Improving Year 5 students’ learning outcomes in problem-solving through mathematical literacy

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Abstract Solving mathematics word problems remains as difficult tasks for elementary students. One way to overcome this problem is by applying mathematical literacy. This study aimed to describe teachers’ ability in managing the learning process and determine the learning outcomes of Year 5 students. This study employed a qualitative approach, specifically Classroom Action Research. The study design was carried out in three cycles. The data collection related to teachers’ ability in learning management was conducted by observation, was analysed using descriptive statistics, with the category of “poor, fair, average, good, and excellent”. On the other hand, students’ learning outcomes were measured by a mathematics test, were analysed by using percentages and referred to the school's minimum criteria of mastery learning. The results showed the increase in teachers' learning management ability, the average of cycle I, II and III was 4.3 (good), 4.6, and 4.8 (excellent) respectively. Besides, the students’ learning outcome was also improved, the average of cycle I, II and III were 62.36 (23.5% of classical mastery learning), 66.18 (58.8% of classical mastery learning), and 85 (70.6% of classical mastery learning) respectively. The results showed that mathematical literacy could improve Year 5 students’ learning outcomes in problem-solving.

1. Introduction
Mathematics learning in elementary schools, as a part of the Indonesian educational system, aims to equip students with the applicable abilities through mathematical activities. So, there is a harmony between learning emphasising the conceptual understanding and skills to solve mathematical problems as well as problem-solving. Students' difficulty in solving mathematical word problems are reading and understanding the problem [1]. This statement suggests that learning mathematics in elementary schools also aims to train students to solve problems. Problem-based mathematics learning will motivate students to learn mathematics more deeply. By having a mathematical problem, students will try to find a solution through various mathematical problem-solving strategies [2]. Good problem solvers monitor their thinking regularly and automatically. They are deliberate about their problem-solving action. They realize when they do not fully understand and they make conscious decisions to switch strategies, rethink the problem, search for related content knowledge that may help, and so forth [3]. Exposing students to some challenges since elementary school is expected to produce high-quality human resources in Indonesia who can compete with other nation.

However, some survey results show that Indonesian students’ problem-solving skill is poor. The results of the Program for International Student Assessment (PISA) reported that Indonesia’s rank is still below most countries for years. Indonesia ranked 64th out of 72 countries. The Trends in International Mathematics and Science Study (TIMSS) in 2015 also recorded Indonesia at the position
of 45 out of 48 for science, and 45 out of 50 for mathematics [4]. Student problem-solving ability is highly influenced by the teaching and learning process that they experience [5]. These facts indicate that the ability of Indonesian students in problem-solving that requires investigating, reasoning, communicating, solving and interpreting problems in a variety of situations is far from satisfactory. To better understand a problem, you may wish to exemplify the problem by considering various special cases. This may suggest the direction or perhaps the plausibility of a solution [6].

The students need the ability to acquire, select, and manage information to survive in unstable, uncertain, and competitive conditions. Such ability requires critical, systematic, logical, and creative thinking. These abilities are all summarised in mathematical problem-solving. One way to facilitate students in solving mathematical problem-solving is by implementing mathematical literacy. The term mathematical literacy used in this study is the activity of writing steps to solve mathematical problems. The steps of solving mathematical problems are: (1) understanding the problem, (2) planning the solution, (3) solving the problem according to the plan, and (4) rechecking [7-9].

Mathematical literacy is the ability of a person to formulate, use, and interpret mathematics in a variety of contexts [10]. This also includes students to think mathematically and use procedures, concept, and facts in explaining a variety of phenomena. The finding of a study conducted by Hunter and Johanning [11] reported that when students are taught mathematical literacy, they can construct their understanding as their mathematical communication skills increase. Thus, mathematical literacy can help students in solving various mathematical problems [11,12].

This expectation is very different from the real conditions in the elementary schools in Banda Aceh. A finding during the 2018 lecturers visits to schools was that students did not write down the steps while solving mathematical word problems. It can be seen from the worksheet that the students did not write the information that is given and asked in the problem. Thus, many students experienced difficulty in solving mathematical word problems correctly. Therefore, to improve students’ understanding of problem-solving is by implementing a mathematical literacy.

Based on the above problems, the research question of this study was how to improve students’ learning outcomes and teachers' ability in learning management by implementing mathematical literacy in Year 5 problem-solving in one of Banda Aceh Elementary School?.

2. Method
This study used a qualitative approach, in particular, Classroom Action Research (CAR). The implementation of the action for each lesson was done based on the stages of action research, namely, planning, action, observation, and reflection. The action in this study used mathematical literacy with 18 mathematical problem-solving strategies in elementary schools [13].

Three out of 18 suitable mathematical problem-solving strategies were selected for Year 5 students. This action research was conducted in three cycles. Cycle I used the guessing and rechecking strategy, cycle II employed drawing or the modelling strategy, and cycle III utilized the calculating strategy.

The subjects of this study were 34 Year 5 students in one of the Elementary Schools in Banda Aceh, consisting of 14 boys and 20 girls. The data collection of the Teacher's Ability Level (TAL) in learning management was done through observation. Whereas, students learning outcomes were measured by a test. The observation data were analysed using descriptive statistics with various categories. The description of TAL based on the average scores were as follows: poor (1.00 ≤ TAL <1.50), fair (1.50 ≤ TAL <2.50), average (2.50 ≤ TAL <3.50), good (3.50 ≤ TAL <4.50), and excellent (4.50 ≤ TAL ≤ 5.00) [14]. Moreover, the test results of students' problem-solving ability were presented using percentages and referred to the minimum criteria of mastery learning in the school. The individual minimum criteria of mastery learning were ≥ 71, and the classical minimum criteria of mastery learning were ≥ 85%.

3. Results and discussion
The classroom action research was carried out in three cycles which were adjusted to the school learning schedule for two weeks. The activities included a collaboration between lecturers, university students,
and teachers. The lecturer acted as a teacher, while the students and the teachers were the observers. The summary of the data analysis results is presented in Table 1.

| Criteria                              | Cycle I | Cycle II | Cycle III |
|---------------------------------------|---------|----------|-----------|
| The average of students’ learning outcomes | 62.36   | 66.18    | 85        |
| Classical mastery learning            | 23.5%   | 58.8%    | 70.6%     |
| Teachers’ ability level               | 4.3     | 4.6      | 4.8       |

Table 1 shows that there was an increase in both students’ learning outcomes and teachers’ ability in learning management in each cycle. The action of cycle I used problem-solving activities using mathematical literacy with guessing and rechecking strategies. The students neither understood nor implemented the problem-solving stages explained by the teacher. Thus, the average of students’ learning outcome was 62.36. The results showed that only 8 out of 34 students who reached at least the minimum criteria of mastery learning in problem-solving (≥ 71) or the classical mastery learning was 23.5%.

The action in cycle II was solving the problems through mathematical literacy by drawing or modelling strategy. The learning process in this cycle indicated an increase in students’ activities since they have begun to understand the steps explained by the teacher. In the learning process, the teacher also controlled the students’ group activities more frequently and repeated the explanation if the students did not understand the content. Students’ learning outcomes in this cycle improved; the average was 66.18. Twenty students satisfied at least the minimum mastery learning criteria or the classical mastery learning was 58.8%.

The action in cycle III was by implementing the calculation strategy. The results in this cycle showed a very effective learning process and active group work. It had a substantial influence on students’ learning outcomes; the average value was 85. Twenty students fulfilled the individual minimum criteria for mastery learning. However, classical mastery learning was 70.6%, meaning that it did not reach the school target of ≥ 85%.

Based on the reflection results in each cycle about a teacher's ability in managing the learning, it showed in cycle I that some indicators of activity types needed to improve. For instance, teachers were too fast in instructing the learning materials to students and the language used was too advanced for elementary school students. Another weakness in the learning process was related to class management. The teacher was lacking in evenly controlling their students in each group work. In cycle II, the teachers could manage their speech speed, use simpler language, and handle their noisy students well. Besides, in cycle III, the process of learning management was more effective, either in explaining the materials to the student or classroom management. The improvement have a positive impact on the student learning outcomes; some students had perfect scores. This finding in line with Vitoria L, Monawati (2016) that students ability to re-check improved. When re-checking their answer, they made sure that they had answered the problem satisfactorily.

Teacher’s ability in managing the learning process was increasing continuously from cycle I to cycle III. Some factors contributed to the teacher’s achievement in managing the learning is student worksheet provided and the appropriate materials designed to meet the student’s ability so that they could to learn independently. Teacher’s achievement in teaching depends not only on mastering the materials and the learning strategy but also the other facilities and infrastructure supporting the teaching and learning process.

4. Conclusion
Based on the results, it can be concluded that student learning outcomes in solving questions related to problem-solving through mathematical literacy improved in each cycle. The average of cycle I, II, and III were 62.36 (classical mastery learning of 23.5%), 66.18% (classical mastery learning of 58.8%), and
85 (classical mastery learning 70.6%) respectively. As for the teacher’s ability in managing the learning process in each cycle also increased. The average of cycle I, II, and III were 4.3 (good), 4.6 (excellent), and 4.8 (excellent) accordingly.

Based on the findings of the research, it is recommended to all teachers of elementary school both in the early grades and in the higher class to apply mathematics learning by emphasizing problem-solving approach through mathematical literacy.

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