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E - 63

Improving Competence Mathematical Self-Efficacy of Junior Secondary School Students by Applying Realistic Mathematics Approach

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Abstract

Quasi-experimental study aims to determine differences in the ability of Self-Efficacy enhancement of student learning using Realistic Mathematics Education (RME) approach with students who learn with conventional mathematical approach (PMB). The design of the study is a non-equivalent control group with a subject population of the entire junior high school students in the town of Palembang that comes from the high school level, moderate and low. From each school level and then taken one school from each school that is picked up taken one class of experiments that have RME and one control class that gets PMB. The instrument used in the form of Self-Efficacy scale questionnaire mathematical students. Data analysis using the t-test, ANAVA. The results obtained are: a realistic approach to mathematics is better in improving the ability of students' mathematical self-efficacy compared to using conventional mathematical approaches, then students from high-level mathematical increase in Self-Efficacy better than students from medium and low levels. In addition, increased mathematical ability of Self-Efficacy is not affected by school level students.
Keywords: Improvement, *Self-Efficacy*, Mathematics Realistic Approach

I. Introduction

In the last 20 years, many research in education (Maria N. and George(2003), Kiamanesh, et al(2003), Dorman(2003), Dewanto(2007)) considered some afective aspects, and one of them is *Self-Efficacy* as a factor that can improve mathematical skill of students. *Self-Efficacy* is a soft skill of individu to influence the expected result (Feist, 2008). According to opinions from some experts, *Self-Efficacy* is similar to *Self-Confidence* or *Self-Belief.* Bandura (as cited in Feist, 2008:415) defined *Self-Efficacy* as human belief of their own skill to to train them in control the size of the functions themselves and the events in their environment. *Self-Efficacy* is a major determining factor for the development of individual choice, persistence in the use of various difficulty, and patterned thoughts and emotional reactions they experience (Bandura,1998). *Self-Efficacy* can be generated from the students through four sources, namely (1) authentic mastery experiences, (2) vicarious experience, (3) verbal persuasion, (4) physiological affective statsituation of es. The level of *Self-Efficacy* (high-low level) can be combined with the environment (responsive-unresponsive environment) which is generated four possible result: (a) if the high *Self-Efficacy* and responsive environment, then the result is a success,(b) if the low *Self-Efficacy* and responsive environmental, the result is humans can become depressed when they observe others successfully complete the tasks that they think are difficult, (c) when the high *Self-Efficacy* met unresponsive environment, men were commonly will strive to change environment, such as protest or social activism, (d) When the low *Self-Efficacy*

combine to unresponsive environment, humans will conduct apathy, easy to give up, feel helpless (Bandura, in Feist, 2008: 415-416).

Self-Efficacy ability is also required in 2006 curriculum for the junior high school mathematics in Indonesia. The demands of the development of *Self-Efficacy* ability is stated in the curriculum which mentions that mathematics must inculcate respect for the usefulness of mathematics in life, namely to have curiosity, attention, and interest in studying math, and tenacious attitude and confidence, and problem solving. To develop students' *Self-Efficacy* ability, it is required an mathematics learning approach that is able to foster *Self-Efficacy* ability. One approach to learning mathematics that can be used to develop *Self-Efficacy* is Realistic Mathematics Education (RME) approach.

Realistic Mathematics Education (RME) consider that mathematics as a human activity, three basic principles of RME, namely (a) Guided Reinvention and Progressive mathematization; (b) didactical Phenomenology , and (c) Self-models developed. As well as having five characteristics: (1) using a contextual problem, (2) using the model, (3) using the contribution of students, (4) the interaction in the learning process, (5) use a variety of learning theories relevant, interrelated, and integrated with other learning topics (Treffers, 1991; Gravemeijer, 1994; Armanto, 2002; Darhim, 2004).

The principles and characteristics of RME is in accordance with the demands of 2006 curriculum for teaching mathematics in Primary and Secondary school levels in Indonesia or the it is called Kurikulum Tingkat Satuan Pendidikan (KTSP) which requires contextual learning. According to Treffers and Goffree (Sabandar, 2001), the context plays a major role in all aspects of education, namely the generation of concepts, model building, application, and in practice certain skills. In the implementation, the context is used from the beginning and continuing to build understanding through learning trajectory in a learning process.

From the aspect of mathematical modeling and learning implementation, the process of finding solution to solve the problem starts from changing the word problems into concrete models, continue into the form of symbols through the process by showing an understanding about what is known, what is asked, and what is necessary arithmetic operations. While in RME, contextual problem-solving process is done by using the model. Modeling is to bridge the gap between informal mathematical knowledge and formal mathematics of students. Students develop the model using mathematical models (formal and informal) that has been learned by solving contextual problems of the real situation (real) is already known to the students that found the ”model of” in the form

of informal, followed by finding a ”model for” in the form of formal. Finally, students gain knowledge in the form of problem solving math standards.

Through contextual problem solving and modeling, it will develop an interactive activity and learning process. Learning activities with RME is expected to develop the students' Self- Efficacy ability.

Some studies were conducted by researchers as noted above, it is generally carried out in mathematics class, and it is not to use a particular learning approach in enhancing *Self-Efficacy*. Unless research conducted by Morrow (2007) with higher education student as subjects research with Problem-Based Learning approach. Therefore, the problem of an increase in *Self-Efficacy* ability for junior high school students is necessary to conduct further research.

Based on the above, the research question in this study are: (i) can RME approach increase the ability of self-efficacy for junior high school students in mathematics class? (ii) how does the influence of mathematical skills of students who are classified as high, medium, and low ability to increase student self-efficacy in mathematics?

Research Methods

This study was a quasi-experimental study with a model of non-equivalent control group. The study population was a junior high school students from the different school level in the city of Palembang. Determining the level of schools based on the results of the accreditation of the school in Palembang in 2008; The best school level is A-accredited school, the good school level is B-accredited school, and the worst school level is C-accredited school. Sampling studies were conducted as follows: first, four schools were randomly drawn with the provisions of the accreditation , one A-acrredited school, two B-accredited schools, and one C-accredited school. Both of the schools of each school taken the experimental class and the control class.

There are four experiment classes with RME and four control that gets entirely teaching and learning process taught by the one teacher. RME teaching materials used in the experimental class was developed and compiled by researchers through the validation process by experts as well as teachers and then tested in small groups and in the classroom, while the teaching materials used in the control classes arranged by the teacher. The implementation of study was done in class IX for three months based on 2006 curriculum.

To measure the increasing of *Self-Efficacy* ability, mathematical questionnaire used a set of matematics *Self-Efficacy* scale adoption (Nicolaidou, 2003) which consists of 40 items that all are valid based on the results of the trial. The increasing between pretest and posttest scores were calculated that occurred for each student by using the normal formula gain (N-gain).

Results and Discussion

The results of students' *Self-Efficacy* test were described and analyzed based on learning approach and school level. Mathematical *Self-Efficacy* test data obtained from 299 students, consisting of 150 students for experimental group (RME) and 149 students for control group (Conventional learning process). Data description of mathematical *Self-Efficacy* test shows that it is increase mathematical ability of students as a follow in Figure

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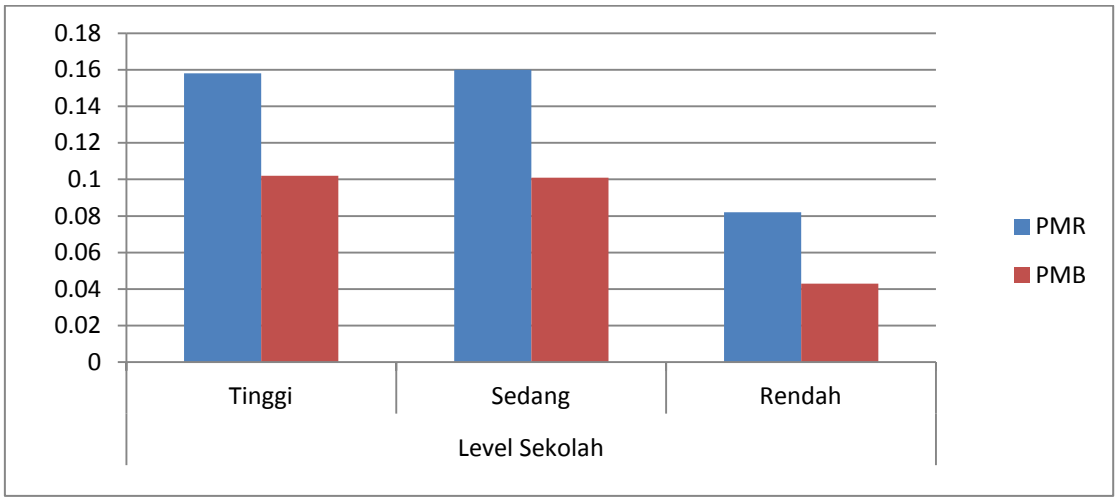


Figure 1. The comparison of mean N-gain score of Mathematical *Self-Efficacy* ability based on approach and school level

In figure 1, it shows that that the quality of *Self-Efficacy* mathematical learning of students who obtain Realistic Mathematics Education (RME) is better than the students who received the conventional mathematical learning (PMB). This is indicated by the acquisition of N-gain mean score of students from groups RME is greater than the mean score of the acquisition gain of N-PMB group for students of all levels of school

In general, the increasing mathematical *Self-Efficacy* ability of students as discussed above has not shown any significant difference and viewed from a variety of factors. To determine the significant differences of mathematical *Self-Efficacy* ability between students who received PMR and students who have PMB, it will be performed statistical analysis. All statistical tests in the analysis of the increasing mathematical *Self-Efficacy* ability are using the N-gain scores.

1. Influence Factors From School Level And Learning Approach to Improvement and Mathematical *Self-Efficacy*

The table 1 below is the result of a two-way ANOVA analysis to determine the influence factors from school-level (best, good, and bad) and the factor p (RME and PMB) as well as the interaction between the two factors to the increased ability of the mathematical *Self-Efficacy*.

Table 1 The results of a two-way ANOVA between School Level and learning Approach to Improved mathematical *Self-Efficacy* Ability of Student

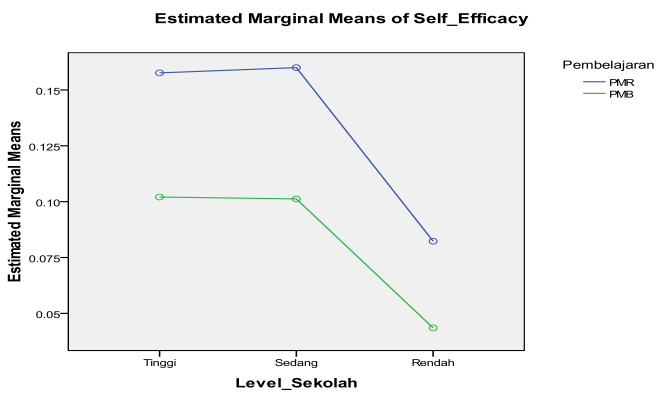
Data	Sum of Squares (SS)	dk	Mean	F	*Sig.*
School Level	0,242	2	0,121	8,722	0,000
Learning Approach	0,171	1	0,171	12,348	0,001
School level*learning approach	0,005	2	0,002	0,176	0,839

Table 1 indicates that school-level factors obtained value of F = 8.722 is greater than the critical value of F= 3.027 at significant level of 5% and df = 2 (it can also be seen that the value of Sig. school level less than 0.05). This means that school-level factors have a significant influence on the improvement of mathematical *Self-Efficacy* ability for students. Therefore, students are grouped by school level, they have differences in increasing of mathematical *Self-Efficacy* ability.

In the learning approach factor, it obtained value of F = 12.348 is greater than the critical value of F= 3.873 at significant level of 5% and df = 1 (it can also be seen that the value of Sig. Learning less than 0.05). This means learning approach factors also have a significant influence on the improvement of mathematical *Self-Efficacy* ability for students. Therefore, students are grouped by learning approach, they have differences in increasing of mathematical *Self-Efficacy* ability.

At the interaction between school level and learning approach factors, it is obtained value of F = 0.176 is smaller than the critical value of F= 3.027 at significant level of 5% and df = 2 (it can also be seen that the value of Sig. At interaction the school level * learning approach is greater than 0.05). It can be concluded that there is no interaction between school level and learning approach to the improvement of mathematical *Self-Efficacy* ability for students. In other words, school-level and learning approach do not have a significant influence on the improvement of mathematical *Self-Efficacy* ability for students.

In the graph, the interaction between school level and learning approach to the improvement of mathematical *Self-Efficacy* ability for students. It can be seen in Figure 2



Based on Figure 2 it can be seen that the RME learning is appropriate for all levels of schools, the best school level, good school level, and bad school level in

improving the mathematical *Self-Efficacy* ability for students. It can be seen that the mean score of the *Self-Efficacy* mathematical students taught using Realistic Mathematical Education (RME) approach is higher than the conventional learning approach (PMB). Figure 2 also indicates that students from the good school level get the greatest benefit of learning based on RME when compared to students from the high school level and bad school level.

Discussion

The results of data analysis from both the descriptive and statistical analysis show that there are significant differences increase Self-Efficacy mathematical ability of students who obtain Realistic Mathematics Education (RME) compared to students who received conventional learning approach (PMB). This increase occurred in all school levels. It shows that the RME approach can improve the ability of mathematical Self-Efficacy for junior secondary students. The following will discuss the Self-Efficacy increase mathematical ability for students in terms of school levels and learning approach.

Based on the results of data analysis, it found that factors significantly influence is that RME approach in improving competence mathematical self-efficacy student. This is possible because the case was triggered by a mathematical teaching materials based on RME. Learning mathematics that is line to the principles and characteristics of RME will encourage students' ability to increase self-efficacy. This fact is in accordance with the proposed (Bandura, 1998), that self-efficacy can be raised from the students through four sources, namely (1) authentic mastery experiences, (2) vicarious experience, (3)verbal persuasion, (4) physiological affective states.

Four sources of self-efficacy can be raised through the learning process in the classroom, for example the process of re-invention mathematical concepts, immediately experience of the student, presentation from students, the experience of others, and the process of group discussion, it will form the social aspects and psychological aspects. Figure 3, Figure 4and Figure 5 below shows the students' activity in doing presentation. This activity figured out the development of Self-Efficacy in the learning process. Appearing in front of the class showed the courage and confidence of students.

The results of statistical analysis of the findings that there is no interaction between the approaches (RME, PMB) by school level (best, good, bad) in the improvement of the Self-Efficacy mathematical ability of students. This means that the learning approach and school levels together no effect in improving students' ability to self-efficacy. This is due to that the ability of Self-Efficacy is the mental ability of personality which takes time in training this ability.

Conclusion

Realistic Mathematics Education (RME) approach is better in improving the ability of students' mathematical self-efficacy compared to using conventional learning approaches, then students from high-level mathematical increase in Self-Efficacy better

than students from medium and low levels. In addition, increased mathematical ability of Self-Efficacy is not affected by school level students.

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