Analysis of mathematical literacy skills and mathematics self-efficacy of junior high school students

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Abstract. This study aims to describe mathematical literacy skills, mathematics self-efficacy and the relationship between mathematical literacy skills and mathematics self-efficacy of the grade IX students of the junior high school. The research subjects were 35 grade IX students from one of the junior high schools in Yogyakarta who had high math achievement. The results of the study are as follows, 35 students as the research subject have medium criteria in mathematics literacy skills. The result shows that the average skill of students in employing mathematical concepts, facts, and procedures has the highest average among other mathematical literacy indicators which was in the high category. The other indicators that are formulating situations mathematically, interpreting mathematical outcomes and making arguments base on mathematical information or mathematical outcomes were at medium criteria. The average of students' self-efficacy was at high criteria. The relationship between mathematical literacy skills and self-efficacy of students was at medium criteria because of the R-value of 0,428.

1. Introduction

The era globalization provides many demands in various sectors, one of which is in education. Education in the era globalization is required to equip students with various abilities to face global competition. There are at least four abilities that students need to have in facing the global era: 1) Investigating outside their environment; 2) Understanding the point of view of himself and others; 3) Expressing the ideas possessed to various characteristics of people effectively; 4) Taking actions needed to solve problems [1]. Based on these four capabilities, it can be seen that the abilities needed in the global era are related to the ability to solve problems, including problems related to mathematics in life and to communicate the solution.

Mathematics learning in Indonesia emphasizes the importance of the ability to solve problems in life. One of the aims of mathematics learning is for students to have problem-solving skills that include the ability to understand problems, design mathematical models, complete models and interpret solutions obtained and so that students have an attitude of respect for the usefulness of mathematics in life, namely having curiosity, attention, and interest in learning mathematics, as well as

tenacity and confidence in problem-solving [2]. The ability to solve problems and use mathematical knowledge that is owned is closely related to mathematical literacy skills.

In simple terms, mathematical literacy can be understood as the ability to apply mathematics in life. According to the Organization for Economic Cooperation and Development (OECD), mathematical literacy is a person's ability to formulate, implement and interpret mathematics in various contexts [3]. Mathematical literacy shows a person's ability to use knowledge and skills rather than merely mastering it theoretically [4]. Mathematical literacy is closely related to mathematical modeling, namely the ability to formulate mathematical models, use knowledge and skills to work on models, and interpret and evaluate results [5].

Facing the era of globalization, mathematical literacy skills will help students to solve problems around them with mathematics. In addition, someone who is mathematical literate can estimate, interpret data, and solve various everyday problems in various situations, and can communicate them [6]. That is why by having good mathematical literacy, students will be able to solve various daily problems.

According to the OECD, there are three mathematical processes that describe how one connects the context of a problem with mathematics and resolves the problem [3]. The three processes are: (a) formulating the situation mathematically; (b) using concepts, facts, procedures, and mathematical reasoning; (c) interpreting, applying and evaluating the results or solutions of mathematical problems. Another opinion stated that mathematical literacy includes four processes, namely representing, manipulating, reasoning, and problem-solving [7].

Another skill that is important for students is self-efficacy. Self-efficacy possessed by students will help students in solving problems [8]. Self-efficacy is a belief that someone has that he is able to carry out an action and achieve specific goals [9]. Self-efficacy can also be interpreted as the belief a person has about what he can do and the confidence that results can be achieved because of his actions [10].

Someone who has good self-efficacy will easily adjust to difficult situations. When students work on math tests, the confidence they experience while reading and analyzing a problem determines the length of time and effort they need to solve the problem [11]. Self-efficacy of students has an influence on their attitude in the selection of tasks, persistence in tasks, and response to failure [9]. If students have high self-efficacy, they will set higher goals, have less fear of failure, and will find new strategies when they fail [12].

Self-efficacy has three dimensions, namely magnitude, generality, and strength [13]. Magnitude is related to the level of difficulty encountered in completing a task. Generality is related to self-efficacy shown by individuals in sharing different tasks. Strength is related to how the power of self-efficacy has. Self-efficacy can be seen from how resilient and tenacity a person has in completing a task he has.

Based on the above explanation, the ability of mathematical literacy and self-efficacy toward mathematics are two important things that influence student success. This research is expected to provide information regarding mathematical literacy skills and self-efficacy of junior high school students. Therefore, the purpose of this study is to describe the ability of mathematical literacy, student self-efficacy towards mathematics and to understand the relationship between mathematical literacy skills and self-efficacy of junior high school students.

2. Method

This type of research includes survey research. This study analyzed mathematical literacy skills and self-efficacy of junior high school students, especially IX grade students. This study began in August 2018 to October 2018. The population of this study was grade IX students from one of the junior high schools in Yogyakarta who had high math achievement in the 2018/2019 school year. The sample used in this study were 35 students.

Data collection techniques conducted in this study were tests and questionnaires. Collecting data to measure mathematical literacy skills are obtained by using mathematical literacy questions in the form of an essay. Whereas to measure students' self-efficacy towards mathematics using a questionnaire.

The instrument used to measure students' mathematical literacy skills consists of 5 items in the essay. Each item includes four indicators of mathematical literacy. The four indicators of mathematical literacy are formulating situations mathematically; employing mathematical concepts, facts, and procedures; interpreting mathematical outcomes; making arguments base on mathematical information or mathematical outcomes.

While the instrument used to measure student self-efficacy is a self-efficacy questionnaire. Self-efficacy questionnaire consists of 13 statement items from 4 indicators of self-efficacy. The indicators used are the belief in the ability to understand the mathematical material, the belief in the ability to complete tasks related to mathematics, confidence in achieving goals' learning mathematics, and the belief in resilience and tenacity learning mathematics.

3. Results and Discussion

This study was to determine how students' mathematical literacy abilities, student self-efficacy, and whether there was a relationship between mathematical literacy skills and mathematics self-efficacy of junior high school students. In this study, information was obtained through the result of tests of mathematical literacy and self-efficacy questionnaires. Based on Table 1, it can be seen that students' mathematical literacy abilities are in the medium criteria.

Table 1. Description of Overall Students' Mathematical Literacy

Descriptions	Result
Criteria	Medium
Average	26,77
Highest possible score	55
Lowest possible score	0
Highest score achieved	41
Lowest score achieved	16

Table 2. Frequency Distribution and Percentage of Students' Mathematical Literacy

	Very high	High	Medium	Low	Very low	Total
f	0	7	20	8	0	35
%	0	20	57.14	22.86	0	100

Table 3. Description of Indicators of Mathematical Literacy Skill

Indicators	Percentage	Average	Criteria
Formulating situations mathematically	37.7%	5,66	Medium
Employing mathematical concepts, facts, and procedures	49.9%	7,48	High
Interpreting mathematical outcomes		7,89	Medium
Making arguments base on mathematical information or mathematical outcomes	38.3%	5.74	Medium

The percentage and criteria in the first indicator show that the students' ability to identify and understand the problem given is quite good. In addition, this shows that students' ability to represent problems in mathematical situations (using variables, symbols, images) is quite good. This shows that students can understand the problem thoroughly. Whereas in the second indicator, employing mathematical concepts, facts and procedures are at high criteria. This shows that students have good ability in using mathematical concepts, facts and procedures that they know in understanding the problems given. Not only that, it shows that students also have a good ability in designing and

implementing strategies to find mathematical solutions. Whereas the third indicator is in the criteria of the medium. This shows that students' abilities are quite good at interpreting mathematical results back to the real world context. As for the ability to provide arguments based on mathematical information or mathematical results, students have good abilities.

Based on the results of the analysis it can be seen that many students who have good abilities determine important information from the problem presented. Unfortunately, even though they can determine important information they still have difficulty in representing the problem, especially in the form of images. This is in line with research that results in many student weaknesses in fact number skills, visual-spatial skills, and information skills [14]. However, making the right mathematical model can help students solve problems [15]. Mathematical literacy problems can be more easily solved if students can determine the appropriate procedure. That is why students must be able to choose important information and model it [16]. According to Garderen, someone who has difficulty in visual-spatial skills can cause difficulties in distinguishing and connecting information that exists meaningfully [17]. Therefore, it is important for teachers to help students formulate situations mathematically.

Besides formulating situations mathematically, many students have difficulty making arguments. This is in line with research that shows that many students have a low ability to provide reasons related to the selection of strategies in solving problems and drawing argument from the results of problem solving [18]. Even though they have been able to determine the solution from a problem, students may not be able to provide the right reason for using a procedure or even why they can make conclusions.

The self-efficacy questionnaire used in this study consisted of 13 items from four indicators. The statement consists of 8 positive statements and 5 negative statements. The average self-efficacy score is 46.7. It can be concluded that the self-efficacy category is high. This means that students have good confidence in their ability to understand mathematical material, complete tasks related to mathematics, succeed in achieving goals in mathematics learning and believe that they will be able to have resilience and tenacity in mathematics learning.

Table 4. Description of Overall Students Self-Efficacy.

Descriptions	Result
Criteria	High
Average	46.7
Highest possible score	65
Lowest possible score	13
Highest score achieved	64
Lowest score achieved	25

Table 5. Frequency Distribution and Percentage of Student Self-Efficacy Criteria.

	Very high	High	Medium	Low	Very low	Total
f	11	12	9	3	0	35
%	31.43	34.29	25.71	8.57	0	100

Furthermore, after knowing how mathematical literacy skills and self-efficacy students will find out how the relationship between mathematical literacy skills and student self-efficacy. To find out how much the relationship between mathematical literacy skills and student self-efficacy, statistical tests were used. Statistical used is Pearson Product Moment. Based on the R-value obtained, it can be seen that the correlation for the relationship between mathematical literacy and self-efficacy is included in the medium relation criteria.

Table 6. Correlation of study Variables ($n = 35$)

Variables		Math Literacy	Self-Efficacy
Math Literacy	Pearson Correlation	1	0.428
	Sig. (2-tailed)		0.010
Self-Efficacy	Pearson Correlation	0.428	1
	Sig. (2-tailed)	0.010	

Self-efficacy helps students to develop mathematical skills in mathematical problem solving [3]. Problem-solving is part of mathematical literacy so that in other words self-efficacy is also related to mathematical literacy. In addition, self-efficacy in mathematics is considered a student's ability to solve mathematical problems or become successful in mathematics tests [4]. Research shows that self-efficacy has a significant influence on problem-solving abilities [19]. Hoffman's research shows that students who have high self-efficacy have better problem-solving skills than students with low problem-solving skills [20]. In difficult situations, students with low self-efficacy tend to be easy to give up, while students with high self-efficacy will try harder to overcome the challenges that exist [21]. Individuals with low self-efficacy abilities will stay away from difficult tasks as they view the task as a threat to them [8]. Collins's research shows that students who have higher self-efficacy exhibit sharpness in mathematical calculations and show greater persistence in the work of difficult mathematical problems than students with low self-efficacy [22].

4. Conclusion
Based on the results and discussion, the mathematics literacy skills of junior high school students are in the criteria of being moderate. Students' ability to apply concepts, facts and procedures are at high criteria. However, many students find it difficult when formulating situations mathematically and making arguments based on information or mathematical results obtained. Self-efficacy of students towards mathematics is high. Students as a whole have had a good belief in their abilities in mathematics, their success in mathematics learning and their resilience and tenacity when obtaining difficulties in mathematics. Based on the results of statistical tests, it was found that mathematical literacy abilities and self-efficacy of junior high school students had a moderate correlation. Therefore, the suggestion for further research is to find out other factors that might influence the ability of mathematical literacy and self-efficacy as well as how efforts can be made to help students develop both of these things.

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