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Enhancement of Junior High School Students Problem Solving Ability Using Missoury Mathematics Project Learning Model with Individual and Small Group Assignments

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ABSTRACT

Mathematical problem solving ability is very important since it can help students to solve their daily problems. Studies shows that most of students only wants to know the standard procedures when they learn mathematics, and tends to give up when the given problems are different. This comparative study aims to know the students mathematical problem solving enhancements, and whether there is significant difference between two groups of students which acquire Missoury Mathematics Project learning model with individual or small group assignments. Samples for this research are junior high school students from SMP Advent II Bandung, grade seven. The instruments used in this research are mathematical problem solving test and quesionaire of responses. The research result shows that the mathematical problem solving enhancement categorized as high1. And there is a significant difference between those two groups of students which acquire Missoury Mathematics Project learning model with individual or small group assignments2. While the result from the quesionaire of responses shows that students like the Missoury Mathematics Project learning model.

Keywords: Mathematical Problem Solving Ability, Missoury Mathematics Project.

INTRODUCTION

Mathematics is one of the universal subject which has an important role in the development of human thinking power, and is a science that is able to integrate with other subjects and real life (Rostika & Junita, 2017). From a course of learning we are expected to not only be able to master the material, but can use the knowledge in dealing with problems to achieve an achievement and be able to apply it in every course of learning.

National Council of teachear of Mathematics (NCTM) stated that mathematics learning includes five abilities, that are:

1. mathematical communication
2. mathematical reasoning

3. mathematical problem solving
4. mathematical connection and
5. mathematical representation (Hikmasari & Scolastika , 2018).

Mathematical problem solving as one of the ability in mathematics learning, has four basic steps, that are: Understanding the problem, divising the plan, Carrying Out the plan, and looking back (Polya, 1973). Those steps can help students in terms of practicing how to think and reason in drawing conclusions from a problem that is routine or not routine (Yarmayani, 2016). Furthermore mathematical problem solving can facilitate students in solving their daily life problems and is an ability that is very important to be learned and improved by students (Akbar, 2018).

Studies shows that the students mathematical problem solving ability are not high yet. Nurlian (2014) found that students can only solve mathematics problems which are similar with the given example. The reasons are because mathematical problem solving are rarely given (Aisyah, 2018), not enough variety in mathematics problem solving problems (Putra, 2018), and most of students only wants to know the standard procedures when they learn mathematics, and tends to give up when the given problems are different (Kurniawan, 2015).

Missoury Mathematics Project (MMP) learning model is one the learning alternative which can enhance the mathematical problem solving ability, because this model emphasizes more on students, not only to be passive class participants but will be more interactive to give opinions and solve any problems during the learning process (Bambang, 2018; Fakhrudin, 2015). Good (2006) stated that: "Missouri Mathematics Project (MMP) was a good way to teach math concept". Furthermore, the Missouri Mathematics Project (MMP) learning model is a structured learning model to find out standard steps / procedures in solving various routine or non-routine questions, and students will get more material both from the results of discussions, projects, and presentations from the teacher (Rizki, 2016). The characteristic of the Missouri Mathematics Project (MMP) is that each student individually learns the instructional material conveyed by the teacher and the results of the individual are brought in groups to be discussed and mutually discussed by group members, and it is hoped that through project assignments students can be skilled in solving problems and have a variety of experiences in solving mathematical problems (Rahmiati, 2016; Latifah, 2014).

There are five steps in implementation of MMP learning model, that is:

1. Review
2. Development

3. controlled practice
4. Seatwork and
5. Homework (Marliani, 2015 dan Hidayah, 2015).

This study aims to see the junior high school students mathematical problem solving enhancement using Missouri Mathematics Project learning model with individual and small group assignments.

METHODS

This study use comparative design which involves two groups of junior high school students. The sample are junior high school students from two classes in SMP Advent II Bandung, grade seven.One group of students acquire MMP learning model with individual assignments, while the other group of students acquire MMP learning model with small group assignments. The research instruments are mathematical problem solving test and quesionaire of responses. The test contains five essay problems, given as pretest and posttest, which are tested for validity and reliability first. While the questionaire of response contains 20 statements with 10 negatives statement and 10 positive statements.

In this quantitative research, the first thing to do is to analyze the pretest, posttest and normalized gain to have the information about students initial mathematical problem solving abilities and the mathematical problem solving enhancement after being taught using MMP learning model. To see whether there are a significant difference in the students initial mathematical problem solving ablity and the students mathematical problem solving enhancement, between those who get individual assignments and those who get small group assignments, diffrence between means tests were carried out, by first testing the normality and homogeneity. Furthermore, the questionaire of responses were analyzed to know whether the students likes the MMP learning model or not.

RESULTS AND DISCUSSION

The results discussed here are divided in three sections, which are accordance with the aim of this study.

1. Descriptive Analysis

Below table shows the descriptive statistics of pretest, postest and normalized gain of the students mathematical problem solving ability. But in this study report, it is limited on the

mean, standard deviation, variance, minimum and maximum score of students' problem solving ability.

Table 1. **Descriptive Statistics**

	MMP with Individual Assignments			MMP with Small Group Assignments		
	Pre	*Post*	*Normalized Gain*	*Pre*	*Post*	*Normalized Gain*
Sampel Size	20			23		
Mean	6.05	38.80	0.7487	7.09	43.13	0.8384
Std. Deviation	4.893	4.959	0.10693	4.670	2.989	0.07110
Minimum	0	30	0,53	0	38	0.71
Maximum	21	48	0,93	18	49	0.97

Maximum score = 50

The initial students mathematical problem solving ability within both groups of students are averagely low (6.05 and 7.09), comparing with the maximu score of 50. But, after being taught using MMP learning model, the scores increases so that the students mathematical problem solving ability considered as moderate (38.80 and 43.13). This results shows that MMP learning model can increase the students mathematical problem solving ability, whether they have individual assignments or small group assignments. There were students who do not know how to solve the mathematical problem solving at the beginning (minimum score in pretest is 0 in both group of students), but after they were taught using MMP learning model, their students mathematical problem solving ability increases (minimum posttest score is 30 and 38). Furthermore, the normalized gain scores showed that the students mathematical problem solving enhancement categorized as high averagely, in both group of students (0.7487 and 0.8384). The result that MMP learning model can enhance students' mathematical problem solving ability is similar with the results reported in the studies of Gunawan (2019), Hidayah & Ulya (2016), Putra & Fitriyani (2016), Hidayah (2015), Latifah (2014), and Junaedi (2013).

2. Means Difference Analysis on Students Initial Mathematical Problem Solving Ability.

Before MMP learning model were implemented, the researcher wants to know whether the populations of students initial mathematical problem solving abilities are not significantly different or not. For that purpose, different between pretest test were done. But, firstly normality test was done to determine which statistics used, parametric or non parametric statistics test.

Table 2. **Normality Test for Pretest**

Group	*Shapiro Wilk*		
	Statistic	*Df*	*Sig.*
MMP with Individual Assignments	0.872	20	0.013
MMP with Small Group Assignments	0.943	23	0.213

Table 2 shows that the significant value (or p-value) for normality test of the students initial mathematical problem solving ability is 0.013 for the MMP with individual assignments group of students which is lesser than 0.05 (alpha), so it can be concluded that the population of students initial mathematical problem solving ability for the MMP with individual assignments group of students is not normally distributed. Furthermore, Table 2 also shows that the significant value (or p-value) for normality test of the students initial mathematical problem solving ability is 0.213 for the MMP with small group assignments group of students which is greater than 0.05 (alpha), so it can be concluded that the population of students initial mathematical problem solving ability for the MMP with small group assignments group of students is normally distributed.

Since one of the population of students initial mathematical problem solving ability is not normally distributed, the non parametric statistics test is used for the difference between means test, that is Mann Whitney test.

Before the difference betweeen means test, the homogeneity test was done to see whether the population variances of the students initial mathematical problem solving abilities are homogeny or not, and since one of the popupation of students initial mathematical problem solving abilities are not normally distributed, the based on median row was the considered row.

Table 3. **Homogeneity Test for Pretest**

	Levene Statistic	*df1*	*df2*	*Sig.*
Based on Median	0.007	1	41	0.935

Since the significant value showed in Table 3 is 0.935, which is greater than 0.05 (alpha), it can be concluded that the population variances of the students initial mathematical problem solving abilities are homogeny.

Table 4. **Mann Whitney Different Between Means Test for Pretest**

	Pretest
Mann-Whitney U	196.000
Wilcoxon W	406.000
Z	-0.832
Aymp. Sig. (2-tailed)	0.405

Table 4 shows that the significant value is 0.405 which is greater than 0.05 (alpha), so it can be concluded that there were no significant difference in the students initial problem solving ability, between those who will be taught using MMP learning model with individual assignments and those who will be taught using MMP learning model with small group assignments.

3. Means Difference Analysis on Students Mathematical Problem Solving Enhancement

After the MMP learning model were implemented, the researcher wants to know whether the populations of students mathematical problem solving enhancement are significantly different or not. For that purpose, different between normalized gain test were done. But, firstly normality test was done to determine which statistics used, parametric or non parametric statistics test.

Table 5. **Normality Test for Normalized Gain**

Kelas	*Shapiro wilk*		
	Statistic	*Df*	*Sig.*
MMP with Small Group Assignments	0,955	20	0,442
MMP with Small Group Assignments	0,968	23	0,646

Table 5 shows that the significant value (or p-value) for normality test of the students mathematical problem solving enhancement is 0.442 for the MMP with individual assignments group of students which is greater than 0.05 (alpha), so it can be concluded that the population of students mathematical problem solving enhancement for the MMP with individual assignments group of students is normally distributed. Furthermore, Table 5 also shows that the significant value (or p-value) for normality test of the students mathematical problem solving enhancement is 0.646 for the MMP with small group assignments group of students

which is greater than 0.05 (alpha), so it can be concluded that the population of students mathematical problem solving enhancement for the MMP with small group assignments group of students is normally distributed.

Since both of the populations of students initial mathematical problem solving enhancement are normally distributed, the parametric statistics test is used for the difference between means test, that is T-test.

Before the difference betweeen means test, the homogeneity test was done to see whether the population variances of the students mathematical problem solving enhancement are homogeny or not, and since both of the popupations of students mathematical problem solving enhancement are normally distributed, the based on mean row was the considered row.

Table 6. **Homogeneity Test for Normalized Gain**

	Levene Statistic	***Df1***	***Df2***	***Sig.***
Based on Mean	2.603	1	41	0.114

Since the significant value showed in Table 6 is 0.114, which is greater than 0.05 (alpha), it can be concluded that the population variances of the students mathematical problem solving enhancement are homogeny. Furthermore, for the T-test, the row for equal variances assumed will be the considered row.

Table 7. **T-test for Normalized Gain**

	t-test for Equality of Means						
	t	df	Sig. (2tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						Lower	Upper
Equal variances assumed	-3.066	51	0.003	-0.14521	0.04736	-0.24029	-0.05014

Table 7 shows that the significant value is 0.003 which is lesser than 0.05 (alpha), so it can be concluded that there is a significant difference in the students problem solving enhancements, between those who were taught using MMP learning model with individual assignments and those who were taught using MMP learning model with small group assignments.

4. Analysis on Students' Responses

Missoury Mathematics Project learning model according to Slavin (2007) was designed to help students get the best achievement in learning, by giving them more practices. The question is:

Do the students like the MMP learning model? The result of the questionaire of students' response given in below table will answer that question.

Table 8. **Students Responses toward MMP Learning Model**

Statement No.	MMP with Individual Assignments					MMP with Small Group Assignments				
	Responses				Average of Students' Positive responses	Responses				Average of Students' Positive responses
	SS	**S**	**TS**	**STS**		**SS**	**S**	**TS**	**STS**	
2 (+)	1	13	6	0	63%	8	12	2	1	84%
	70%		30%			87%		13%		
10 (+)	8	11	1	0		9	12	2	0	
	95%		5%			91%		9%		
19 (+)	1	4	13	2		7	14	2	0	
	25%		75%			91%		9%		
7 (-)	1	11	6	2		0	3	14	6	
	60%		40%			13%		87%		
14 (-)	0	0	13	7		1	0	8	14	
	0%		100%			4%		96%		
15 (-)	5	5	10	0		6	5	11	1	
	50%		50%			48%		52%		

Table 8 shows that after learning using MMP learning model with individual assignments, averagely 63% of the students give positive response towards their learning experience. And, for students who were taught using MMP learning model with small group assignment, averagely 84% of the students give positive response. So, it can be concluded that the students like the MMP learning model.

Conclusion

The result of this study shows that the students initial mathematical problem solving ability considered as low. After the junior high school students learn using MMP learning model, the students mathematical problem solving ability were increased, within both groups of students who get individual assignment and those who get small group assignments. Furthermore, the students mathematical problem solving anhancement are considered high.

Statistically, there are no difference in the students initial mathematical problem solving ability, between students who will be taught using MMP with individual assignments and students who will be taught using MMP with small group assignments. But, after the MMP learning model

were implemented, The results shows that statistically, there are significant difference in the students mathematical problem solving enhancements, between students who are taught using MMP with individual assignments and students who are taught using MMP with small group assignments.

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