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THE APPLICATION OF REALISTIC MATHEMATICS EDUCATION (RME) ON FRACTION MATERIAL IN THE SECOND GRADE OF ELEMENTARY SCHOOL

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Abstract

Many students consider mathematics as a difficult subject. Mathematics is often considered a scary subject. Therefore, teachers must innovate with fun learning methods for students. The purpose of this study is to determine (1) the implementation of Realistic Mathematics Education (RME) in the mathematics subject of fractions for grade 2 at SD Negeri 3 Kadipiro, (2) the impact of the implementation of Realistic Mathematics Education (RME) in the mathematics subject of fractions for grade 2 at SD Negeri 3 Kadipiro. This study is a qualitative study with a case study approach. This research was conducted at SD Negeri 3 Kadipiro Bantul. Data collection was carried out through interviews, observations, and documentation to determine the reflection of learning and follow-up of the educators in mathematics learning activities. The results of this study are (1) the implementation of Realistic Mathematics Education (RME) in the mathematics subject of fractions for grade 2 at SD Negeri 3 Kadipiro has been able to improve the students' learning achievement, (2) the implementation of RME has been able to make the students actively involved in the learning activities so that they are able to understand the learning material better.

Keywords: character education; elementary school; realistic mathematics education (rme); mathematics

1. Introduction

Realistic Mathematics Education (RME) is an approach to learning mathematics by encouraging students to build their own knowledge with experiences in everyday life. RME believes that mathematics is a human activity to reason existing problems so that the solutions make sense. Learning mathematics is a process of constructing knowledge. Learning mathematics is not just training students to do mathematical calculation techniques. However, learning mathematics should encourage students to think mathematically in solving mathematical problems (Freudenthal, 1991). The process of mathematical thinking is a deep and ongoing process in understanding mathematics. The process of mathematical thinking can help humans solve their life problems. By being able to think mathematically, a person can build self-confidence in facing and solving their life problems (Mason & Stacey, 1982).

Mathematics can be understood as " *mathematizing* ", that is, human activity in organizing and interpreting something that happens in the real world mathematically

- and not just a closed system of mathematical content that is only transmitted or even discovered, then mathematical models become very important. It is impossible to talk about " *mathematizing* " without involving mathematical models (Fosnot & Dolk, 2001). Mathematical models are mind maps that people use when they are organizing, solving problems, and exploring relationships in mathematical problems. For example, when someone is thinking about numbers, they might use the number line model. When someone thinks about relationships between numbers, they imagine moving forward and backward on the number line. Another example of a model is the geometric number model. In this model, the number 64 can be changed to an 8 x 8 square or a 4 x 4 x 4 cube. Some other models are based on their use in arithmetic operations, for example the number 64 is changed to 2 to the power of 6, or 70 - 6, or 32 x 2, or 8 squared, or 128/2, or 100 - 36.

The models drawn by the early grade 1 children are generally more of a depiction of their interactions with the object than a depiction of the object. As the children develop, it will of course change. What is interesting is that children all over the world may draw some objects such as trees, flowers and suns in the same way. Eventually, the similarity of these depictions can become a universal generalization scheme (Kellogg & O'Dell, 1969). The development of mathematical models has the concept that at first children create models based on their interactions with the object. Then, the model description will change into a generalization of the concept by ignoring their interactions with the object. In this process, children should construct their own knowledge rather than being told or taught.

The RME learning design should contain a "hypothetical learning trajectory" which contains predictions of possible ways students will solve mathematical problems. These predictions serve to help teachers provide stimulation to students so that they can find the most efficient way to organize ideas to solve problems mathematically. In RME, every idea put forward by students is something that must be appreciated and developed into an efficient idea (Simon, 1995).

The context of the problem in RME plays an important role in providing stimulus to students so that they can involve them in thinking about solving a problem mathematically. The context of the problem given should be designed in such a way that it can help students construct their knowledge in mathematics, not just apply certain calculation techniques. In addition, the learning context must be able to encourage students to explore various alternative problem-solving strategies (Fosnot & Dolk, 2001). However, the context of problems in mathematics learning is often designed not in accordance with the real situation around students so that it can hinder the understanding of the context being studied (Agustina et al., 2020). If designed well, RME can present the context of learning problems according to what students encounter in real life so that it can improve students' understanding in learning (Kubra Guler, 2018). Other studies state that RME has brought positive impacts on the development of students' reasoning, creativity, and activeness in learning (Fauzan, 2002).

A research finding states that RME designed based on the context of problems in rural areas has been able to help improve students' reasoning and communication skills (Palinussa et al., 2021). Therefore, RME can be used as an alternative solution to improve students' achievement. Other studies show that RME-based modules have

been able to improve students' communication skills so that they are very good to be applied in elementary school learning activities (Atikah et al., 2021). Then, there is also research that states that RME has been able to improve *Higher Order Thinking Skill* (HOTS) abilities (Ariati & Juandi, 2022). However, from the studies above, there has been no research that specifically examines the application of Realistic Mathematics Education (RME) to fractional material in grade 2 of elementary school. This aspect is what distinguishes this study from the previous studies and at the same time becomes a limitation of the study because the research was not carried out broadly but more specifically. This study aims to produce a picture of the application of RME to fractional material in the second grade of elementary school so that RME is worthy of being an approach choice in mathematics learning in elementary schools.

2. Methods

The research method used is qualitative with a case study approach. This study aims to analyze the existing facts so that the essence of the problem is obtained. Qualitative research emphasizes the sequence of events and the authenticity of events (Somantri, 2005). The objects of this study were grade 2 teacher (1 person) and grade 2 students (15 people) of SD Negeri 3 Kadipiro. The selection of objects was based on information that grade 2 students of SD Negeri 3 Kadipiro had difficulty in understanding fractional material. Therefore, the Realistic Mathematics Education (RME) approach was applied to help students improve their learning achievement in fractional material.

Data collection was conducted by using interview, observation and documentation techniques. Interview respondents were the grade 2 teacher and students of SD Negeri 3 Kadipiro. Meanwhile, observations were conducted during the learning activities. From the interview and observation activities, the researchers hope to obtain facts of educator's reflection and follow-up to learning activities, especially on the application of RME to students' learning achievement in grade 2 fraction material. While documentation was conducted to examine students' learning outcomes after experiencing the learning with the RME approach.

To test the validity of the data, researchers used source and technique triangulation. Source triangulation was carried out to obtain data validity by checking data with several sources. In addition, technique triangulation was carried out by collecting varied data, namely interviews, observations, and documentation (Sugiyono, 2016).

Data analysis was conducted in three stages. First, the researcher collected data containing important facts. Second, the data obtained were grouped according to the research objectives. Third, the author drew conclusions based on the data obtained so that the research objectives could be achieved (Echa Savitri & Rezi Ramadhana, 2020).

3. Results and Discussion

3.1 Fraction Learning in Grade 2

Based on the results of the class teacher's interview, most of the 2nd grade students had difficulty in learning fractions about the concept of parts of the whole.

An interesting fact is that students are very enthusiastic about the various learning tools and media used in learning (Fajri et al., n.d.; Surahmadi et al., 2016). In the mathematics learning activity about fractions, the teacher tried to use paper and scissors as a model. Paper was used to illustrate a cake. Then, the teacher gives the students a learning problem: "If I have a cake and want to divide it into 2, how do you divide it?". The students were asked to divide in various ways. The paper was cut vertically and horizontally.

Then, the teacher encouraged the students to do the same experiment with the context of the problem that the cake was divided into 3 and 4. Students looked enthusiastic about the activities carried out. The teacher walked around to make sure students were not having difficulties. When there was a group that looked like they were having difficulties, the teacher approached and gave instructions so that students could think creatively. When students succeeded in finding a way, they were encouraged to find another way.

In the next experiment, each group was given 12 pictures of cakes. They were given the context of the problem that the cakes would be given to 2 people. The teacher asked the students to think about how many cakes each person would receive. They were asked to practice how to divide them. If a group successfully completed the task, the students were motivated to find another faster way. The group that successfully completed the task was motivated to present in front of the class. Next, students were given similar tasks with the concept of dividing 1/3 and 1/4. The teacher always encouraged students to find the fastest way to solve the problem. Then, students shared their findings by presenting in front of the class.

In this learning, the teacher tried to help students built their knowledge and understanding by guiding students to find their own concepts in the material of fractions of parts of the whole. The first step taken was to introduce the basics of fractions with one object. From this concept, learning was developed by using several objects so that the expected learning target could be achieved.

In group activities, some students seemed to have difficulty solving problems. In this case, the teacher played a role in providing encouragement with a few hints to spark their creativity (Ayu Erlina & Sutarni, 2024; Febriana, 2023). A student from a group asked, "Sir, how do I do it? I'm confused?" The teacher asked, "Do you understand your assignment?" Then, the student answered, "Yes, Sir." The teacher said, "You have succeeded in making a fraction of 1/2 by dividing it vertically. I'm sure you can find another way besides that. The important thing is that when it is divided, the size is the same. Are you able to do it?" After listening to the teacher's explanation, the students felt excited and continued trying to solve the problem. In this case, the teacher played a role as a motivator so that students did not give up easily. (Maryam et al., 2023; Primasari et al., 2021).

During the presentation, some students seemed hesitant and felt less confident when speaking. In this situation, the teacher again played the role of a motivator (Novianti, Nurhayadi, et al., 2018). The teacher gave a reward in the form of a group score if there were students who wanted to do a presentation. In addition, the teacher asked all students to give a warm applause when the students wanted to do and finished the presentation. By doing that way, students are expected to feel more comfortable and confident in doing presentations.

At the end of the lesson, the teacher gave practice questions related to the fraction material. The students were asked to work individually. The purpose of this activity was to measure the level of students' absorption of the material being studied. Based on the results of the practice questions, the average class score was 68. This shows that the class average was still below the Minimum Completion Criteria (KKM) score of 70. For this reason, it was necessary to improve learning in the next meeting.

3.2 Self-Reflection and Learning Improvement

After conducting the learning reflection activity, the teacher concluded that learning improvements were needed to be designed. The average results of the practice questions that were still below the KKM showed that learning improvements were still needed. Based on the evaluation results, the teacher argued that students needed to be given stimulation with the context of mathematical problems involving objects that they liked (Noviana et al., 2019). Therefore, the teacher decided to use jelly because he thought that the object was very popular with children and could bring good imagination to students.

At the beginning of the lesson, the teacher showed some packs of jelly and provided contexts for mathematical problems related to the jelly. The teacher told three problems they faced. First, the teacher stated that he had 24 packs of jelly. He wanted to share one third of the jelly each to Tania, Dion, and Akbar. The teacher asked the students to think about how to count them and make sure each student got an equal share. Second, the teacher had 18 packs of jelly. He wanted to give one third of the jelly to Tania, Dion, and Akbar. The students were asked for helping the teacher to think of a way to calculate the number of jelly packs received by each student with their own ideas. The teacher again conveyed that each student must get a fair share. The purpose of this activity was to stimulate the students to be able to understand the contexts of the existing problems well so that they were able to find solutions to the problems.

After ensuring that students understood the contexts of the problems, the students were asked to form groups and discussed solutions to the problems. Each group was given a paper that functioned to describe the solution to each problem. The teacher went around to ensure that all students were active in their respective groups. While going around, the teacher found one student who looked upset with his friend. He said, "Sir, he doesn't want to help with this assignment." Then, the teacher asked, "Son, is what he said true?" The student answered, "No, sir. I'm just thinking. Be patient!" Then, the teacher gave advice so that they got along with each other. The teacher suggested choosing a group leader who would be the leader of each group. The goal was the problems in each group were resolved properly. In this case, the teacher acted as a guide who had the task of ensuring that students be positive while studying (Harefa, 2020).

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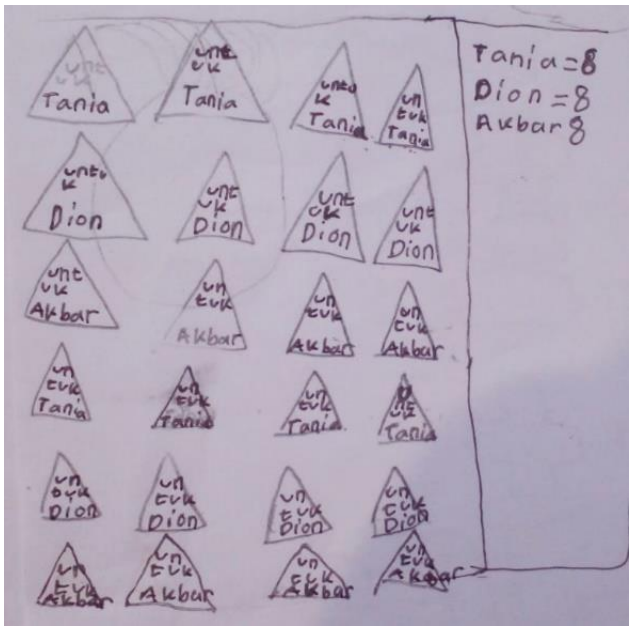

Figure 1 Result of students work: Problem regarding Tania, Dion, and Akbar

Several groups were seen to be able to solve the problem well as in figure 1. The teacher approached and asked to confirm the students' work. "Students, how did you solve the problem?", asked the teacher. A student answered, "We drew a triangle and then wrote a name in the triangle, Sir". Next, the teacher asked, "What is the function of the names?". Then, he answered, "So that he knows how much he gets, Sir". Knowing the answer, the teacher gave his appreciation for the students' ideas and creativity. After that, the teacher asked, "Students, can you find another way that is faster than before?" The teacher's goal was to motivate students to find a more practical way to count. The teacher saw that the method used by the students was correct but less efficient because it took more time. After listening to the teacher's question, the students discussed again to try to find another more practical way.

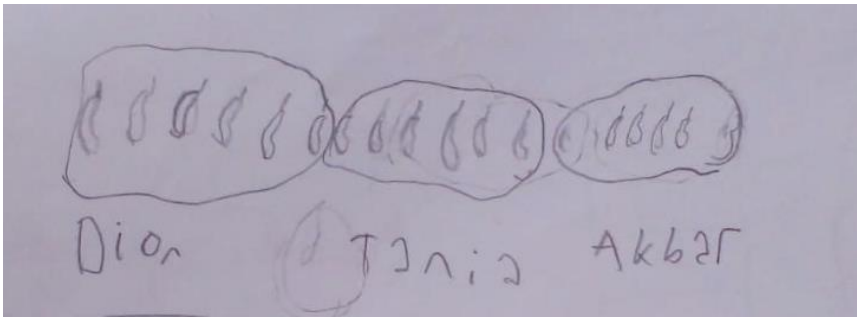

Figure 2 Another result of students work: Problem regarding Tania, Dion, and Akbar

A few moments later, the teacher found a group that was able to work in a unique way as in figure 2. The teacher asked, “How did you solve the problem?” A student answered, “We made 18 pictures and then we circled six, Sir”. The teacher asked, “What do you mean circled again?” The students answered, “That’s what we got, sir”.

The teacher smiled proudly as he said, “Great, kids. How many parts did you circle?” The students answered altogether, “Six, Sir”. Frowning, the teacher said again, “I asked how many parts, not how many pieces, son”. The students looked confused and looked at each other. The teacher then said, “Okay, students. Now you try to think again about the teacher’s question. I asked, how many parts did they each get?”. Listening to those words, the students discussed again to find the answer.

Then the teacher asked the students who had completed their work to dare to do a presentation in front of the class. Students seemed hesitant to come forward. The teacher explained the benefits of presentations. Students could share knowledge with each other and taught other students the knowledge gained in the group. The teacher also reminded the ethics when a student wanted to do a presentation. The teacher asked the student who was doing the presentation to speak in an audible voice. Then, other students must respect by listening carefully and giving applause as a form of support. After hearing the teacher's explanation, students took turns to do presentations. They shared each group's unique ways of solving problems. All were given appreciation for their efforts. The teacher advised students to think of the most practical way to solve math problems.

At the end of the lesson, the teacher again distributed questions about fractions. Students were asked to work individually. The purpose of this exercise was to measure the improvement of students' abilities after participating in the learning activities. The results of the exercise showed that the average student score was 77. This indicates a significant improvement in student learning outcomes. However, further improvements needed to be made to maximize the students’ learning achievement.

3.3 Learning with the Help of Audio-Visual Media

Next, the teacher conducted self-reflection again. The results of the reflection stated that students needed to be given more varied learning media to stimulate their imagination. The teacher designed the third meeting with the help of a learning video that was shown via an LCD projector. This learning video functions to help students understand the concept of fractions of parts of a whole in an audio-visual manner. (Anugrah & Margana, 2022). The students looked very enthusiastic watching the video about fractions. The activity was followed by a question-and-answer session about the material presented in the video.

Figure 3 Teaching using video

After watching the learning video, the teacher conveyed the context of the math problem. Students paid attention to the teacher's story about the problem she was facing. The teacher stated that he had 24 packs of jelly. She wants to give a quarter of the jelly each to Zidan, Meshach, Messi, and Dion. Then, the teacher said that he had 16 packs of jelly. She wanted to give 1/4 of the jelly to Putri. Students were asked to help the teacher count how many packs of jelly each student would get. However, before asking students to discuss in groups, the teacher made sure that all students understood the context of the problem presented.

Then, students worked in groups to discuss the solution to the problem. Students appeared to be more fluent in solving problems. This was because students already understood the context of the problem they were facing. When the teacher found one group was able to solve the problem, the teacher asked them to describe the solution they found on a piece of paper. Then, students were motivated to find other, more practical ways. Students were taught to help each other and listened to the opinions of other students.

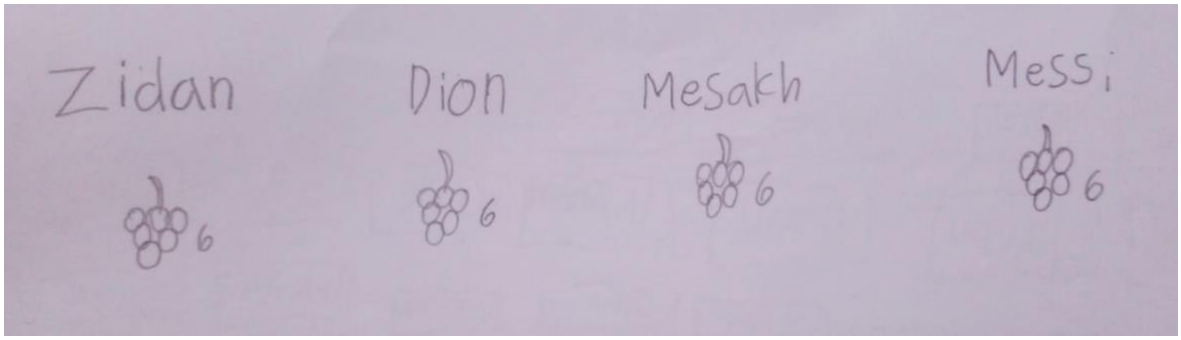

Figure 4 Result of students work: Problem regarding Zidan, Dion, Mesakh, and Messi

In the first problem, the teacher observed that a group could describe the solution with a simpler picture than before. In the previous meeting, some students needed to draw and write the name of the jelly recipient on each picture to make sure who got

the jelly. This indicated that students created a solution model based on the situation they understood but had not considered the efficiency of the solution time. After students saw other solution models from their friends, they were able to develop a more efficient solution by creating a simpler picture as shown in figures 4 and 5.

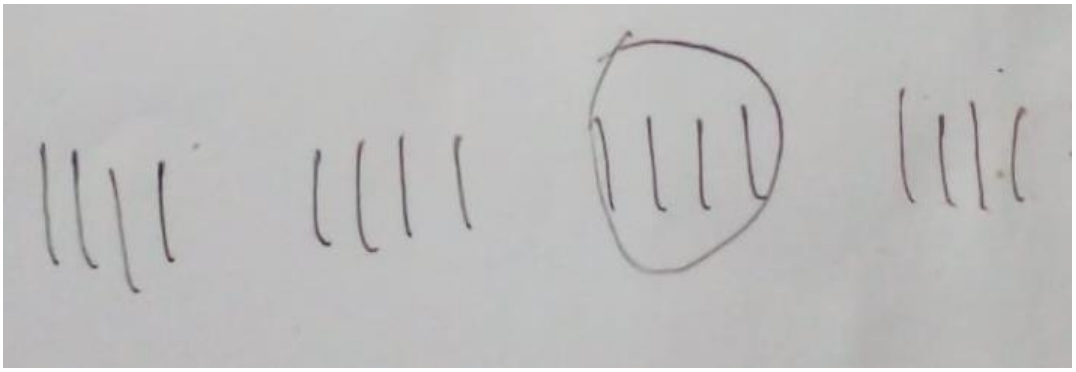

Figure 5 Another result of students work: Problem regarding Zidan, Dion, Mesakh, and Messi

After finishing, students took turns to do presentations in front of the class. Students began to look accustomed to sharing with each other. They looked more comfortable because they felt appreciated when speaking in front of the class. At the end of the lesson, the teacher gave questions to measure students' learning progress on the fraction material with the concept of part of a whole. The results of the practice questions showed an average class score of 90. This condition was very encouraging because students were able to maximize their potential.

Conclusions

The implementation of Realistic Mathematics Education (RME) in SD Negeri 3 Kadipiro in grade 2 with fraction material was carried out by giving students the opportunity to understand the context of the problem by involving objects that students often encountered in everyday life such as cakes and jelly. The goal was the students could easily get an idea of the problems they faced so that they had high imagination and creativity to try to solve problems. In addition, based on teacher reflection, students needed to be stimulated with concrete media such as real objects and learning videos so that RME-based learning could further motivated the students in learning. Based on a case study at SD Negeri 3 Kadipiro, it could be concluded that learning with RME could make the students actively involved in learning so that it had an impact on improving their learning achievement.

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