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PMRI Learning With Blended Learning Strategy to Improve Mathematical Literacy Skill

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Abstract

The mathematics literacy of students in State Junior High School 5 Semarang is still low. Students face difficulties when they are solving stories related to daily life. The objective of this study is to determine the effectiveness of PMRI learning assessed similarly to PISA with Blended Learning strategy towards students' mathematical literacy skills. The learning includes face-to-face activities and the use of computer technology (online or offline). The population in this study was the students of VIII graders of State Junior High School 5 Semarang in the academic year of 2015/2016. This research used quantitative method. The sample was chosen by random sampling and it was obtained class og VIII E, VIII F, and VIII G as experiment and control classes. The data were obtained by mathematical literacy skill test method. The data analysis used was proportion test, Anova test and Gain test. The results show that (1) the average of mathematics literacy skill on the PMRI learning with Blended Learning has reached the classical completeness that is at least 75% of students reach a minimum score of 70; (2) the average of mathematics literacy skill of class with PMRI learning with Blended Learning is better than class with expository learning.

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INTRODUCTION

The quality of mathematics education in primary and secondary schools in Indonesia is worse compared to other countries in the world. This is reflected in the results of the international assessment of student achievement. The results of the Programme International Student Association (PISA) on students' skill in Indonesia in science and mathematics lessons show Indonesia's position is very low compared with other countries. Indonesia began to follow PISA in 2000. During the four-time participation, Indonesia receives low results. PISA assessment in 2009, Indonesia was ranked 61 out of 65 participants with an average score of 371, while the international average score was 496. Meanwhile, in 2012 Indonesia decreased that is ranked 64 out of 65 countries participating with a score 375 (OECD, 2014).

Preliminary studies show that more than 50% of students do not have the skill to analyze, gather information and make conclusions. It is supported by PISA 2009 and 2012 results, which show less than 10% of Indonesian students who are capable of solving problems that require complex thinking. It shows the students' mathematical skill in Indonesia is very low (Susanti, et al., 2014). One of the factors that cause PISA Indonesia result is low is students' habit in solving contextual problem. The problems in schools are generally different from PISA's that use contextual problems (Lutfianto, et al., 2013). Indonesia is generally poorly trained to solve problems with characteristics such as those in PISA that have contextual substance, demanding reasoning, argumentation and creativity in solving it. The assessment instruments of learning outcomes designed by math teachers are generally less related to the context of life faced by students and less facilitate students in expressing the process of thinking and arguing. So it is not in line with the criteria of PISA's questions.

Mathematical questions in the PISA study mainly measure the mathematical literacy of reasoning, argumentation and mathematical literacy rather than questions that measure the raw technical capabilities associated with memory and calculation alone. There are 3 major components in the PISA study, they are (1) the content component in the PISA study is interpreted as the content or subject matter or subject of mathematics studied in the school. (2) The process components of the PISA study are interpreted as the things or one's steps to solve a problem that can be resolved, (3) the context component in the PISA study is interpreted as the situation illustrated in a problem (OECD, 2010).

The mathematical literacy in PISA is defined as the individual's skill to identify and understand the role of mathematics in the world and to use mathematics in relation to the demands of life (Thomson, et al., 2013). Ojose (2011) defines literacy as knowledge to know and apply basic mathematics in our daily lives. The definition of mathematical literacy within the framework of the 2015 Mathematical PISA by OECD (2013) and Stacey (2012), mathematical literacy is (1) a person's skill to formulate, employ, and interpret mathematics in various contexts as the mathematical processes skill, (2) the use of mathematical reasoning and concepts, procedures, facts and mathematical tools to describe, explain, predict phenomena, and (3) mathematical literacy can assist one in applying mathematics into the everyday world. According to Stacey (2012), mathematical literacy as an individual's skill to identify and understand the role of mathematics in real life.

The Government continues to improve the quality of education in Indonesia by undertaking various efforts including: training for teachers, teacher education qualifications, teacher certification, curriculum improvement, application of new learning models and so on. The quality of education is related to teaching and learning activities. Learning activities in school is the most fundamental activity, because the success or failure of the achievement of educational goals is influenced by the learning process experienced by learners. Therefore, teachers in the learning process are expected to prepare the right learning instruments.

According to Wardono (2014), to develop students' literacy skills, it is required a mathematics learning approach that is able to instill literacy skills. One approach of mathematics learning that can have a positive impact on students' literacy skills is the Realistic Mathematics Approach (RME). This realistic mathematics education was developed by the Freudenthal Institute since 1971 known as RME (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 the starting point for

the development of ideas and concepts of mathematics (Sumandya, 2013). Freudenthal introduces the term "guided reinvention" as a process that students do actively to rediscover a mathematical concept with teacher guidance (Wijaya, 2012). Rediscovery of ideas and mathematical concepts should be started from the exploration of various situations and problems of the real world (Gravemeijer, 1994). Freudenthal's statement that "mathematics is a form of human activity", underlies the development of RME.

In addition to the development of learning innovations, it is also needed the development of assessment in the form of PMRI test instruments in measuring the skill of students to use questions or problems that can be adopted from various situations so that it becomes the source of learning. This is in line with how to measure students' skills in the PISA test, that is by using real life related questions. PISA is a study of international student assessment programs organized by the Organisation for Economic Cooperation and Development (OECD). PISA aims to determine the skill of 15-year-olds to use the abilities and skills they have learned in school in living their daily lives in a challenging global age (Stacey, 2011).

Along with the objectives of PISA, besides, mathematical literacy skill, students are also required to know the information technology that develops today, it must be noticed that the education in the current era of globalization is required to prepare students to show their intellegence, creativeness and independence. Improving the role of science, mathematics and technology in modern life, requires all society to take a part, not just for people who want a scientific career, be a mathematician or a science and technology expert. The research emphasizes the importance of connecting school math to the outside world, knowing how to calculate mathematics, understand it or apply it correctly and interpret it with real life situations (Drabevoka, et al., 2014).

Quality education should include two dimensions of academic orientation and essential life skill orientation. The academic orientation focuses on the learners, while the orientation of life skills provides the provision to the learners to be able to survive in real life. Therefore, PISA also developed another assessment, that is by measuring the skills in the field of information and communication technology (ICT) (Stacey, 2011).

Based on the description of the problem, it can be concluded that mathematical literacy skill is very important to face problems in real life, because the mathematical literacy is closely related to work and duties in everyday life (Stacey, 2012). In addition, life skills are also important as a provision to survive in modern life. By looking at the problem of the low literacy of mathematics of students in Indonesia, especially in State Junior High Schooli 5 Semarang, it is necessary to conduct an effort to improve students' mathematical literacy skills. The effort that can be done is to hold an innovation in learning mathematics.

One of the lessons in mathematics learning that relates mathematical problems with contextual problems is the Realistic Mathematics Education (Sembiring, 2008). PMRI is Mathematics Education as a result of adaptation from Realistic Mathematics Education (RME) which has been aligned with cultural condition, geography, and life of Indonesian society (Suryanto et al, 2010). According to research conducted by Wardono & Mariani (2014), Wardono (2015) states that the PMRI approach with character education and PISA-like assessments is effective in improving students' mathematical literacy skills.

Besides the mathematical literacy skill, students are also required skills to face the increasingly sophisticated era of globalization in science and technology. Students must be prepared from an early age to be a human who has the skills and excellence. So, besides PMRI, it is required also other innovations in learning so that two goals are achieved. In this case, it is needed to involve technology in learning activities. Blended learning is an appropriate learning for that purpose. Blended learning is a learning that combines e-learning system with conventional learning or face to face.

According to Jeffrey, et al. (2014), blended learning is described as a way of teaching that eliminates time, place and situational constraints, but enables high quality interaction between teachers and students. Blended learning combines innovative e-learning equipment and technological advantages with traditional classroom learning to provide the most appropriate learning methods to individual students (Hui Hsu, et al., 2014). The students can learn more independently and can develop knowledge as widely as possible by utilizing computers or the internet network available. One of the lessons involving face-to-face activities and the

use of technology is blended learning. Blended learning is a learning that integrates traditional learning face-to-face and computer-oriented learning (online and offline) as well as a variety of communication options that teachers and students can use. This shows that blended learning is a flexible learning because it does not depend on time and place to learn. This learning offers some convenience because computer learning does not completely eliminate face-to-face learning (Pradnyawati, 2014). Whitelock & Jelfs (2003) provides three definitions for blended learning, which is a combination of (1) traditional learning and online learning (2) media and equipment used in e-learning (3) some pedagogical approaches, regardless of the use of learning technology.

From what is described above, the researcher intends to conduct research entitled The Analysis of Mathematical Literacy Skill with PMRI Learning PISA-like assessments with Blended learning strategy. In this research, the researcher will see the effectiveness of PMRI learning PISA-like assessments with Blended Learning.

METHOD

The type of this research was quantitative research. The quantitative research methods can be interpreted as a research method based on positivism philosophy, it was used to examine the population or a particular sample, sampling techniques were generally conducted randomly, data collection was by using research instruments, quantitative/statistical data analysis with the aim to test the hypothesis (Sugiyono, 2012: 14). In this study, the researcher gave the treatment by using PMRI learning in experiment class 1, PMRI learning with Blended Learning strategy in experiment class 2, and expository learning in the control class.

The research was conducted in State Junior High School 5 Semarang in the academic year of 2015/2016. The population in this research was the students of VIII graders with the research sample of class of VIIIE, VIII F, and VIII G. The sampling in this research was conducted by cluster random sampling technique, VIIIE class as control class, VIII F class as experiment class 1, and VIII G class as the experimental class 2. The statistical test used to determine the classical completeness in the mathematics literacy test was by using the proportion of right side test (z test) and the mean difference of mathematical literacy skill by using ANOVA test, the improvement of the mathematical literacy skill with Gain test.

The data collection methods in this research were written test method and documentation method. The test was a tool or procedure used to know or measure something in an atmosphere, in a prescribed manner and rules (Arikunto, 2013: 67). The documentation method was data collection method to get initial data about students' skill which become object of research. The instrument used in this study was a written test instrument.

The stage of data processing included activities to process the score of mathematics literacy test, performed analysis and discussion on the results of data processing research, and draw conclusions based on research results obtained to answer the formulation of research problems. The data analysis of the test result was done to know the effectiveness of PMRI learning with Blended Learning, that was, if (1) the average of mathematical literacy skill in the PMRI learning with Blended Learning reached the classical completeness that was at least 75% of students by reaching minimum mastery of 70; (2) the average of mathematics literacy skill of the class that was treaten by using PMRI learning with Blended Learning was better than PMRI learning class and expository learning;

RESULT AND DISCUSSION

Based on the results of mathematics literacy test, then it is performed the completeness test, difference average test, Test Gain. The classical completeness test is performed to find out the complete proportion of students. Based on the results of the calculation of learning mastery in the classroom with PMRI learning with blended learning by using the proportion of right side test , it is obtained $Z_{count} = 2.39$, it is obtained $Z_{table} = Z0,45 = 1.64$. Because $Z_{count} > Z_{table}$, then Ho is rejected and H1 accepted (Sukestiyarno, 2013: 119). Hence, based on the results of the study, it can be concluded that the students' literacy skill in the classroom with PMRI learning with blended learning that has reached the minimum mastery criteria of 70 reached more than 75%.

Classical completemess also occurs in PMRI learning. Based on the results of the calculation of

learning mastery in the classroom with PMRI learning by using the the proportion of right side test, it is obtained $Z_{count} = 1.98$, it is obtained $Z_{table} = Z0,45 = 1.64$. Because $Z_{count} > Z_{table}$, then Ho is rejected and H1 accepted. PMRI learning that has reached the minimum mastery criteria of 70 to reach more than 75%.

The average difference test is performed to determine which mathematical literacy skills in which class were better than others, they are between the classes which are using PMRI learning and the PMRI learning class with Blended Learning or classes which are using expository learning. The average difference test used is the ANAVA test.

At the Test of Beetween-Subjects Effect output, it is seen the significant values for column variables sig = 0.01 = 1% <5% then H_1 is accepted and H_0 is rejected. This indicates that average of one class with expository learning, PMRI learning and PMRI learning with Blended learning has a different skill of mathematical literacy.

Furthermore, to know the difference of average between each class, it is conducted further test. The further test used is the Post Hoc Tukey test. From the result of Post Hoc test in the three classes, the following results are obtained: (1) between expository learning class and PMRI learning class, it is obtained sig on table of Multiple comparisons = 0,019 <5% which means taht there is difference of average of student's mathematics literacy skill in class of learning expository with PMRI learning classes (2) between expository learning classes and PMRI learning classes with Blended Learning. , it is obtained the sig on table Multiple comparisons = 0,000 <5% which means there is difference of average of student's mathematical literacy skill in expository learning class with class of PMRI learning Blended Learning (3) between class of PMRI learning with class of learning PMRI with Blended Learning, it is obtained sig at table Multiple comparisons = 0.009 <5% which means Ho is rejected and H1 accepted, it means there is difference of average of student's mathematical literacy skill in class of PMRI learning with class of PMRI learning with Blended Learning.

From these results, it can be concluded that the average literacy skill of the three classes is different. The average difference between experiment 1, experiment 2, and control can be seen in Figure 1 below.

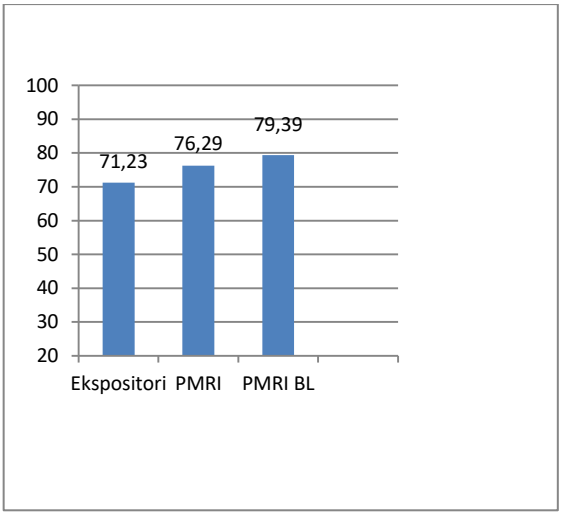

Figure 1. Mean of Postest Score

RESULT AND DISCUSSION

Based on the results of the completeness test and the average difference test, it is obtained that with the implementation of PMRI learning-Blended learning, the students can achieve the mastery learning and the average of students' mathematical literacy skill is better than classes that use other learning. With the application of PMRI learning - Blended learning, the students become more active.

The differences in the students' mathematical literacy skill in the three classes because of differences in treatment or implementation of learning in the three classes. The learning activities in the class of PMRI with Blended learning is more interactive because in the learning, the students involve in the process of concept formation. The students have created a tool of geometry aids and learning materials in the form of papers independently and then present the material in front of the classroom by using power point. The learning activities are conducted with group discussions with teachers as a classroom discussion facilitator. This makes the students more enthusiastic and active in the learning because before they start face-to-face learning in the classroom, students have a provision of material knowledge that will be learned from the results of independent learning with each group outside the classroom learning. So when the face-to-face learning in the classroom, the teacher only helps enhance the concept understanding that may still be less precise delivered by the students. Students have more time to practice doing math literacy problems.

The mathematical literacy skill on the PMRI learning with blended learning can improve because the learning is not limited to classroom and lessons only, so students have more time to explore, gain knowledge from many sources and build mathematical concepts. The students more often practice doing mathematics literacy problems either individually or group discussion with or without using computer. The mathematical literacy skill on PMRI learning can be improved through rediscovering the concept of mathematics. The principle of rediscovery means that students are given the opportunity to find their own mathematical concepts by solving various contextual questions. Based on the given problem, the students construct the model of the problem situation and then arrange a mathematical model for (model for) finishing up to acquire formal mathematical knowledge (Gravemeijer in Nalole, 2008).

CONCLUSION

Based on the result of research and discussion about mathematics literacy analysis in PMRI learning with Blended Learning strategy, it can be concluded that: (1) the average of the mathematics literacy skill in the PMRI learning with Blended Learning has reached the classical completeness, that is at least 75% of students reach a minimum score of 70 ; (2) the average of class of mathematics literacy skill in the PMRI learning with blended learning is better than class with expository learning.

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