperative learning stage, students are required to learn in groups, both in understanding the material and when doing assignments. With such a learning phase, the MMP learning approach is deemed appropriate to be integrated into the type of TPS cooperative learning. This is based on the opinion about TPS learning according to Ratumanan (2015: 192) namely that "TPS learning provides an opportunity for students to work independently and cooperate with others". This can be used as a supporter of the results of the study that the MMP learning approach in TPS type cooperative learning is more effective than the MMP learning approach in NHT type cooperative learning towards the mathematical problem-solving ability of XI MIPA MAN Yogyakarta III students in the 2016/2017 school year.

Based on the results of the study, the advantage of the MMP learning approach is the large number of exercises or project assignments given to make students able to solve various problems independently. In addition, the stages or steps of development and cooperative work make concepts embedded in students' minds stronger. then H1 is accepted. So it can be concluded that the MMP learning approach in cooperative learning type TPS is more effective than the MMP learning approach in cooperative learning type NHT on the mathematical problem-solving ability of students in class XI MIPA even semester of MAN Yogyakarta III in the 2016/2017 school year.

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makes more meaningful for students because students are required to be able to understand the material delivered by researchers at the beginning of individual lessons, and when working on group assignments do not depend on other friends because the number of students in one group is only 2 students. So if there is no one in the group, students will ask the teacher (researcher). Based on the observations of researchers when using the MMP learning approach on TPS type cooperative learning, learning activities look smooth, students actively ask researchers, students look really understand the material presented, and students look more confident when delivering the results of their work. So when researchers provide seatwork that is done independently at each end of learning, students in this class do not feel difficult because they already understand the material well.

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Based on the results of the study, the advantage of the MMP learning approach is the large number of exercises or project assignments given to make students able to solve various problems independently. In addition, the stages or steps of development and cooperative work make concepts embedded in students' minds stronger.

CONCLUSION

Based on the results of data analysis and the discussion described above, the researcher can conclude the following:

1. Based on the results of a two-sided hypothesis/t-test with a significance level of 5% and a degree of freedom of 55, a score is obtained $t_{count} = 2{,}3029 > t_{table} = 2{,}0055$. So that H_0 is rejected and H_1 is accepted. This means that there is a significant difference between students' mathematical problem-solving abilities who are taught using the MMP learning approach in TPS type cooperative learning, and students who are taught using the MMP learning approach in NHT type cooperative learning in class XI MIPA students in the even semester of MAN Yogyakarta III in 2016 academic year / 2017.

2. Based on the results of the one-party hypothesis/t-test with a significance level of 5% and a degree of freedom of 55, a score is obtained $t_{count} = 2{,}3029 > t_{table} = 1{,}6739$. So H_0 is rejected and H_1 is accepted. This means that the MMP learning approach on TPS type cooperative learning is more effective than the MMP learning approach on NHT type cooperative learning towards the mathematical problem-solving ability of class XI MIPA students in the even semester of MAN Yogyakarta III in the 2016/2017 school year.

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