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Mathematical Literacy Reviewed from Student's Metacognition On the PJBL Learning with RME Approach Assisted *Edmodo*

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Abstract

This study aims to find patterns in the learning of mathematics literacy skills on the PJBL learning with RME approach assisted e*dmodo* reviewed from student's metacognition. This type of research is concurrent mixed methods. The study design non-equivalent (pretest-posttest) Control Group Design. The data collection technique by using tests, observation, documentation, and interviews. This research subject is class VII N 36 Semarang. Based on the results that the mathematics literacy skills reviewed from students' metacognition are distinct, that students with higher mathematical literacy skills has 5 students with high category metacognition, 8 students with medium category metacognition. Students with medium mathematical literacy skills has 4 students with high category matecognition, 8 students with medium category metacognition and 1 student with low category metacognition. Furthermore, students with low category mathematical literacy skills has 5 students with low category metacognition.

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INTRODUCTION

The education process in schools inevitably involves a process called learning. According to Richardson (1998) that learning is associated with changes in behavior of a person against a particular situation caused by his experiences over and over again in that situation, where changes in behavior that can not be explained or basic propensity to demeanor respond, maturity, or someone circumstances shortly. A learning process, the components involved are students. Students are the most important human component and be central to the process of learning in basic education to upper secondary, thus forming an intelligent human beings and educate each other (Najichun, 2016: 140).

Math is a tool for developing human way of thinking which is indispensable in life (Nur, 2018: 15). Agree with the statement, mathematics is one of the subjects that is widely used and exploited to solve problems in everyday life (Mardiyanti, 2018: 255). PISA (2015) defines mathematical literacy as the ability of individuals to formulate, use and interpret mathematics in a variety of contexts, including the ability to perform reasoning mathematically and using the concepts, procedures, facts as a tool to describe, explain and predict phenomena or events. Mathematical literacy helps a person to understand the role or usefulness of mathematics in everyday life as well use it to make the right decisions as citizens of a constructive, concerned and reflective (OECD, 2017). Similarly, the assertion that the mathematical literacy plays a role in improving the quality of one's life as the basis (Khoir, 2019: 112).

The last studies indicate that the ability of students' mathematical literacy is still low. This is evidenced by the research on the mathematical literacy skills by an international survey organization PISA (Program for International Student Assessment) conducted by the OECD (Organization for Economic Co-operartion and Development) every three years to students aged 15 years. Results obtained Indonesian children in the most recent year is still low, although there was a slight increase from the previous year. The mean score of mathematical literacy in 2015, namely 386 (level 2), whereas the international average score of 496 at level 3 ("Rate and Improved Outcomes PISA Indonesia Experience," 2016). In 2012 and 2009 respectively only reached 375 and 371 (Putri, 2018: 53).

Metacognition in mathematics is an individual's consciousness about the thought process that is owned and individual way to control the process in solving mathematical problems (Murti, 2015: 3). Furthermore metacognition means one's knowledge of information processing skills and knowledge of cognitive character in the beginning of problems and problem-solving strategies (Schneider & Artlet 2010 in Kusuma, 2019: 27). According Novitasari (Nurmalasari, 2015: 140), the level of metacognitive skills possessed by each individual are different from one another depending on the activity of learning to do.

Based on the results of interviews that have been conducted by researchers with a mathematics teacher at SMP N 36 Semarang that administer in class VII F, VII G, VII H and VII I found most students difficulty in expressing the concept or symbol, especially in the material rectangles and triangles and difficulties experienced students are students still difficult to distinguish the properties of rectangles and triangles properties. After the researchers gave a questionnaire to students in grade 7 G, the results showed that the students' metacognition ability is low. Conversely when students are confronted by the teacher about the experience who ever happened to students. Students are quite catch what was intended by the teacher but it’s different again when students return invited to work on the problems of stories and theories, students are back in focus.

Trianto (2004) explains that the PJBL is an innovative learning on the student centered and put the teacher as a motivator and facilitator, where students are given the opportunity to work autonomously construct learning. Students' ability to solve real problems in school and outside school experience based on a mathematical process, called horizontal mathematics and vertical mathematics. This process can be achieved in learning using RME approach (Fauzan & Yerizon, 2013 in Fajriyah, 2019: 58).

RME is an approach to mathematics education involving students develop their understanding by exploring and solving problems defined in the context of which involved the interest of students. According

Gravemeijer (1994) (Junaidi: 2015), there are three principles in designing the study of mathematics by RME approach, namely 1) guided reinvention, 2) didactical phenomenology, and 3) self-developed models.

According to Kemp and Dayton, the benefits of learning media is to improve the quality of learning outcomes of students (Putra, 2015). One of the online media are used as a media of e-learning is *Edmodo* developed by Nic Borg and Jeff O'Hara at the end of 2008. One Edmodo function can be used as a communications platform to support the learning of students learning level, individual, group and whole class (Karimah, 2018: 98).

METHOD

This type of research is cuncurrent mixed methods. The design of research is nonequivalent (pretest dan posttest) control group design. The population in this study is second semester of seventh grade students SMP N 36 Semarang. The sampling technique used is the technique of random sampling, in this way researchers define two classes of class VII SMP N 36 Semarang as the class that will be used as a sample for applied the model of PJBL learning with RME approach assisted edmodo will be applied in class VII G as classroom experiments and the model of discovery learning-scientific in class VII F as the control class.

Quantitative data collection techniques by providing a description about the test form. Tests are given that mathematical literacy skills test in which test items on the description of each measure indicators of mathematical literacy skills. The test is given twice: initial capability test (pretest) and the last capability test (post-test).

Data collection techniques in qualitative research, namely (1) questionnaire of students 'metacognition, (2) interview to determine the students' metacognition, interview guides used in this research is a form of semi-structured, (3) documentation of the research, (4) observation to determine the performance of teachers and activity students. Observation techniques that will do is direct observation. Providing the sheet form of learning observation performance to obtain data on the activities of teachers. Charging observation sheet is done by check list. Charging activity observation sheet performed after the learning process has been completed.

RESULTS AND DISCUSSION

The learning process in this study in terms of quantitative and qualitative measure of three stages: (1) the planning make learning device, (2) the stage of implementation of learning, and (3) the assessment phase testing the effectiveness of learning. The planning stage, an assessment of the learning device of PJBL with RME approach assisted *edmodo* to mathematical literacy skills that include syllabus, lesson plans, worksheets, math literacy skills test, the questionnaire of students' metacognition abilities, *edmodo* media design, as well as modules. Validation of the learning device is done by using the validation sheet provided by the researcher.

Learning device validator carried by two lecturers of pascasarjana UNNES as well as a math teacher SMP N 36 Semarang. Results of the assessment of the validator analyzed based on the results of the average score given by the validator where used rating scale is 1 to 5. The results of each validator can be seen in Table 1.

Table 1. Results of Assessment Learning Tool

No.	Jenis Data	Rata-rata Skor Validator			Rata-rata total	Kategori
		V1	V2	V3		
1.	Perangkat pembelajaran					
	a. Silabus	4,50	-	-	4,50	**Sangat Baik**
	b. RPP	4,55	-	-	4,55	
	c. LKS	4,50	-	-	3,50	
2.	Tes literasi matematika	4,5	-	-	4,5	
3.	Angket metakognisi	-	4,00	-	4,00	**Baik**

The implementation stage of this research carried out by two persons namely mathematics teacher SMP N 36 Semarang and student of Masters in Mathematics Education. Data analysts and data result of PJBL learning with RME approach assisted *edmodo* observation conducted by researchers by paying attention to 14 aspects of assessment of observation presented in Table 2, as follows.

Table 2. Result of Learning Observation

No.	Kualitas Keterlaksanaan Pembelajaran	B-1	B-2	Rata-rata	Kategori
1.	Pertemuan 1	3,78	3,64	3,71	Baik
2.	Pertemuan 2	3,92	4,07	3,99	Baik
3.	Pertemuan 3	3,82	4,14	3,98	Baik

Furthermore, researchers also presents the data in a graph based on Table 2. The graph shown in Figure 1, as follows.

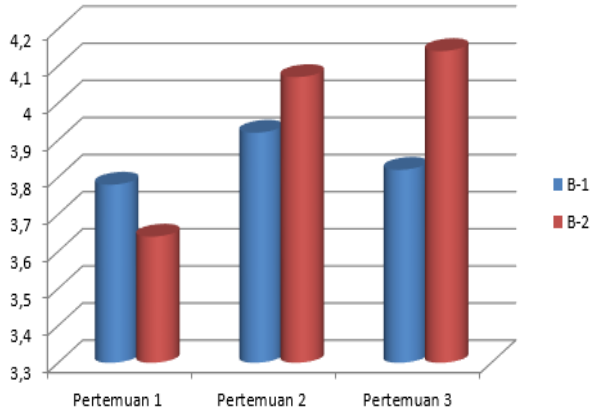

Figure1. Furthermore, researchers also presents

Based on Table 2 it can be concluded that the preparation and management of learning has been prepared in earnest, it's proved with the implementation of this study fall into either category.

The assessment phase is the next stage after researchers conducted a study in the form of experiments class of PJBL Learning with RME approach assisted *edmodo* and in control class learning with discovery learning-scientific approach. Learning outcomes assessment is done by giving the description test. Description Test is given by the researchers is mathematical literacy skills test.

Mathematical literacy skills tests in this study were divided into two, preliminary mathematical literacy test and the final mathematical literacy test. Analysis of experimental data consists of two data analysis, namely (1) the analysis of quantitative data, (2) the analysis of qualitative data. Analysis of quantitative data on preliminary data normality test, homogeneity, as well as the similarity two averages test. Then the analysis of quantitative data on final data includes mastery learning test, t two parties test, and linear regression.

Analysis of quantitative data on preliminary data of mathematical literacy skills test both classes can be seen in Table 3, 4, and 5 as follows.

Table 3. Data Normality Test of Early Mathematical Literacy Skills Test

Kelas	Uji Lilifors		Taraf signifikan
	L_o	L_{tabel}	
Kelas Eksperimen	0,0791	0,1591	5%
Kelas Kontrol	0,0969	0,1571	

According to the table, it can be concluded that $L_o < L_{table}$ so H_o accepted, meaning that preliminary data derived from a population of normal distribution.

Table 4. Homogeneity Test of Preliminary Data of Mathematical Literacy Skills Test

Kelas	Uji Bartlett		Taraf Signifikan
	χ^2_{hitung}	$\chi^2_{(1-\alpha)(k-1)}$	
Kelas Eksperiman & Kelas Kontrol	0,7810	2,3026	5%

Based on Table 4, it can be concluded that $\chi^2_{calculated} < \chi^2_{(1-\alpha)(k-1)} = 0{,}7810 < 2{,}3026$ so H_o acceptable means preliminary data derived from a homogeneous population.

Table 5. Similarity Two Averages Test

Matematika

Kelas	Uji Kesamaan Rata-rata		Taraf Signifikan
	t_{hitung}	t_{tabel}	
Kelas Eksperimen & Kelas Kontrol	−0,0829	1,99	5%

According to the table above, it can be concluded that $-1{,}99 < -0{,}0829 < 1{,}99$ so H_o acceptable means both classes have the same average.

Quantitative data analysis at the final data of mathematical literacy skills test on the experimental class can be seen as follows.

First, mastery learning test. The proportion test is used to test of classical completeness. Proportions test used in this study is the right proportion test to the proportion of students who reached KKM (70) at least 70% on the number of students in the class. Based on the calculations have been done by researchers, it is obtained $z_{calculated} = 1{,}68$ and $z_{table} = z_{0,5-\propto} = 0{,}17$ with significant level 5%. It can be concluded that $z_{calculated} > z_{table}$ so H_o rejected, which means the proportion of students on the PJBL learning model with RME approach assisted *edmodo* which reached KKM greater than 70%. The above calculation is similarly with the results of the calculations in the study (Aula, 2019: 99) states that the calculation results of proportion test obtained $z_{calculated} = 2{,}298$ and the value of $z_{table} = 1{,}96$. So H_o rejected, it means the student proportion with PJBL assisted project assesment has been reached 80%.

Second, do t two parties test in the experimental class. Final data analysis showed that the two classes have the same variance (homogeneous), the statistical test used is t two parties test with the variance of two classes are same and it is not known. Based on the research result shows that $t_{calculated} = 2{,}5410$ and $t_{table} = t_{(1-\propto)(n_1+n_2-2)} = 1{,}6698$, so $t_{calculated} > t_{table} = 2{,}5410 > 1{,}6698$ with significant level 5% (Sudjana, 2005: 242-244). It can be concluded that H_o rejected which means the average of mathematical literacy skills on the PJBL learning with RME approach assisted *edmodo* greater than from the average of mathematical literacy skills on the *discovery learning* with *scientific* approach.

Third, do a regression analysis to determine the statistical model that can be used to predict the mathematical literacy skills based on students' metacognition. Analysis was conducted on the stage (1) simple linear regression. The regression equation $\hat{Y} = -56{,}69 + 0{,}6195X$ was used to determine the relationship between the independent variables (students metacognition) with the dependent variable (the mathematical literacy skills). Phase (2) regression linearity, linierity used to test the regression linearity. Based on the analysis above, so $F_{calculated} < F_{(\propto)(k-2,n-k)} = 1{,}97 < 2{,}62$ with significant level 5%. It can be concluded that H_o accepted which means that the connection between students metacognition with mathematical literacy skills are linear.

Phase (3) simple linear regression coefficient significance, serves to determine whether the coefficient of regression means or not. Based on these results that $F_{calculated} \geq F_{(\propto)(1;n-2)} = 33{,}04 \geq 4{,}18$ with significant level 5%. It can be concluded that H_o rejected, which the coefficient of regression means.

Phase (4) The simple linear correlation coefficient is used to determine how much influence students' metacognition on mathematical literacy skills of student. Based on these calculations it can be concluded that $r^2 = 53\%$ the means to positively influence between metacognition and mathematical literacy skills.

The effectiveness of the test chart can be seen in Figure 2 below.

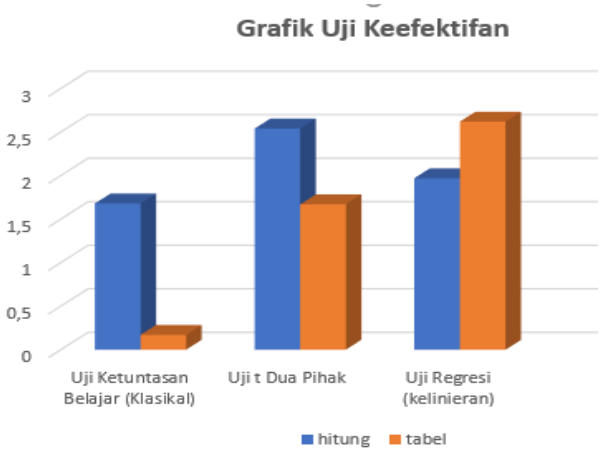

Figure 2. The effectiveness of the test chart

Based on the calculation above it can be concluded that PJBL learning with RME approach assisted *edmodo* effective to improve the mathematical literacy skills. The statement was similarly with the following statement is particularly RME realistic activities provide students with tasks that are situated in the context of which they consider meaningful. They are interest to resolve the problems and challenges and want to understand the math in order to achieve it (Bray, 2015: 22).

Qualitative data analysis involves the validity of the data test, data reduction, data presentation, and

conclusion. The conclusion of this study can be seen in Table 6 as follows.

Table 6. Mathematical Literacy Skills Reviewed from Students' Metacognition

Literasi Matematika	Metakognisi siswa	Jumlah Siswa	Persentase
Tinggi	Tinggi	5	16 %
	Sedang	8	26 %
Sedang	Tinggi	4	13 %
	Sedang	8	26 %
	Rendah	1	3 %
Rendah	Rendah	5	16 %
		31	100 %

Mathematical literacy of high category in terms of students' metacognition

Mathematics literacy skills of high category have students' metacognition differently, which is 5 students with high category metacognition and 8 students with medium category metacognition.

Based on the metacognition questionnaire and mathematical literacy skills test on students then 5 students with high category metacognition had a very good metacognitive knowledge. Students have the aspect of declarative knowledge as well and the aspects of procedural knowledge students have the precision in using these troubleshooting procedures. Later on conditional knowledge students have the ability to choose the procedures that are effective in solving problems even though there are still shortcomings.

In the aspect of the experience / metacognitive regulation, students have planning very well. Indicated by filling the questionnaire statements that involve aspects of planning appropriately. Then on aspects of information management strategy students were able to show it by choosing the information needed to solve a problem.

The third aspect is comprehension monitoring subjects includes in the very nice category. Indicated by filling in the metacognition questionnaire statement. Furthermore, the aspect of debugging strategies students have deficiencies in correcting errors in the process of resolving the problem. The last aspect was evaluation, students began to realize the mistakes in solving the problems faced.

Based on the metacognition questionnaire and mathematical literacy skills test to the students then 8 students with medium category metacognition have good metacognitive knowledge. Students have a good declarative knowledge aspect and procedural knowledge aspects of the student are less careful in using these troubleshooting procedures. Later on conditional knowledge students have the ability to choose the appropriate procedures to solve the problem even though there is still a mistake.

In the aspect of the experience / metacognitive regulation, students have a good planning although there are errors in planning. Then on aspects of information management strategies students were able to show it by choosing the information needed to solve a problem.

The third aspect is comprehension monitoring of subjects included in either category. Indicated by filling in the metacognition questionnaire statement. Furthermore, the aspect of debugging strategies students have deficiencies in correcting errors in the process of resolving the problem. One final aspect of assessment / evaluations of students assess their work with good results.

Mathematical literacy of medium category in terms of students' metacognition

Mathematics literacy skills of medium category have students' metacognition differently, which is 4 students with high category metacognition, 8 students with medium category metacognition and 1 student with low category metacognition.

Based on the metacognition questionnaire and mathematical literacy skills test in students then 4 students have a good enough declarative knowledge. The next knowledge is procedural knowledge, the student has sufficient procedural knowledge. Because in math literacy skills test results can be seen clearly the method is used to solve the problems. Third knowledge that conditional knowledge, the students have sufficient conditional knowledge to solve the problems but sometimes the student is still confusion in solving the problems with the right strategy.

In the next stage of experience / metacognitive regulation. Students have enough planning in solving the problems faced. In the second aspect of information management strategies, students have difficulty in organizing the information obtained. When comprehension monitoring process, students are good enough in monitoring the results of his work but still need accuracy to monitoring in his work.

In the fourth aspect of debugging strategies, there is graffiti on the outcome of the process and less accuracy in understanding the problems faced. Finally, the assessment / evaluation, students assess the overall results of his work well even though despite difficulties at first.

Based on the metacognition questionnaire and mathematical literacy skills test in students then 8 students have a good enough declarative knowledge. The next knowledge is procedural knowledge, students have a pretty good procedural knowledge. Because the test results of mathematical literacy was clearly to used in solving the problem. Third knowledge that conditional knowledge, students have weakness in solving the problems with the right strategy.

In the next stage of experience / metacognitive regulation. Students have rether bad planning in solving the problems faced. In the second aspect of information management strategies, students have difficulty in organizing the information obtained. When comprehension monitoring process, students need to see the results of his job carefully.

In the fourth aspect of debugging strategies, there are a few streaks in justifying a mistake on the outcome of the process. One final assessment/ evaluation, students assess overall results of his work pretty well eventhough there were a mistake.

Based on the metacognition questionnaire and mathematical literacy skills test in students then 1 student has sufficient declarative knowledge although there were weakness. The next knowledge is procedural knowledge, students have a pretty good procedural knowledge. Because the test results of mathematical literacy was clearly to used in solving the problem. Third knowledge that conditional knowledge, students have difficulty in determining the appropriate strategy in solving the problem.

In the next stage of experience / metacognitive regulation. Students have a good enough planning in solving the problems faced. In the second aspect of information management strategies, students have confusion in organizing the information obtained. When comprehension monitoring process, students need to track back before his work was collected.

In the fourth aspect of debugging strategies, student corrected the mistake of his result but not overall. One final assessment/ evaluation, student were assessing his work results overall fairly well.

Mathematical literacy of lower category in terms of students' metacognition

Mathematics literacy skills of low category hase the same students' metacognition, which is 5 students have low category metacognition too.

Based on the metacognition questionnaire and mathematical literacy skills test that is given to the students. Students have metacognitive knowledge is not good. Students have enough declarative knowledge because students do not understand the basic tasks of a student and the students difficulties in preparing purposes in the learning process. The second is procedural knowledge, students have difficulty in using the right strategy when working on a problem. Later on conditional knowledge that students are confused in deciding what and how to apply strategies to solve the problems.

In the next stage of experience/ metacognitive regulation. Students have enough planning because the result of mathematical literacy skills test that are not clear. Then information management strategies of the students are not seen in the process of work and difficulty in selecting the information that will be used to solve the problems. In the aspect of comprehension monitoring students were able to monitor the results of his work but sometimes students are not accurate and there are no significant changes.

The next aspect is debugging strategies, students are not able to justify the incorrect results of his work to be a true problem solving. Then, in the aspect evaluation, the students did not assess whether the learning strategies was right or not.

Based on the description above, this results similar with previous studies (Carr et al. 1994; Vermeer et al. 2000; Verschaffel. 1999) revealed that metacognition plays a role in a new mastery and business mathematics (Desoete, 2018: 673).

CONCLUSION

The following conclusions were obtained as the first PJBL learning with RME approach assisted *edmodo* efektif effective to improve the mathematical literacy skills. The statement is based on testing the effectiveness of which has been described in the above results and discussion. The second researchers know math literacy skills by PJBL learning with RME approach assisted *edmodo* in terms of student's metacognition. So students with math literacy skills

of high category has a different metacognition are high and medium. Students with math literacy skills of medium category have different metacognition, namely high, medium and low. But students with math literacy skills of low category has low category metacognition too. Based on the conclusion that teacher gave a task to improve the math literacy skills in the subject of medium and low category.

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