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THE ROLE OF KNOWLEDGE, TOLERANCE, MULTICULTURAL, AND SPIRITUAL DIMENSIONS IN SHAPING A NATION'S BETTER FUTURE

Reviewer:

Titien Soewastiningsih Soebari

Editor:

Slamet Untung ▪ Maghfur Ahmad ▪ Yusuf Nalim
Ahmad Rosyid ▪ Muhamad Muzayin

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JL. Kusuma Bangsa No. 09 Pekalongan 51141
Telp. (0285) 412575 Fax. (0285) 423418
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MATHEMATICAL REASONING AND SELF REGULATED LEARNING TOWARDS STUDENTS' PROBLEM SOLVING ABILITY

Agus Setiawan¹, Juwita Rini²

¹ Institut Agama Islam Ma'arif NU Metro Lampung, ² IAIN Pekalongan
4905as@gmail.com

ABSTARCT

This research aims to determine: (1) Are there any differences in problem solving skills between students who have high, medium and low mathematical reasoning, (2) Are there any differences in problem solving skills between students who have high and low self regulated learning, (3) Is there any interaction between mathematical reasoning and self regulated learning on problem solving abilities. This research is a comparative causal research with factorial design 3 X 2. The subjects of this research were students of class VIII A SMP Ma'arif 1 Metro. The instruments used to collect data are problem solving essay tests, mathematical reasoning tests and questionnaires for self regulated learning. Hypothesis testing used two-way Anova test with unequal cells while Anava prerequisite test was data normality test and variant homogeneity test. The conclusions of this research are: (1) There are differences in problem solving abilities between students who have high, medium and low mathematical reasoning, (2) There are differences in problem solving abilities between students who have high and low self regulated learning, (3) There are interaction between mathematical reasoning and self regulated learning on problem solving abilities.

Keywords: *Mathematical Reasoning, Self Regulated Learning, Problem Solving Ability*

Introduction

Education plays a very important role in the development and progress of a nation. With the advancement of science, technology and globalization is considered a challenge that every country must develop education in line with the development of the 21st century. And one of the emphases of the challenge of education today is the promotion of 21st century skills among students. Problem solving skills are one of the main capabilities of this century. The importance of problem solving was stated by Branca (1980) that problem solving ability is the

main of mathematics. One factor that influences problem solving ability is mathematical reasoning. Schunk (2012) suggests that students often use analogy reasoning methods to solve problems. According to Akinmola, (2014), mathematical reasoning refers to the ability to analyze mathematical situations and construct logical arguments. This is a habit of mind that can be developed through mathematical applications in different contexts. Yulianti, et al. (2013) states that students' reasoning abilities must be trained so that students can use logical reasoning in solving a mathematical problem.

The research of Adegoke (2013) and Setiawan (2016) shows that reasoning ability influences the success of students' achievement in mathematics. In fact, several studies such as Choudhury and Das (2012); Heng - Yuku and Sullivan (2000) and Nunes, Byrant, Barnes, and Sylva (2012) state that there is a relationship between mathematical reasoning ability and achievement in mathematics. In particular, Nunes, Byrant, Barnes, and Sylva (2012) in their study found that mathematical reasoning ability can reliably to predict student achievement in mathematics. Similarly, Choudhury and Das (2012) in their study in Malaysia found that geometrical abilities (ability to reason and spatial ability) were good predictors of student achievement in mathematics.

The ability to solve problems in learning mathematics is related to the way students learn which is known as Self Regulated Learning (Elvina and Tjalla, 2013). The concept of Self Regulated Learning (SRL) is one of the important concepts in social learning theory. SRL can be defined basically as an iterative form, activities directed at targets that involve interpreting tasks, setting goals, choosing, adapting or even creating effective strategies to achieve these goals, monitoring progress, and adjusting approaches as needed (Zimmerman, 2008). According to Schunk (2012) SRL refers to the process used by students to focus thoughts, feelings and actions systematically on achieving goals. Thongchai (2016) and Chazan (2014) research shows that SRL influences learning outcomes. Research by Reni et al. (2008) shows that there is no difference in the results of

writing text learning between students who have high SRL and low SRL. Different results are shown in the research of Asri, Setyosari, Hitipeuw, & Chusniyah, (2017) showing that there are differences in mathematics learning outcomes between students who have high SRL and low SRL. While the research results of Elvina and Tjalla (2013) showed that there is no significant relationship between SRL and problem-solving abilities.

Based at some of these studies, the question may arise as to why something that has clearly been the result still has to be examined again. Following the novelty and rationale which is to be the reason of researcher to examine the influence of mathematical reasoning and self regulated learning on students' problem solving abilities. From several studies that researchers have encountered related to mathematical reasoning, almost all researchers only see the general influence of mathematical reasoning with the achievement of learning mathematics through correlational research. In other words, some of these studies only come to the conclusion that reasoning has a positive influence on mathematics learning achievement. In this research, the researcher intends to categorize the levels of students' mathematical reasoning which is will be seen at which level has the most significant influence. In this research also examine the interaction between mathematical reasoning and self regulated learning on problem solving abilities.

This research is a comparative causal research designed with a 3×2 factorial design. According to Kerlinger (1973) comparative causal research, also called ex post facto research, is a systematic empirical investigation in which the researcher does not control the independent variables directly because the existence of these variables has been happened, or because these variables basically cannot be manipulated. Meanwhile, according to Gay (1981) comparative or ex post facto causal research is research in which researchers try to determine the cause or reason, for the existence of differences in behavior or status in individual groups. Subjects in this study were students of VIII Ma'arif 1 Metro Middle School. The subjects of this study were 26 students. Data collection methodes are

documentation method, questionnaire method, and test method. The research instrument consist of a mathematical reasoning test, a self regulated learning questionnaire and a problem solving ability test. Analysis prerequisite test is data normality test with Lilliefors and variant homogeneity test with Bartlett test. Data analysis test used is the analysis of two-way variance with unequal cells (Budyono, 2009).

Research Results and Discussion

In accordance with the research design formulated earlier, hypothesis test for this research use anava two ways with unequal cells. Hypothesis test with two-way ANOVA with unequal cells is carried out after the fulfillment of population normality requirements and population variance homogeneity. The results of calculations for hypothesis testing are presented in the table 1.

Table 1. Analysis of Two-Way Variants

Tests of Between-Subjects Effects

Dependent Variable: Problems solving ability

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2484.462 ^a	5	496.892	43.208	.000
Intercept	118771.228	1	118771.228	10327.933	.000
SRL	944.819	1	944.819	82.158	.000
Penalaran	1772.610	2	886.305	77.070	.000
SRL * Penalaran	151.996	2	75.998	6.609	.006
Error	230.000	20	11.500		
Total	121312.000	26			
Corrected Total	2714.462	25			

a. R Squared = .915 (Adjusted R Squared = .894)

From the calculation of F for H_{0A} (Reasoning) obtained the value of $F = 77.070$, $p < 0.05$, H_{0B} (SRL) obtained the value of $F = 82.158$, $p < 0.05$ and H_{0AB} (SRL * Reasoning) obtained the value of $F = 6.609$, $p < 0.05$, the results of which appear in the table above obtained a test decision that H_{0A} was rejected, H_{0A} was rejected and H_{0AB} was rejected. Based on the test decision obtained the following conclusions.

- 1) There are differences in problem solving abilities between students who have high, medium and low mathematical reasoning,
- 2) There are differences in problem solving abilities between students who have high and low self regulated learning,
- 3) There is an interaction between mathematical reasoning and self regulated learning on problem solving abilities.

The results of the first hypothesis indicate that there are differences in problem solving abilities between students who have high, medium and low mathematical reasoning, this is the same with the results of Adegoke's (2013) research; Setiawan (2016); Choudhury and Das (2012); Heng - Yuku and Sullivan (2000) and Nunes, Byrant, Barnes, and Sylva (2012) which state that mathematical reasoning affects learning outcomes. Another opinion expressed by Schunk (2012) suggests that students often use analogy reasoning methods to solve problems. Akinmola (2014) mathematical reasoning refers to the ability to analyze mathematical situations and construct logical arguments. Based on this opinion in the problem solving process, reasoning is needed to analyze, determine the problem solving strategy and conclude the results of the problem solving so that mathematical reasoning affects the problem solving ability of students.

The results of the second hypothesis indicate that there are differences in problem solving abilities between students who have high and low self regulated learning. This is in line with the results of Asri, Setyosari, Hatipeuw and Chusniyah (2017) research which shows that SRL has an effect on problem solving abilities. Zimmerman (2008) argues that SRL is an iterative form, activities directed at

targets that involve interpreting tasks, setting goals, selecting, adapting or even creating effective strategies to achieve these goals, monitoring progress, and adjusting approaches according to need. The activities of students who have high SRL are confident in the problem solving process as Zimmerman argues and in accordance with Schunk's opinion above, so SRL has an effect on students' problem solving abilities.

The results of the third hypothesis indicate that there is an interaction between mathematical reasoning and self regulated learning on problem solving abilities. The meaning of the interaction between mathematical reasoning ability and SRL on problem solving ability is that the characteristics of the differences between the three categories of mathematical reasoning for each SRL category show different results and not all of the SRL reasoning categories and vice versa are significant to problem solving abilities.

Conclusion

Based on the above discussion, it can be concluded from this research is:

- 1) There are differences in problem solving skills between students who have high, medium and low mathematical reasoning.
- 2) There are differences in problem solving abilities between students who have high and low self regulated learning.
- 3) There is an interaction between mathematical reasoning and self regulated learning on problem solving abilities.

The results of this study indicate that mathematical reasoning and SRL have a significant effect on students' problem solving ability so that the teacher / educator must pay attention to both of these variables in the learning process so that students' problem solving abilities can increase.

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