Mathematics literacy on creative problem solving with realistic mathematics education approach assisted by e-learning schoology

Anisa Luthifa Azmi[a,*], Wardono[a], Adi Nur Cahyono[a]

[a] Mathematics Department, Faculty of Mathematics and Natural Sciences, UNNES, Indonesia
D7 Building1st floor, Sekaran Campus, Gunungpati, Semarang 50229

* E-mail address: anisaluthifa29@gmail.com

Abstract

This research aimed to find out the influence of Creative Problem Solving (CPS) model of learning with RME approach with the help of Schoology to increase junior high school students' mathematic literacy and students' learning output. This research used design true experimental design pretest-posttest control group design. This research used qualitative research method which involved control group and experiment group. The sampling technique used was random sampling. The experiment class was given a treatment in the form of Creative Problem Solving-RME learning. Meanwhile, the control group was given a treatment in the form of expository-scientific. The data were collected by using mathematic literacy's ability test, observation, and interview. From the final data of mathematic literacy's ability test, the researcher analyzed and obtained that: (1) the students' proportion in Creative Problem Solving-RME learning which passed the minimum criteria of mastery learning (KKM) was about 75%; (2) the average of students' mathematic literacy on Creative Problem Solving- RME learning was better than those on expository learning. Afterwards, we can conclude that Creative Problem Solving-RME learning was effective to improve students' mathematic literacy.

1. Introduction

Mathematic is one of the science disciplins which is taught to every stage of education. It is hoped to give some contributions to develop students' ability. According to Puskur (in Usdiyana, dkk, 2009), the objective of mathematic learning in elementary school and intermediate grade is to prepare the students to be able to face the situation changing in this life and in this always developing world, though the action exercise based on logical thinking, rational, critical, precise, honest, efficient, and effective. Based on the observation which was conducted in SMP N 2 Demak, the researcher obtained an information in which 50% of junior high school students complained because they often faced some difficulties in understanding mathematic's problem, as a result they often did some mistakes in finishing the task which was given by their teacher. Those number of mistakes also indicate that the rate of students' mathematic literacy was still low. This was shown by the result of *Programme for International Students Assesment (PISA)* which measures students's ability under 15 years old in sciences, mathematic, and reading literacy which they had learnt in school in this full of challenge's global era (Stacey,2011).

Based on the OECD (2015) the result of PISA in Indonesia's Mathematic is ranked on 63rd from 70 participants. It is proven from students' inability in finishing a problem in the form of formulating, applying, and interpreting mathematic into various contexts. Wardono et.al. (2017) suggest that the result achieved in the survey is far from satisfying. The Indonesia's position is caused by the lowness of students' literacy which one of them is Mathematics literacy. The result of PISA points out that Indonesian students are unfamiliar and pressed to solve PISA's question in which the

ability of mathematic literacy is highly necessary (Wardono, et al.,2018).

According to Asikin (2008: 38), to solve this problem, we need to improve students' ability on Mathematics literacy in order to be increase in the following year. As what the curriculum expects, a teacher is expected to do the learning goal which is to develop the mathematics ability. The condition process runs along with the activeness and factuality will exist if a teacher as a facilitator is able to apply the correct learning model to one particular chapter in order to stimulate the sudents' problem solving ability. An alternative learning model which can be used to teach the concepts of mathematics in problem solving context is *Creative Problem Solving (CPS)*.

One of the approaches in mathematics' learning which can give positive effect towards students' mathematic literacy ability and develop students' character is realistic approach (Wardono et al., 2015). It is adopted from RME. According to Budiono (2016), in Indonesia, RME is often called as Indonesia's Realistic Mathematic Education or *PMRI*. Indeed, *PMRI* is an appropriate learning to apply.

According to Nalole (2008), mathematics presentation which is started with something concret or called as *Realistic Mathematics Education (RME)* has been long developed in Netherlands.

For more, Sumandya (2013) says that RME refers to Freudenthal's opinion that mathematic must be related with the reality which is human activity, where contextual problem is used as starting point to develop the idea and mathematics concept. It means that mathematics must be close with the children and relevant with the daily situation. Wijaya (2012) adds that *learning by doing* is one of the RME's superiority.

According to Wardono (2018), realistic mathematics learning is an approach of mathematics learning which used *contextual problems* as a beginning step in learning process. The students are asked to organize an identify mathematics aspects in that problem. They have chances to freely describe, simplify, interpret and finish that contextual problems according to their own way either in individual or group, based on their experience or earlier knowledge they have. Then, with or without teacher, the students are expected to use those contextual problems as the source of mathematics concept or definitions which abstractively increased.

The development of information technology nowadays causes various changing in every aspect of life. Entering the Asean Economic Citizen (MEA), Indonesian *stakeholder* must follow International standard in order to keep survive in this global era (Murtiyasa, 2015). The developing also occurs in education aspect. Therefore, the educational process must be done based on the fundamental conditions to science development. Technology science development gives ease to access any knowledge or information quickly, easily and accurately from any sources. Moreover, mathematics learning holds an important and essential rule to science development. Sinambela (2008) states that if the students are trained to finish problems then they will be able to take a decision since they already have skill about how to collect information, and realize how important to recheck the final result.

In this sophiscated and modern era, technology and information development are growing very fast. Along with technology and information development, there are some effects exist both positive and negative effects. One of them is the use of internet by school age children. It should be directed to be useful and positive usage to support their education. Along with many social medias are developing, there is a social media named *Schoology* by *Nicolas Borg and Jeff O'Hara* (2008) which is considered can support children's education.

According to Wardono et.al, PMRI learning with *Schoology* media connects mathematics informal science which is obtained from students' daily life with mathematics formal concept using Schoology in students' learning. They will be more energic, interested, active and enthusiastic in learning so that the learning will be more meaningful. They will be more active not only in answering but also in using *e-learning* either inside or outside the class.

Again, Wardono et al (2016) explain that since 2000, there are 3 kinds of curriculums applied namely 2004 curriculum, 2006 curriculum, and 2013 curriculum. Eventhough the curriculum are changed and fixed time to time, unfortunately it still cannot lift up the students' achievement in international forum. This matter is not in line with the condition. The observation that the function and rules of the teachers in mathematic learning, especially about the way they transfer the lesson is never change even though the curriculum is. Wardono et al (2018) also state that one of the solution which can be done by the teacher in order

to improve students' mathematics PISA ability in solving the problem is innovate mathematics learning and develop learning assessment instrument.

1.1. Mathematics Literacy

According to Kramarski (2004), mathematic literacy is graded by giving problems to the students which show daily or real life situation. Meanwhile, according to Gunes et al (2015), mathematic literacy is student's ability in solving problems, analysing, assessing, and finding the effective solution in different acpect and situation. Again, Wong in Kuswidyanarko et al (2017) explains that mathematic literacy is the ability in understanding and applying mathematics basic knowledge in daily life. Ojose (2011) reinforces that mathematic literacy ability is students' ability in understanding and applying some mathematic applications like facts, principle, operation, and problem solving in past and recent daily life.

Moreover, mathematics literacy can help someone in understanding the use or rule of mathematics in daily life and as a basic consideration in making the correct decisions as developing, caring and thinking citizen (Hawa, 2014).

The important aspect in mathematic literacy is involving and using mathematics in every kind of situations (Thomson, 2013). It can be done by applying their mathematics knowledge to analyze and handle situation they face.

1.2. Creative Problem Solving

CPS (Creative Problem Solving) learning model is a model which is centered in problem solving skill followed by creativity (Karen et.al, 2008). CPS learning model can stimulate to think and act creatively. Besides, it also can stimulate students' progress and thinking development to solve the faced problems correctly (Mitra, 2013). In this CPS learning, students are required to be active so they can take the ability they have to solve problem they never met during the learning process.

CPS learning model consists of problem clarification stage, opinion disclosure, evaluation, selection, and also implementation (Pepkin, 2004: 2). By accustoming the students to use independent steps in problem solving, it is expected to help the students to improve their mathematics literacy and overcome the difficulties in learning mathematics. The class' setting in CPS learning can be in small discussion in which the

members are heterogeneous based on their early skill. This heterogeneous distribution group will stimulate the bond which support each group. The students who face difficulties can ask either to the another students or their teacher, so it is expected they can improve their mathematisc literacy and learning output.

1.3. Schoology

According to Besana (2012) schoology is a social network with school environment based. Schoology is pointed to use by teachers, students. Schoology's display is likely same with Facebook social network. It offers a way of communication which is obviously secure and easy. They can make collaboration between students and teachers and share contents like text, picture, link, video, and audio. By using Schoology, the teachers can monitor studens' activity and give task, note, or lesson which can be easily accessed by the students.

2. Method

This research used quantitative approach. It is a kind of approach which produces findings obtained by using statistic procedures or any procedures from qualification (measurement). This research was a Quasi Experimental. The design is a development from *True Experimental Design*, which is hard to be done. Quasi experimental's objective aims to obtain the information which is a assumption for information which can be obtained by true experiment in imposibble condition to control and/or manipulate all of the relevant variables. The research design used was *One Group PretestPosttest Design*.

Table 1. One Group Pretest-Posttest Design

Class	Pre-Test	Treatment	Post-Test
Experiment	O_1	X	O_2
Control	O_3		O_4

First, the researcher did a measurement (pretest), gave a treatment namely *Creative Problem Solving* model for a particular timme, and then did the measurement for the second time (posttest).

The population used in this research was all of the seventh grade students of SMP Negeri 2 Demak Academic Year 2017/2018 with the number of 277 students. Those students were

divided into 9 classes. Further, this research used random sampling technique. It was conducted through the consideration that the students had been placed in class randomly without looking to their grade, gender, and group.

The sample as well the subject of this research was VII B students with the total of 30 students were choosen as research class with *Creative Problem Solving* assisted by *Schoology* learning model and VII A Class with the total of 31 students was choosen as the control group. The instrument used in this research was mathematic literacy ability test. The test would be given in the form of essay question. There were several tests given, they were normality, homogeneity, same two average and hypotheses test.

The data in this research were students' mathematic literacy ability in space and shape content in square chapter. While to collect the data, this research used test method and observation.

The tests were done in order to obtain quantitative data which were in the form of students' score on mathematic literacy ability in space and shape content in square chapter. Then, then the data were tested to find out the students' average score on mathematic literacy ability in space and shape content in square chapter which was previously learnt by using *Creative Problem Solving* model and realistic scientific approach assisted by *Schoology*. Meanwhile, for the attitude assessment and learning quality, the researcher used observation method.

Based on the result of test instrument analysis which covered validity, reability, and practicality of the question, it was obtained that the appropriate questions can be used as the evaluation test to measure students' mathematic literacy ability. The analysis techniques used in this research were: (1) normality test using Chi-squared test, (2) homogeneity test using Levenne, (3) right side T-test, (4) paired T-test, and (5) gain test.

3. Results & Discussion

The learning will be effective if (1) more than 75% students' mathematic literacy on *Creative Problem Solving* using *Schoology – RME* achieved the minimun criteria of mastery learning (*KKM*) and (2) students' mathematic literacy average in learning *Creative Problem Solving* using *Schoology – RME* was better than students' mathematic literacy average in expository learning. Before the mastery test, it was necessary to do the prerequisite test first. In this research, normality

test using *Kolmogorov Smirnov's* test with significance level of 5% obtained a Sig score on experiment and control class was *0,200 > 0,05,* so that H_0 was accepted. It means that class' second post test score distributed normally. Meanwhile, homogeneity test was done using Levene test and obtained 0,006 > 0,05 so that the H_0 was accepted which means that it was homogeneous.

The classical mastery test was carried out in order to find out if the total of students passed the learning was 75%. According to table z, it was obtained z_{table} with $\alpha = 5\%$ opportunity $(0,5 - \alpha) = 1,64$ with the significance level was 5% and $z_{count} = 3,24$. Because of $z_{count} > z_{table}$ so that H_0 was rejected. So, we can conclude that the students' proportion which achieved the classical mastery was > 75%.

In T-test counting for independent sample, it was obtained $t_{couunt} = 6,7$, $t_{table}=1,67$ score. Because $t_{count} > t_{table}$, so that H_0 was rejected and H_1 was accepted. So, we can conclude that students' mathematic literacy ability average on *Creative Problem Solving* using *Schoology –RME* was better than the average of expository mathematic literacy ability.

Further, the experiment class shows that there was no students who obtained low score. There were 32,26% students successfully gained average score and 67,74% show high score. Meanwhile, the control class shows that 26,67% students obtained low score, 66,67% students obtained average score and 6,66% students obtained high score. The average enhancement which occurred in experiment class and control class can be seen in figure 1.
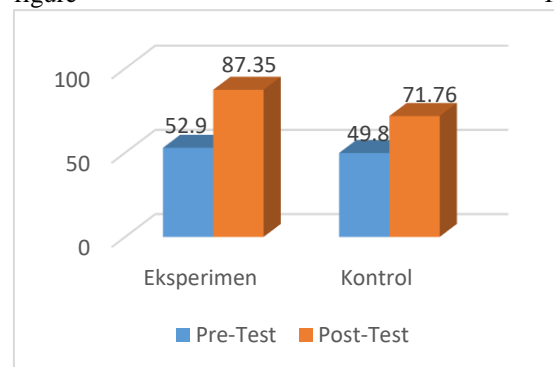

Figure 1. Histogram of the Improvement of Mathematic Literacy on Experiment Class

Based on all of the tests above, we can conclude that *Creative Problem Solving* using *Schoology-RME* learning was effective in improving students' mathematic literacy. It was

supported by a reasearch by Soviawati (2011) which uses realistic approach, the students will not only easily master the concept and material but also remember the lesson they got. Besides, in the experiment class, the learning media which is *Schoology* website is also used.

Again, Wardono (2014) states that RME learning model with character education and PISA same assessment was effective in immproving students' ability in finishing mathematics literacy problems. Nuriana (2007) argues that CPS can improve students' creativity and learning output. Also, Sutrisno (2009) explains that CPS learning can help the students to meet the minimun criteria of mastery learning or called as *KKM*. However, the difference of this research tothe earlier research was on the material, students' character as the research object, and learning approach. From some of those researches, they supported that the use of *Creative Problem Solving* with RME approach using *Schoology* can improve students' mathematics literacy and learning output.

4. CONCLUSION

Based on the preliminary description of discussion and findings, there are several conclusion which can be drawn, as follows (1) students' proportion on *Creative Problem Solving* using *Schoology-RME* which meets the minimun criteria of mastery learning is about 75 % and (2) students' mathematics literacy ability test result in class which used *Creative Problem Solving* using *Schoology-RME* learning is better than expository learning class. From those conclusion, it was expected that the use of *Creative Problem Solving* using RME assisted by *Schoology* learning model can be applied. In the end, hopefully, the students will get accustumed to doing the contextual test and improving students' learning output and their mathematic literacy. Besides, they can also learn through *e-learning* without face to face learning with their teacher.

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