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Discovery Learning - PMRI in Improving Mathematics Literacy of Junior High School Students

Anik Rosita[1]✉ , Wardono[2], Kartono[2]

[1.] SMK Bina Nusantara Semarang, Indonesia
[2.] Universitas Negeri Semarang, Indonesia

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Abstract

The lack of mathematical literacy is a worrying thing. It must be noticed that the literacy is an important ability that must be owned by students as future stakeholders. The objective of this study is to analyze the discovery learning - PMRI which effectively improve students' mathematical literacy. The type of research used was quantitative research, experimental research with quasi-experimental design nonrandomized control group, pretest – posttest design. The determination of control and experiment class was by using random sampling technique. The experimental class was treated in the form of discovery learning - PMRI while the control class is given discovery learning - scientific learning. The data were collected using mathematical literacy test, observation, and interview. The data from the data analysis of the final score of mathematical literacy, it is found that (1) the proportion of students in discovery learning-PMRI that fulfills the Minimum Criteria of Mastery Learning is 70, it reaches 70%; (2) the average of students' mathematical literacy on discovery learning - PMRI is better than the average of students' mathematical literacy on discovery learning, and (3) The improvement of mathematics literacy of discovery learning class - PMRI is higher than discovery learning - scientific class . So it can be concluded that discovery learning – PMRI is effective in improving students' mathematical literacy.

✉Correspondence:
Jl. Kemantren I No. 5 Semarang, Indonesia
E-mail: arosta_354@yahoo.com

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INTRODUCTION

Entering the era of Asean Economic Community (AEC), Indonesian stakeholders must follow international standards in order to survive in this global era (Murtiyasa, B., 2015). Similarly, the world of education, where the world of education is a means/medium to prepare students who will become stakeholders in Indonesia. Sinambela (2008) states that when students are trained to solve problems they will be able to make decisions because they already have skills on how to collect relevant information, analyze information and realize how it is necessary to re-examine the results. In addition, according to Curriculum Center (in Usdiyana, et al., 2009) the objective of mathematics learning in elementary and secondary education is to prepare students to be able to face changing circumstances in life and world that always change, through practice acting on the basis of logical, rational, critical, accurate, honest, efficient and effective thinking. However, the ability of mathematics in international forums is still low when compared with other countries. Wardono, et al (2017) states that the results achieved in the survey are still far from satisfactory. This is proven from the results of surveys conducted by international institutions such as the Program for International Student Assessment (PISA) which put Indonesia in an unfavorable position among the countries surveyed. Among others, in 2015, Indonesia ranks 62 of 70 countries (OECD, 2016).

PISA is an OECD international program for evaluating reading, science and mathematics skills, it aims to identify the ability of 15-year-old children to use the abilities and skills they have learned in school in living their daily lives in challenging global times (Stacey, 2011). The low position of Indonesia when compared with other countries in the survey is due to the students' low mathematical literacy.

According to OECD (Stacey, 2010) "mathematical literacy is the capacity of individuals to formulate, use, and interpret mathematics in various contexts. This includes mathematical reasoning and the use of concepts, procedures, facts and mathematical tools to describe, explain, and predict phenomena. It leads individuals to recognize the role of mathematics in life and make good judgments and decision-making needed by constructive, reflective people." Meanwhile, according to Wong (2004) mathematical literacy is defined as the ability to use knowledge and mathematics skills in various situations and different contexts in everyday life. Mathematical literacy can help one to understand the role or usefulness of mathematics in everyday life and as a basis for consideration in making appropriate decisions as a building, caring, and thinking society (Eve, 2014).

One approach in mathematics learning that can have a positive effect on students' mathematical literacy skills and to develop students' character is a realistic approach (Wardono et al, 2015). This realistic approach is adopted from PMRI. According to Budiono and Wardono (2014), in Indonesia, PMRI is often referred to as Indonesia Realistic Mathematics Education. The PMRI was developed by the Freudenthal Institute, since 1971, it is known as PMRI (Realistic Mathematics Education) with the idea that mathematics is a human activity and mathematics must be linked to contextual problems, where contextual problems are used as a starting point for the development of ideas and concepts of mathematics (Sumandya, 2013). Realistic learning is not only related to the context of the real world but also related to the emphasis of the imagination, so the problem given in the learning can also be imagined by the students, it is in line with the statement of Webb in Wardono et al (2016).

Discovery learning by Bruner (in Balim, 2009) is a students' activity in the learning process, students construct knowledge based on new information and from data they collect in an explorative learning environment. Suriadi (2006) states that discovery is a mental process in which the students are able to assimilate a concept or principle. The mental processes in question include: observing, reviewing, understanding, classifying, making hypothesis, explaining, measuring, making conclusions and so on. It is hoped that if the students are actively involved in finding a basic principle of their own, they will understand the concept better, long remembered and will be able to connect other contexts. At the end of discovey learning, students make a conclusion. In Mawaddah (2015) After drawing the conclusion, students should pay attention to the generalization process which emphasizes the importance of mastery of the lessons on the meaning and the broad principles or principles that underlie one's experience, as well as the importance of the regulatory process and the generalization of the experiences.

The purpose of this study is to analyze learning effective discovery learning - PMRI in improving mathematics literacy of junior high school students.

METHODS

The population of this study was the students of VII graders of State Junior High School 2 Semarang in the academic year of 2017/2018. The type of research used was quantitative, experimental research with quasi-experimental design nonrandomized control group, pretest-posttest design, it was research with two classes, one class of experiment and one control class. The determination of control and experiment class was by using random sampling technique. The experimental class was treated in the form of discovery learning-PMRI while the control class was given discovery learning - scientific.

Initial Capability Test was conducted to know the initial students' mathematical literacy skill. Furthermore, students were also given a pretest to find out the improvement of students' mathematical literacy. After each class gets the learning as it has been determined, at the end of the learning, posttest was conducted to compare mathematical literacy of the experimental and control class.

RESULT AND DISCUSSION

The learning is effective when (1) student's mathematical literacy who are treated by discovery learning - PMRI reaches the classical completeness 70 classically, with proportion > 69,5%, (2) the average of students' mathematical literacy skill who are treated by discovery learning – PMRI are better from the average of students' mathematical literacy skill who are treated by using discovery learning, and (3) the students' mathematics literacy of discovery learning – PMRI is higher than students' mathematics literacy of discovery learning-scientific.

Before the effective test, it is necessary to test the prerequisites first with SPSS. In this study, the normality test is by using Kolmogorov-Smirnov test with a significance level of 5%, it is obtained the Sig value in the experimental class of 0.168> 5% then Ho is accepted. Similarly, the control class obtained the Sig 0.116> 5%, then Ho is accepted. This means that the post test value of the two classes is normally distributed. While the homogeneity test is conducted by using Levene test, it is obtained the Sig 0.095> 5%, it means the data is homogeneous.

First for effective test, a classical completeness test is conducted to see if the number of students who fulfill minimum criteria of mastery learning is higher than 69,5%. As for the hypotheses as follow.

H_o : $\pi \leq 0{,}695$ (proportion of students who complete classical completeness ≤ 69,5 %).

H_1 : $\pi > 0{,}695$ (proportion of students who complete classical completeness > 69,5%).

The test criterion is Ho rejected if $z_{hitung} > z_{(0,5-\alpha)}$. Based on z table, it is obtained the value of z table with a significance level of 5% is $z_{(0,5-0,05)} = z_{0,45} = 1{,}64$. Because 2.2116 > 1.64, then Ho is rejected. Thus, it can be concluded that the proportion of students who complete classical completeness > 69,5%.

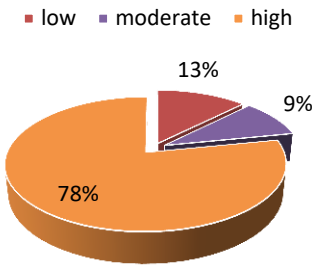
Second, calculation of the value of t for independent samples, As for the hypotheses as follow.

H_o : $\mu_1 \leq \mu_2$ (average of skor experimental class ≤ control class).

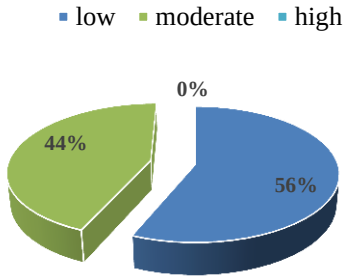
H_1 : $\mu_1 > \mu_2$ (average of skor experimental class > control class).

The test criterion is H_1 accepted if $t_{count} > t_{(1-\alpha)(n_1+n_2-2)}$. From the calculation, it is obtained t value = 9.84. With a significance level of 5% and degrees of freedom 62, it is obtained t table = 1.999. Because 9.84 > 1.999 then Ho is rejected. Thus, it can be concluded that the average of students' mathematical literacy skill who are treated by discovery learning-PMRI are better from the average of students' mathematical literacy skill who are treated by using discovery learning.

Third, improvement gain test. Before improvement gain test, score of gain test each classes must be calculated. Based from the calculation, obtained data as follow.



Picture 1. Gain Score of Experimental Class



Picture 2. Gain Score of Control Class

Based from diagrams, the experimental class showed that 13% students show low gain scores, 78% students show moderate gain and 9% show high gain scores. Whereas the control class show 56% students show low gain, 44% show a medium gain score and 0% indicate a high gain score. Having obtained the value of the gain of each student in each class, then it is conducted t test to see whether the improvement in experimental class is higher than the control class. As for the hypotheses as follow.

H_o : $\mu_1 \leq \mu_2$ (improvement students' mathematics literacy of experimental class $\leq$ control class).

H_1 : $\mu_1 > \mu_2$ (improvement students' mathematics literacy of experimental class > control class).

The test criterion is H_1 accepted if $t_{count} > t_{(1-\alpha)(n_1+n_2-2)}$. In the calculation, the value of t for independent samples, it is obtained t value = 6.415. With a significance level of 5% and degrees of freedom of 62, it is obtained t_{table} = 1.999. Because 6.415> 1.999 then Ho is rejected. Thus, it can be concluded that the students' mathematics literacy of discovery learning – PMRI is higher than students' mathematics literacy *of discovery learning-scientific.*

Based on the overall test above, it can be concluded that learning by using discovery learning – PMRI is effective in improving students' mathematical literacy. This is in accordance with Wardono and Mariani (2014) which states that the PMRI learning model with character education and assessment like PISA is effective in improving students' skills in solving mathematical literacy problems.

CONCLUSION

The discovery learning - PMRI in class of VII I of State Junior High School 5 Semarang is effective signed by: (1) the proportion of students on discovery learning - PMRI which fulfill Minimum Criteria of Mastery Learning is 70 reach 70% and (2) the result test of students mathematical literacy by using discovery learning - PMRI is better than the students who are treated by using discovery learning, and (3) the improvement of students' mathematical literacy with discovery learning - PMRI is higher than students with discovery learning - scientific.

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