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Analysis of Mathematical literacy Ability Viewed From Students' Mathematics Self-concept Based on Gender Differences on IMPROVE Learning with PMRI Approach

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Abstract

This research was aimed to know the effectiveness of IMPROVE learning with PMRI approach and to describe student's mathematical literacy ability based on their Mathematics self-concept and gender. The subjects of this study were the students of class VIII.4 as the experimental class and VIII.5 as control class. This research was conducted in SMP Negeri 2 Lubuklinggau South Sumatera in the academic year of 2017/2018. The result of this study showed that IMPROVE learning with PMRI approach is effective. In the aspect of the mathematical literacy process, female students with high mathematics self-concept is excellent in seven aspects, male students with high mathematics self-concept master in six aspects, women and men students with moderate mathematics self-concept master in the six aspects well, female students with low self-concept mathematics excellent in seven aspects, men with low mathematics self-concept mastered the five aspects well, and the last, female and male students with very low mathematics self-concept each mastered two aspects and five aspects.

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INTRODUCTION

Mathematics is something that cannot be separated from education because mathematics is a lesson that must be learned at every level of education. It cannot be denied that mathematics is the basis of all technological knowledge and development in the world, this is in line with the disclosed National Council of Teachers of Mathematics (in Walle: 2008) that abilities in mathematics will open the door to a productive future, this means weak in mathematics means letting the door close. The achievement of mathematical success is not only seen based on the National exam result obtained by students in Indonesia nationally but more than that through international assessments. In the international arena, Indonesia is still classified as a low quality of education. This can be seen from the various results of international assessments, including the Program for International Student Assessment (PISA) which is a test conducted by the Organization of Economic Co-operation and Development (OECD) which takes place every three years assessing the knowledge and skills of students aged 15 years (OECD, 2017). PISA measures reading ability (reading literacy), science (science literacy), mathematics (mathematics literacy), problem-solving, and finance (financial literacy). The results of the PISA assessment of student literacy abilities in 2006 ranked Indonesia 50th out of 57 participating countries, then in 2009, Indonesia's position was in the 61st position of 65 participating countries (OECD: 2007, OECD: 2010). Then Indonesia's worst position occurred in 2012, which was ranked 64th out of 65 countries that participated in PISA (OECD: 2014), and in 2015 Indonesia was ranked 62 of 70 PISA participants (OECD: 2017).

Ojose (2011) argues that mathematical literacy is the knowledge to know and apply basic mathematics in everyday life. Mathematical literacy is a human need as a basis for lifelong learning (Mahdiansyah & Rahmawati: 2014) because in individual mathematical literacy is required to be able to use reasoning skills, understand mathematical concepts, explain the mathematical meaning in the problem and solve the problems it faces. Literacy ability measured in PISA is in according to Permendiknas No. 22 tahun 2006 (Wardhani and Rumiati: 2011), the purpose of mathematics learning for primary and secondary education aims to have the following abilities: 1) understanding of mathematical concepts, explaining the interrelationship between concepts and applying concepts or algorithms, flexibly, accurately, efficiently and precisely in problem-solving; 2) using reasoning on patterns and traits, manipulating mathematics in making generalizations, compiling evidence, or explaining mathematical ideas and statements; 3) solving problems that include the ability to understand problems, design mathematical models, complete models and interpret solutions obtained; 4) communicating ideas with symbols, tables, diagrams, or other media to clarify the situation or problem; 5) having an attitude of respecting the usefulness of mathematics in life, namely having curiosity, attention, and interest in learning mathematics, as well as tenacity and confidence in problem-solving.

So many factors can be the cause of low mathematics literacy ability. Pakpahan (2016) revealed that one of the factors that influence the achievement of mathematical literacy is student identity. One of the things related to student identity is mathematics self-concept. Mathematics self-concept students or students' beliefs about their own abilities in the field of mathematics, are an important part of education and closely related to the success of learning (Marsh and O'Mara in OECD, 2013). Correspondingly, Luo, et al (2014) also revealed that there is a close relationship between mathematics self-concept students with student success in learning. Sumarmo (Hendriana: 2017) states that there are several indicators of Mathematics self-concept, namely: 1) sincerity, interest, interest: showing willingness, courage, persistence, seriousness, interest in learning, and doing mathematical activities; 2) able to recognize their own strengths and weaknesses in mathematics; 3) confidence in their abilities and success in carrying out their mathematical tasks; 4) understanding the benefits of learning mathematics, a preference for learning mathematics; 5) collaborate, be tolerant, and respect the opinions of others; and 6) social behavior: shows the ability to communicate and know how to put yourself.

In addition to internal factors that come from within students, there are also external factors that can cause students' low literacy ability. Among of them is the lack of habituation of students to mathematics literacy problems that are applied in innovative learning and can support it. Students' Mathematical literacy ability can be improved by

getting students to solve non-routine problems which has the context of mathematical literacy and presented in the form of story problems. Through non-routine problems that demand mathematical literacy ability, students will be accustomed to solving problems that require logic, reason, creativity, critical attitude and high order thinking skills (Gilfeather dan Regato, Freudenthal dalam Sanjaya, 2014), while students are only accustomed to routine problems but are not familiar with non-routine problems or mathematical literacy problems which are often in the form of story problems (Fitriono: 2015) this is similar to Ose (2017) expressed that students' ability in story problems still very low. Habituation of students to non-routine problems in learning that train students' metacognition becomes an option in an effort to improve mathematical literacy ability, where metacognition is needed in students to be able to choose, determine, and execute strategies to solve problems (Gartmann and Freinberg, 1993). One of the learning that fits to this purpose is IMPROVE learning where IMPROVE learning is a learning activity based on the acronym of IMPROVE, namely Introduction the new concept, Metacognitive questioning, Practicing, Reviewing and reducing difficulties, Obtaining mastery, Verification, Enrichment (Mevarech and Kramarski, 1997). IMPROVE is also an important learning to be applied because during the learning process students are conditioned to learn in groups so as to train active students to do question and answer so students can think critically and logically. Mujib (2016) in his study also concluded that students who obtained IMPROVE learning were better than students who received conventional learning.

In addition to using IMPROVE learning, need an approach to improve mathematics literacy ability is, an approach is needed that allows students to understand existing problems and concepts with learning that is appropriate to the context that surrounds students. This is in line with the opinion expressed by Sari (2016) which states that contextual problems can be used as a starting point in mathematics learning to help students develop their knowledge of the mathematical concepts they learn. The success of the PMRI approach has also been proven in several studies, including research conducted by Pitaloka, Susilo, & Mulyono (2013) which concluded that students taught with PMRI were completely flat and better than conventional learning. Wardono & Kurniasih (2015) also stated that real learning is an innovation in mathematics learning that can be used to improve mathematical literacy ability.

Based on the previous description, research question in this study are: (1) is IMPROVE learning with the PMRI approach effective to mathematical literacy ability?; (2) how is the mathematical literacy ability of female students with high mathematics self-concept; (3) how is the mathematical literacy ability of male students with high mathematics self-concept; (4) how is the mathematical literacy ability of female students with moderate mathematics self-concept; (5) how is the mathematical literacy ability of male students with moderate mathematics self-concept; (6) how is the mathematical literacy ability of female students with low mathematics self-concept; (7) how is the mathematical literacy ability of male with low mathematics self-concept; (8) how is the mathematical literacy ability of female students with very low mathematics self-concept; and (9) how is the mathematical literacy ability of male students with very low mathematics self-concept. The description of mathematical literacy carried out is related to the learning carried out, namely using IMPROVE learning with the PMRI approach. Gender in this study is used as a tool to classify differences in behavior, abilities, and individual characteristics. This is in line with what was expressed by Stewart & McDermott (2004) which states that gender is used to compare differences between women and men, both in terms of their personality, behavior, and abilities.

METHOD

This research is a mixed method study with post-test only control group design. The study was conducted at SMP Negeri 2 Lubuklinggau, South Sumatra using cubes and cuboids. The population of this study was all eighth grade and as a sample were students of class VIII.4 and class VIII.5. In the learning process, Grade VIII.4 students as an experimental class are taught by IMPROVE learning with PMRI approach, while class VIII.5 as a control class is taught using PBL.

Data sources in this study were students obtained from the results of the mathematics literacy ability test and the results of mathematics self-concept questionnaire. Data collection techniques consist of

interviews, tests of mathematical literacy ability, and questionnaires. The research instrument consisted of interview guidelines, test instruments in the form of tests of mathematics and non-test literacy ability in the form of mathematics self-concept questionnaires, the instruments used were validated by experts, and for the literacy ability test questions were tested first to find out the quality of the questions used. There are two data analyzes in this study, namely the prerequisite analysis in the form of normality, homogeneity, and average two-equality test and hypothesis test analysis, namely in the form of complete testing of averages, proportion test, average difference test, and proportion difference test. Whereas for qualitative data analysis passes the stages of data reduction, data presentation, and conclusion. Before analyzing qualitative data, for the first, students are classified by the categories of mathematics self concept from each gender. Then the description of mathematical literacy abilities is based on the classification that has been carried out, there are female students with high mathematics self-concept, male students with high mathematics self-concept, female students with moderate mathematics self-concept, male students with moderate mathematics self-concept, female students with low mathematics self-concept, male students with low mathematics self-concept, female students with very low mathematics self-concept, and male students with very low mathematics self-concept.

RESULT AND DISCUSSION

First, the analysis carried out to determine the effectiveness of IMPROVE learning with the PMRI approach. After IMPROVE learning with the PMRI approach was carried out in the experimental class, and Problem Based Learning (PBL) in the control class, both classes were given the final test of mathematical literacy ability. The recapitulation of the results of the experimental class and the control class mathematical literacy abilities is presented in table 1.

Table 1. Recapitulation of Final Test Data for Mathematical Literacy

No	Description	Experimental class	Control class
1	Average	81.18	71.29
2	The highest score	96.47	95.29
3	The lowest score	61.18	55.29
4	Standard Deviation	9.26	9.92
	Students who complete	33	19
	Students who didn't complete	4	14

Then performed the due diligence of the average mathematical literacy ability based on the calculated deadline (test value = 73.49), the average due diligence was analyzed using one sample t-test. Based on the results of the calculation of t-test obtained the value of analysis obtained the value t_{value} = 5,052 and the value of t_{table} for α = 5% and dk = 68 is 1.688. $t_{value} > t_{table}$, so H_0 is rejected. The conclusion is that the average mathematical literacy ability of the experimental class students reaches the limit.

Proportion test is a test to see the number of students in the experimental class that achieve minumum completeness area is more than 75%. Based on the results of the calculation of the proportion test obtained the value of z_{value} = 1.988 and the value of z_{table} = 1.645. $z_{value} > z_{table}$, so H_0 is rejected. This means that the proportion of students who study with IMPROVE learning with the PMRI approach is more than 75%.

The average difference test aims to see the differences in the average mathematical literacy ability between the experimental class and the control class. The data analysis was performed using Mann-Whitney Test because the data on mathematical literacy abilities of the experimental class and control class were not normally distributed. Based on the results of the calculation of the Mann-Whitney test obtained the value of z_{value} = 4,012 and the value of z_{table} = 1.645. $z_{value} > z_{table}$, so H_0 is rejected. So it can be concluded that the average experimental class mathematical literacy ability is better than the average control class mathematics literacy ability.

Proportion difference test is a test to see whether the number of students in the experimental class who reached the minumum completeness is more than number of students who reached the minumun completeness in the control class. Based on the results of the calculation of proportion difference test obtained the value of z_{value} = 3.009 and the value of z_{table} = 1.645. $z_{value} > z_{table}$, so H_0 is rejected. This means that the proportion of students' mastery

abilities in the experimental class is more than the proportion of completeness of mathematics literacy ability in the control class. Based on the analysis carried out, it can be concluded that IMPROVE learning with an PMRI approach is effective.

While, based on the results of the mathematics self-concept questionnaire, students from five categories only obtained four categories of mathematics self-concept, namely high mathematics self-concept, moderate mathematics self-concept, low mathematics self-concept, and very low mathematics self-concept consisting of female and male students. Then eight subjects were taken from each mathematics self-concept category represented by female students and male students. The results obtained for female students with high mathematics self-concept are able to master mathematics literacy well in all aspects. Students are able to recognize, understand the problem given and present the results of the solution. In addition students also make mathematical models based on known elements. Students are also able to reason and give reasons for strategies to solve problems logically. The ability of students in solving aspects is considered to be very good which is reflected in the coherence of the stages used and presented in good formal and technical language and the use of appropriate symbols. Overall the ability of students in all aspects of mathematical literacy is considered very good. This is in line with what was revealed by Ayodele (2011) which states that students 'self-concept can influence students' abilities in mathematics. Whereas male students with the same category were able to master six aspects of mathematical literacy, namely communication, mathematical, representation, reasoning and reasoning, designing problem solving strategies, as well as symbol usage aspects, formal, technical and operating languages. Male students in the high mathematics self-concept category are still not good in the aspect of using mathematical tools because students have not been able to represent images well based on the problems given. Students do not make use of ruler tools so that the images given by students are less precise in their representation.

For the moderate category of mathematics self-concept, both female students and male students mastered six aspects of literacy well. The six aspects of literacy are mathematising, representation, reasoning and argument, devising strategies for solving problems, using symbolic, formal, and technical language and operations, and using mathematical tools. As for communication skills, students have not been able to understand the problem and interpret the elements given in the questions given properly, so students need to be given practice questions that train students' communication skills so that they can understand and communicate problems properly.

The next literacy ability is for students with low mathematics self-concept category. Female students in a low category of mathematics have a very good mathematical literacy skill. Students are able to master all aspects of mathematical literacy well. it's just that the aspect of communication needs further training that students can communicate the answers to the final stages. Unlike other students, students' mathematical literacy abilities in this category are not in accordance with the level of mathematics self-concept. This can be caused by several factors. Among them are external factors, the factors that come from outside the student which causes mathematics students to be low while their mathematical abilities are high. One of them is the teaching style or learning model conducted by the teacher is not attractive to students, so students are less motivated to learn mathematics. According to Awan (2011), there is the relationship between teacher and student causes and students 'results in students' mathematical achievement. Therefore teachers also get a very important role in efforts to improve student learning achievement.

For male students with low mathematics self-concept, they do not understand the problem well, so they have the trouble to determining the problem solving steps. Male students with low mathematics self-concept often misinterpretation in understanding the problem that given so that it needs to be given literacy problems that contains aspects of communication as an exercise to improve communication skills. The ability that needs further attention is the ability of students to use mathematical tools. Students in the low mathematics self-concept category still do not care about the importance of using mathematical tools to help represent questions in the form of pictures to facilitate problem solving. While the mathematical aspects, representation, reasoning and reasoning, devising strategies for solving problems, and using symbolic, formal, and technical language and operations are considered good.

Female students in this category are only able to work on questions that contain mathematical aspects, and representations. While questions that contain aspects of communication, reasoning and reasoning, designing strategies to solve problems, using symbols, formal language, technical and operations and the use of mathematical tools have not been done well. Students are still unable to communicate the purpose of the problem and design strategies to solve problems so that the ability of students to reason and give reasons is also very limited. Whereas male students in the same category of mathematics self-concept have better mathematical literacy abilities, which are able to master five aspects, but have not been able to communicate the problem properly. It can be seen from the students' problem to understanding and choosing the information needed to solve the problem and the frequent use of symbols in the calculation operation that is used so that it affects the presentation of students using technical language that is still often wrong and the unclear formal language used. Overall students with very low mathematics self-concept have lower math literacy skills compared to other students. This is similar to Nagy et al. (2010) who says that mathematics self-concept can be used as a predictor for students' mathematical abilities, the better mathematics self-concept students, the better their mathematical abilities and vice versa.

CONCLUSIONS AND SUGGESTIONS

Based on the analysis and discussion, it can be concluded that IMPROVE learning with PMRI approach is effective and in the aspect of mathematical literacy process, female students with high mathematics self-concept are able to master seven aspects well, male students with high mathematics self-concept master six aspects, students with mathematics self-concept while women and men mastered six aspects well, female students with low mathematics self-concept mastered seven aspects, men with low mathematics self-concept mastered five aspects well, and female and male students men with very low mathematics self-concept each master two aspects and five aspects. To improve the students' achievement of mathematical literacy ability, teacher need to give more practices to the students on math literary questions. Not only in cognitive abilities, furthermore, teacher must also pay attention to the affective aspects that exist in students, especially mathematics self-concept students and establish good relationships with students so that students are motivated to love and learn mathematics to improve students' academic achievement. In addition, the teacher also needs to pay attention to female and male students' judgments on mathematics that can be assessed based on the six mathematics self-concept indicators of students, so that teachers can find the shortcomings of each individual based on their gender and find the source of the problem and improve it by fostering a positive outlook on students mathematics.

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