The Effect of Mathematical Problems Domain to the Students Mathematical Problem Solving Enhancement

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Abstract

The purpose of this study is to see the effectiveness of considering the mathematical problems domain to increase students problem solving ability. More specific, this study aimed to compare the students mathematical problem solving enhancement, between groups of students who are given learning strategies with due regard to mathematical problems domain and groups of students who are given learning strategies regardless to mathematical problems domain. In the group of students where mathematical problems domain was considered, female students will solve mathematical problems with the feminine domain, and male students will solve mathematical problems with masculine domain. Sampels in this study are junior high school (SMP) students grade VII and VIII, and senior high school (SMA) students grade XI, two classes for each grade for the comparative study. Three different teaching strategies were implemented, ATI (Aptittude Treatment Interaction) for the grade VIII students, Treffinger for the grade VII students, and MEA (Means Ends Analysis) for the grade XI students. The instruments are problem solving tests (pretest and posttest) with mathematical problems domain feminine, masculine or general. The result showed that students who are given learning strategies with due regard to mathematical problems domain, have significantly better mathematical problem solving enhancement, than the students who are given learning strategies regardless to mathematical problems domain. This applies for the ATI, Treffinger and MEA learning strategies.

Key words: Mathematical problem solving, , learning strategy, ATI, Treffinger, MEA, problems domain.

Introduction

Mathematical problem solving ability is one ability that students should have so that the goal of mathematics learning stated in the Ministerial Decree Number 22 of 2006 is reached. But the mathematical problem solving ability of Indonesian students was not high yet, though many researches were made with the implementation of various learning strategies to increase the mathematical problem solving ability (Saija, 2010; Sugiman, 2010; Effendi, 2012; Windari, 2014). One reason is because the mathematical problems which usually words problem is difficult to understand by students (Sajadi, 2013). This leads to thoughts on how students can understand the mathematical problems given to them. Saritas and Akdemir (2009) reported that the main problem which continues is how to provide instructional environment, conditions, methods, and solutions that reach learning goals for students with different levels of skills and abilities. Learning approaches and instructional techniques must be developed to ensure students becomes successful learners.

Literatures on gender differences suggest that gender affects mathematical achievement. So, it is important for educators and researchers to taking account or consider the gender differences in the design of mathematical instructions. It is also whhy many researchers are considering gender in their studies, and the result of these studies indicate that there are differences in

mathematical problem solving ability, or general mathematical ability between male students and female students (Zhu, 2007; Tang, 2010; Niederle, 2010; Saija, 2010; Arslan, 2012; Sitorus, 2013; Wardani, 2014). But still rare, perhaps even yet exist, at least found the author, the study on mathematical problem solving ability of students who pay attention on the problems domain. The point is to give students problems of mathematical problem solving in accordance with his or her gender, the male students will solve mathematical problems with the masculine domain, and the female students will solve mathematical problems with the feminine domain.

Mathematical problems domain that are still mostly masculine (Grevholm, B. and Hanna, G., in Saija, 2010). If not masculine, then the problems has general nature. On the other hand the Indonesian Ministries of Education and Culture (2012) reported that the number of male and female students in Indonesia is almost equal. It is hinted in an attempt to enrich mathematical problems domain, more specifically on the mathematical problem solving ability.

Giving mathematical problems in accordance with students gender must be accompanied by the implementation of innovative learning strategies. Three of the many mathematics learning strategies that are considered innovative to increase the students mathematical problem solving ability are ATI (Aptittude Treatment Interaction), Treffinger dan

MEA (Means Ends Analysis). Students mathematical problem solving ability can be improved through ATI learning strategy because at this strategy each students with different cognitive ability will be given different treatment (Syafrudin, 2005). While in the implementation of Trefinger learning strategy, students will be guided gradually to understand, communicate and explain the mathematics concept in everyday life, transformed creatively (Treffinger, 2003).

Onto both group of students, pre-test were given before the lesson began and post-test after the lesson is completed. The mathematical problem solving tests have been through the item validity test, reliability test, item discrimination index, and item difficulty

And further, MEA learning strategy will enable students to achieve final settlement of a given mathematical problem by reducing the difference between the statements within the problem with the purpose of the problem (Muin, 2014).

Methodology

This research is a comparative study on the students mathematical problem solving enhancement, between groups of students who are given learning strategies with due regard to mathematical problems domain and groups of students who are given learning strategies regardless to mathematical problems domain. More further, mathematical problems domain given accordance with students gender is given not only on the final test or posttest, but already begins when students are working in their worksheets.

Samples in this study were grade VIII students from SMPN1 Cisarua, Bandung; grade VII students from SMPN 3 Lembang, Bandung; and grade XI students from SMAN 1 Parongpong, Bandung. For the grade VIII students, ATI (Aptittude Treatment Interaction) learning strategy was implemented, the grade VII students got Trefinger learning strategy; and onto the grade XI students MEA (Means Ends Analysis) learning strategy was implemented. Each of the sample was dividedd into two groups of students based on classes division, where to the first groups of students, learning strategies with due regard to mathematical problems domain was given; and to the second groups of students learning strategies regardless to mathematical problems domain was given. Students in the first group work in small groups each of which is composed of students of the same gender, with heterogeneous capabilities, while students in the second group only compiled based on their ability heterogeneous.

level, before it is given as the instrument to measure the students mathematical problem solving ability. The pretest and-post-test data are then processed to obtain the normalized gain value. Furthermore, the statistical test for difference between the normalized gain value

averages was done, with through normality and homogeneity tests previously. The usefulness of this statistical test is to see whether the normalized gain average for mathematical problem solving ability of students who acquire learning strategies with due regard to problems domain, was significantly better than students who acquire learning strategies regardlesss to problems domain matter.

Results

The results of this study are presented in two different tables. The firs table gives the results for pre-test, post-test and normalized gain of mathematical problem solving ability for pairs of group of students after they acquire learning strategies, ATI, Trefinger or MEA. And the second table gives the significance of the results.

Table 1
Students Mathematical Problem Solving Abilit

Mathematics Learning Strategy			ATI	Trefinger	MEA
With due regard to problems domain	*n*		39	28	32
	Pre-test	$\bar{x}$	19,59	20,07	26,91
		s	7,90	4,60	9,67
	Post-test	$\bar{x}$	64,82	78,50	93,13
		s	18,17	14,02	4,94
	Gain	$\bar{x}$	0,57	0,73	0,91
		s	0,21	0,18	0,06
Regardless to problems domain	*n*		42	32	32
	Pre-test	$\bar{x}$	19,67	18,88	20,63
		s	3,95	6,05	8,97
	Posttest	$\bar{x}$	53,48	70,31	72,13
		s	12,87	10,66	9,99
	Gain	$\bar{x}$	0,42	0,63	0,65
		s	0,15	0,13	0,12

Table 2
Independent Samples Tests

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Gain – ATI	Equal Variances assumed	**5.373**	**0.023**	**3.734**	**79**	**0.000**	**0.151**	**0.040**	**0.070**	**0.231**
Gain-Trefinger		**5.537**	**0.022**	**2.449**	**58**	**0.017**	**0.098**	**0.040**	**0.018**	**0.178**
Gain-MEA		**10.391**	**0.002**	**10.570**	**62**	**0.000**	**0.259**	**0.025**	**0.210**	**0.308**

Values within Table 1 indicates that the average of students mathematical problem solving ability of those two groups of students with all three learning strategies,were almost the same before the lesson began, and look different after the learning strategies were implemented. Furthermore, the normalized gain averages look different as well. More specifically, the gain averages of the groups of student who acquire learning strategies with due regard to problems domain were better than groups of students who acquire learning strategies regardless to problems domain. To see whether the results are significant, the difference between average tests were done.

Difference between average test were done after the normality test and the homogenity test done. Since all the normalized gain values are normally distributed, statistical t-test were used. Table 2 gives the result of the difference between average tests. Difference between normalized gain average test results for those three pairs of groups of students who acquire the ATI, Treffinger or MEA learning strategy, showed that the null hypotheses was rejected, since the sig. values were lesser than alpha (0.05). The meaning is: "There is a significant difference in the students mathematical problem solving enhancements, on average, between students who acquire learning strategy with due regard to problems domain and groups of students who acquire learning learning material. More further, strategies regardless to problems domain.

Conclusion and Recomendation

From the resulls mentioned above, it can be seen that as a whole, implementation of learning strategies ATI, Trefinger and MEA, enabled students to have good mathematical problem solving ability, since all the post-test averages were greater that 50 percents. This led to the mathematical problem solving average gains are in the moderate to high category (in the interval of 0.4 to 1.0). Furthermore, implementing learning strategies with due regard to problems domain produce higher post-test and normalized gain of students mathematical problem solving ability, on average. Combining the results in Table 1 and Table 2 leads to the conclusion, which are the finding in this study, that is: "The average mathematical problem solving enhancements between students who acquire learning strategy with due regard to problems domain, were significantly better than groups of students who acquire learning strategies regardless to problems domain".

Producing mathematical problems with domain which are accordance with students gender, still can be developed for different school levels and different mathematical

mathematics book of mathematical problem

solving problems, with various problems domain, feminine, masculine and general, can be produce, to increase the students mathematical problem solving ability, especially Indonesian students.

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