An action research increasing learning outcomes on fractions of 4th Grade students through RME

Yurniwati1*, Ratih Purnamasari2
1PGSD, Universitas Negeri Jakarta, Jl. Rawamangun Muka no 1, Rawamangun. Jakarta, Indonesia
2PGSD, Universitas PAKUAN, Jl. Pakuan, 16143. Bogor, Indonesia
*yurniwati@unj.ac.id

Abstract. The purpose of this study is to improve the performance of grade 4 students in fractions through Realistic Mathematics Education (RME). This research was conducted at SDN Cilendek Timur 2 Bogor, Indonesia. The research method used is Classroom Action research with Kemmis and Taggart model, which consists of planning, action, observation, and reflection. This study consists of three cycles. The percentage of students who achieved fraction score more than or equal to 70 in the first Cycle was 12.5%, in the second Cycle was 56.5%, and in the third Cycle was 92%. The activities of teachers and students in accordance with the learning steps with RME reach 92.5% at the end of Cycle III. So it can be concluded that RME can improve student learning outcomes in fractions. Also, RME increased students mathematics attitudes

1. Introduction
Mathematics is a universal science that has an important role in various disciplines and advances the human mind. Rapid development in all fields is based on the development of mathematics. Mathematics needed to be given to all students starting from elementary school to equip learners with logical, analytical, systematic, critical, and creative thinking, and collaboration. These competencies are necessary so that students can have the ability to acquire, manage, and utilize information to survive in an ever-changing, uncertain, and competitive state.

However, in school learning, despite many efforts made by educational experts, it turns out that mathematics achievement in Indonesia still below average [1]. One such problem is that mathematics is often regarded as a very difficult subject for students. The negative effect of this view is that there are many students who already feel antipathy with mathematics before they learn math. Student’s difficulties in learning mathematics are verity including conceptual and procedural knowledge of fractions [2]. Based on interviews with 4th Grade teacher at SDN Cilendek Timur 2 Bogor, fraction is very difficult for student to understand. Among 25 students, only about five students can really understand despite being taught repeatedly, and if given a test both formative and summative test, more than half of students score are below an average score.

As Indonesian Curriculum has mandated that in every opportunity, mathematics learning should begin with the introduction of contextual problem, attention to student development, teachers as facilitators promote students construct mathematics concepts. However, in fact, based on observation of mathematics learning process, it is still teacher as center of learning proces. Students just learned procedure knowledge. For example, the addition and reduction of the fractional students are taught to solve the problem with different denominators to equate the denominator first, while the same denominator is taught to directly add or subtract the numerator. Similarly, on fraction multiplication students multiply the numerator with the numerator and denominator by the denominator and on the fraction division students are taught to solve the problem by reversing the denominator position and the divisor. Sometimes students just memorize the procedure.
Therefore, learning mathematics should be appropriate to student’s development. Students learn from real life situation, hands-on experience, an in social context and joyful learning. The main point is students construct knowledge by his/herself, transfer or able to apply the mathematical concept in everyday life [3].

One of the mathematics learning models that able to make students find their own concept is Realistic Mathematics Education (RME). RME takes mathematics as human activity to the classroom and lets students explore a real-world problem and make mathematics meaningful and fun [4]. RME have six principles that are: a) activity principle, students confront to real situation problem; b) reality principle: students working on context problem; c) Level principle, students pass through various levels of understanding; d) intertwinement principle, the domains within mathematics cannot be separated; e) interaction principle, students learn in collaboration; f) Guidance principle, teacher steer the learning process [5]. Realistic learning also greatly considers students’ level of ability, facilitates solving mathematical problems without using standard (algorithmic) solutions.

Some preliminary studies in some countries show that RME improves student's reasoning ability [6], cognitive achievement [1], intuitive skills [7], mathematical understanding and problem-solving [8]. Knowing the successful implementation of RME in other countries, it is necessary to try the implementation of RME in Indonesia, especially in SDN Cilendek Timur 2 Bogor. Therefore, a classroom action research is conducted in order to find out how to improve student-learning outcomes in fractions through the RME model.

2. Method

This research was conducted at SDN Cilendek Timur 2 Bogor on 4th Grades students. The research used Action Research method with Kemmis and Taggart model, consist of 4 stages, there is: a) Planning; b) Action; c) Observation; and d) reflection. The study was conducted in three cycles.

Research data consist of observation data and achievement test. The observational data on the action was the students' learning activities and the teacher's actions each cycle during the action activity using observation sheet. Achievement test obtained using essay. Both data analyzed by descriptive statistics

3. Result and Discussion

In cycle I, the implementation of learning by teachers still has many shortcomings. Even so, in cycle II the teacher has been able to optimize its performance which also impacts on the Minimum Passing Criteria student activeness. Optimization is more perfect when the action has entered the third cycle. Improving teacher performance has a positive impact on students' activity in each cycle. Student's activity in accordance with what has been done by the teacher. For example, when the teacher does not direct the student to associate the concepts being studied with other mathematical concepts, the student does not. Similarly, when the teacher fails to condition the student to explain the answer by drawing the answer on the board, the student does not do it. It can also be seen if the percentage of realistic approach stages that have been done by the teacher on the observation sheet with which has been implemented by the students in each cycle, as follows:

<table>
<thead>
<tr>
<th>Table 1. Learning Activities Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspect</td>
</tr>
<tr>
<td>Teacher activities</td>
</tr>
<tr>
<td>Students activities</td>
</tr>
</tbody>
</table>

Table.1 above shows that if teachers activities increased the student activeness also increase. This data proves how important the role of teachers in the learning process. Student engagement will improve students learning outcomes. The research founding appropriate to Freudental theory, that learning mathematics will be successful if the learning of mathematics is made as a human activity [5].
This proves that mathematics is not a complete set of rules or attributes that students must learn, mathematics is not a ready subject for students, but a dynamic lesson that can be learned by doing.

Based on the results of the tests on each cycle, student learning outcomes about fractions as follows:

Table 2. Student Test Score on Fraction

<table>
<thead>
<tr>
<th>Test score</th>
<th>Cycle I</th>
<th>Cycle II</th>
<th>Cycle III</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score ≥ 70</td>
<td>Sum 3</td>
<td>% 12,5</td>
<td>Sum 13</td>
<td>% 56,5</td>
</tr>
<tr>
<td>Score &lt; 70</td>
<td>Sum 21</td>
<td>% 87,5</td>
<td>Sum 10</td>
<td>% 43,5</td>
</tr>
</tbody>
</table>

Student learning outcomes increase along with teacher performance improvement and student activeness. Neither is the case in cycle III. In the third cycle, students learning outcomes also increase, this is because teachers have been able to implement improvement plans in cycle II.

Several factors that influence the increase of the student learning results are interest, motivation, creativity, cognitive ability, and teacher role as facilitator. Research with the implementation of RME shows that the interest and motivation of students in solving each problem are very high in each cycle. This happens because there is a principle of using context.

Modeling principle of RME also increased students interest and motivation. This research uses concrete model and image model. At the time of division of fractions, the students do the division by using the cake and then proceed with the distribution of the cake image. Students appear to perform activities with enthusiasm.

During the three cycles of research, the students' progress in the conceptual acquisition was apparent. At first, the students have not understood the concept of division. In the 1st Cycle of day one, the students divide the circle cake into 6 sections. Here are the results of student work.

Figure 1. Figure of dividing circle in 6 part.

In Figure 1, the size of circle dividing is not the same and student divide circle into 5 triangles. In this case, the student has not understood the concept of division correctly. But on the day two, most students can do the distribution of the cake correctly, as shown in the following figure:

Figure 2. Dividing circle in 2 part an 4 part
Figure 2 shows students can do the division correctly because students do themselves and experience the learning process with objects. In addition, there is communication between students that allows students who are more expert to direct other students. Communication between students also makes students more confident to ask and share information. In the formation of the concept of addition of fractions of students do not get much trouble. Because they have understood the concept of fractions and the concept of the sum of numbers. Some of the work is presented in the following picture:

In the principle of using the model the students are given learning materials, so they use it to build their concepts. Students are free to manipulate learning media to construct knowledge and mathematics understanding and these findings consistent with the findings of Karaca and Oraya that RME improves student learning outcomes [9].

Principles of students’ use of construction and the principle of interactivity also contribute to increasing interest and motivation among students to be motivated to display better reports from other peers. The use of students' constructs has been able to generate children's activities by training students to work on their own or to be engaged during the lesson. This finding is consistent with the findings of July, Suwarsono, and Juniati that the students’ experience of using concrete objects makes it easier for students to understand the fractions [2], [10].

The research that has been conducted proves that the meaningfulness of mathematical concepts is the main concept of realistic approach of mathematics. Student learning process will only happen if the knowledge (knowledge) studied is meaningful for the students. A knowledge will be meaningful for the students if the learning process is implemented in a realistic context or problem.

4. Conclusion

Based on result and discussion, the conclusion is: 1) RME increased students conceptual and procedural knowledge in fraction; 2) RME increased students attitude toward mathematics; 3) fractional contexts using stories in everyday life related to toys or student favorite foods are more appealing to students; and 4) the group presentation trained students to speak in front of their friends also trained students to analyze their friends’ opinions.

5. Acknowledgments

We would like to express our appreciation and thanks to Directorate of Research and Development – Ministry of Research, Technology and Higher Education (Ristekdikti/MoRTHE) for financial support for this research. And we would to thanks to colleagues who contributed to the research.

6. References


