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STUDENT LEARNING RESULTS ON ADDING FRACTIONS USING THE REALISTIC MATHEMATICS EDUCATION (RME) APPROACH: AN IMPROVEMENT EFFORT

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Abstract

The low understanding of 5th-grade students at SDN Ukirsari on adding fractions became the reason for this research. The issue arises because learning approaches tend to be less student-oriented and do not utilize learning media. The RME (Realistic Mathematic Education) approach is implemented as a corrective action to address this issue. This research is Classroom Action Research (CAR) using the Kemmis and Mc. Taggart model which is characterized by each cycle including 4 stages (planning, acting, observation, reflection). To obtain data on action processes and learning outcomes, observation and test techniques are used. The targets for the success of this research were achieved in cycle II. The results of data analysis on cycle I and II learning outcomes prove that there is an increase in the percentage of students' completion after using the RME approach. Based on data analysis from observations, it can be seen that there has been a change in the quality of the learning process to become student-centered. So, the RME approach succeeded in improving the learning outcomes of 5th-grade students at SDN Ukirsari on the concept of adding fractions and was also able to encourage students to be more active during the learning process.

Keywords: RME, Fractions, Elementary school.

Abstrak

Rendahnya pemahaman siswa kelas 5 SDN Ukirsari terhadap penjumlahan pecahan menjadi alasan dilakukannya penelitian ini. Permasalahan tersebut muncul karena pendekatan pembelajaran cenderung kurang berorientasi pada siswa dan tidak memanfaatkan media pembelajaran. Pendekatan RME (Realistic Mathematic Education) diterapkan sebagai tindakan korektif untuk mengatasi masalah ini. Penelitian ini merupakan Penelitian Tindakan Kelas (PTK) dengan menggunakan metode Kemmis dan Mc. Model Taggart yang bercirikan setiap siklus meliputi 4 tahapan (perencanaan, pelaksanaan, observasi, refleksi). Untuk memperoleh data proses tindakan dan hasil belajar digunakan teknik observasi dan tes. Target keberhasilan penelitian ini tercapai pada siklus II. Hasil analisis data hasil belajar siklus I dan II membuktikan adanya peningkatan persentase ketuntasan siswa setelah menggunakan pendekatan RME. Berdasarkan analisis data hasil observasi terlihat telah terjadi perubahan kualitas proses pembelajaran menjadi berpusat pada siswa. Jadi pendekatan RME berhasil meningkatkan hasil belajar siswa kelas 5 SDN Ukirsari pada konsep penjumlahan pecahan dan juga mampu mendorong siswa untuk lebih aktif dalam proses pembelajaran.

Kata kunci: RME, Pecahan, Sekolah dasar.

INTRODUCTION

Mathematics according to Ruseffendi is a symbolic language and is a deductive science that does not accept inductive proof, mathematics also focuses on organized patterns and structures (Rachmiati, 2017). Rahman and Siagian explained that mathematics is a universal science containing numbers, numbers, and symbols which are also queens and servants of other sciences that play a role in the advancement of science and technology (Sari & Hasanudin, 2023).

Mathematics is crucial to learn because it is inseparable from human life. Mathematics serves as a tool to meet daily life needs, and without the contributions of mathematical concepts, humanity would face numerous difficulties. Hudojo states that the goals of learning mathematics can be categorized into several parts: (a) Formal goals that emphasize shaping reasoning and molding the personality of learners. (b) Material goals that focus on the ability to solve problems and apply mathematics. (c) Skills related to mathematics that can be used to solve mathematical problems, other subjects, or real-life issues and can be applied in any situation, such as critical thinking, logical reasoning, systematic thinking, objectivity, honesty, and discipline in approaching and solving problems (Susanti, 2020).

Mathematics is a science with many branches, and for elementary school levels, the concepts covered include numbers (arithmetic), geometry and measurement, as well as statistics. The concept of numbers is one of the fundamental concepts that must be mastered as it forms the basis for understanding other concepts. The types of numbers studied include counting numbers, integers, and fractions. The concept of fractions is considered more complex compared to counting numbers and integers because it represents something not whole, demanding a deeper imagination and requiring arithmetic skills in counting numbers as a prerequisite.

Conceptual errors in mathematics learning, particularly in the topic of fractions, can be caused by factors related to both teachers and students. Teacher competence greatly influences students' outcomes, interest, and motivation to learn ((Abidin & Purnamasari,

2023), (Asriadi & Wardi, 2018)). Students' learning outcomes and interest will be low if teachers lack mastery of the material and are unable to select and determine appropriate approaches, methods, and teaching media to convey abstract mathematical concepts to elementary school students, who are still in the concrete operational stage of thinking.

On the student side, one contributing factor is a lack of interest in mathematics learning. Current facts indicate that many students still perceive mathematics as difficult and unenjoyable. Research by Risman on students from SDN 04 Taeh in 2020 showed that 66.66% of students had a negative attitude towards mathematics. This negative perception can indeed influence students' learning methods and outcomes. This finding aligns with the research of Tamba and Ginting, indicating that students' views or perceptions of mathematics have a positive and significant correlation with learning outcomes (Tamba et al., 2023). In addition to the interest factor, students often memorize formulas without understanding, leading to their inability to apply these concepts in different situations (Novitasari, 2016). Bartell, Webel, Bowen, & Dyson state that understanding concepts is a fundamental goal of mathematics learning. When students grasp mathematical concepts, they can easily solve problems in mathematics classes (Radiusman, 2020).

The issue of learning related to difficulties in understanding fraction concepts is also experienced by fifth-grade students at SDN Ukirsari Bojonegara, Banten Province. According to the class teacher, the challenges faced are related to affective and cognitive aspects. From an effective perspective, most students do not yet have a good interest and motivation in learning mathematics. From a cognitive perspective, students still struggle to understand the concept of fractions, especially in adding and subtracting fractions with different denominators. Common errors identified in students' answers include 1) difficulty distinguishing between the numerator and the denominator, especially when given word problems, 2) mistakes in the procedure of adding and subtracting fractions with different denominators by directly adding the numerators and denominators, and 3) weak foundation in prerequisite materials such as multiplication of whole numbers, leading to errors in finding common denominators.

Apart from the aspects of interest and motivation, the learning issues described above certainly have other external causes. Therefore, teachers also need to reflect on their teaching practices. After conducting self-reflection facilitated by the research team, several causes were identified, including the selection of teaching methods that did not consider the student's characteristics and the use of media only to introduce basic fraction concepts. In teaching fraction operations, teachers did not use teaching aids but directly provided abstract formulas, leading students to memorize rather than understand. According to Zhang, in teaching fractions, teachers should not rely solely on symbols and operations without explaining the concepts through various activities (Zhang et al., 2014).

After analyzing the problems through reflection, teachers should take action to address them. Understanding the concept of adding fractions with different denominators is urgent because mastering this material is essential for understanding other topics at higher education levels. To resolve the issue of students' understanding of fraction addition and subtraction concepts in the fifth grade at SDN Ukirsari, the teacher and the research team initiated improvements through collaborative classroom action research (CAR). According to Septantiningtyas et al. (2000), CAR is a study conducted by teachers in their classrooms, applying actions and being reflective, following research methodology in several cycles to improve or enhance teaching practices and achieve predetermined goals (Diana et al., 2021).

The determined corrective action to address this issue is to implement a student- centered learning approach and relate the material to real-life contexts relevant to students' experiences.

According to Russefendi, the abstract nature of mathematics makes it difficult to learn (Novitasari, 2016). Therefore, to make it easier for students to understand mathematics, teachers as facilitators should present it in a more concrete form. Regarding fraction concepts, Eichorn further states that to learn fractions correctly, teachers must instill a strong conceptual understanding through real-world situations. Real-world representations can build students' understanding of fraction concepts (Eichhorn, 2018). After discussions and literature reviews, the Realistic Mathematics Education (RME) approach was chosen as a suitable solution to foster students' interest, motivation, and learning outcomes.

The Realistic Mathematics Education (RME) approach, or Pendidikan Matematika Realistik, is a mathematics teaching approach that originated in the Netherlands in the 1970s. This theory emerged from Freudenthal's view that mathematics is a human activity that needs to be connected to reality (Cendekiawaty & Sugiman, 2020). Sembiring explains that in realistic mathematics, mathematical ideas and concepts are developed from the real world, and learning that begins from everyday life will be easily understood by students. Mathematical concepts can be visualized, which helps students find possible solutions to problems using their existing mathematical abilities (Junaedi et al., 2015).

The RME approach has been present in Indonesia for quite some time. Indonesian mathematics education began to recognize RME in the late 1990s. As a result, the theory of RME concepts described above has been frequently tested by other researchers and has proven to have a positive impact on elementary school students' mathematics learning outcomes ((Kurnio, 2017), (Muncarno & Astuti, 2018)). Specifically regarding the concept of fractions, the effectiveness of implementing the RME approach has been extensively studied through experimental research and classroom action research, such as in studies by (Fitriani et al., 2019), (Primasari et al., 2021), (Agustina et al., 2020) and others. The review of these previous studies strengthens the hypothesis of this research that RME can address the issue of low learning outcomes in the topic of adding fractions with different denominators among fifth-grade students at SDN Ukirsari.

This study focuses on two main issues: 1) How does the implementation of RME improve the quality of learning outcomes in the addition of fractions with different denominators among fifth-grade students at SDN Ukirsari-Bojonegara? and 2) How does the learning outcome of adding fractions with different denominators improve among fifth-grade students at SDN Ukirsari-Bojonegara after applying the RME approach? To assess the achievement of the established research objectives, information is collected through peer observation of teacher and student activities during the corrective action (acting stage) and the measurement of student learning outcomes through tests after the corrective action has been implemented.

METHODS

The method used in this research is classroom action research (CAR) because the problem addressed in this study aligns with the definition of CAR. Suyanto defines Classroom Action Research (CAR) as practical research intended to improve classroom learning. This improvement effort is carried out by taking actions to find answers to problems that arise from the daily tasks of teachers in their classrooms. These problems are actual issues genuinely faced in the field, not fabricated problems (Azizah, 2021). The CAR activities in this study were carried out collaboratively between the fifth-grade teacher at SDN Ukirsari, who had the problem, and the researcher. The CAR model used is the Kemmis

& Taggart Model. In this model, the research process is conducted in several cycles, each consisting of four stages: planning, action, observation, and reflection. The following is an explanation of these four stages

1. Planning Stage: This stage involves preparing the action improvement scenario (lesson plan) and instruments for collecting data for the cycle.
2. Action Stage: This stage involves implementing the improvement actions for cycle I, referring to the lesson plan designed.
3. Observation Stage: This stage involves observing the implementation of actions using observation sheets prepared in the previous stage.
4. Reflection Stage: This stage involves discussions between the teacher and the collaborator (observer) to identify the strengths and weaknesses from the observations and test results of the cycle I. The reflection results form the basis for deciding whether to proceed to the cycle II.

The four stages above can also be illustrated by the following diagram.

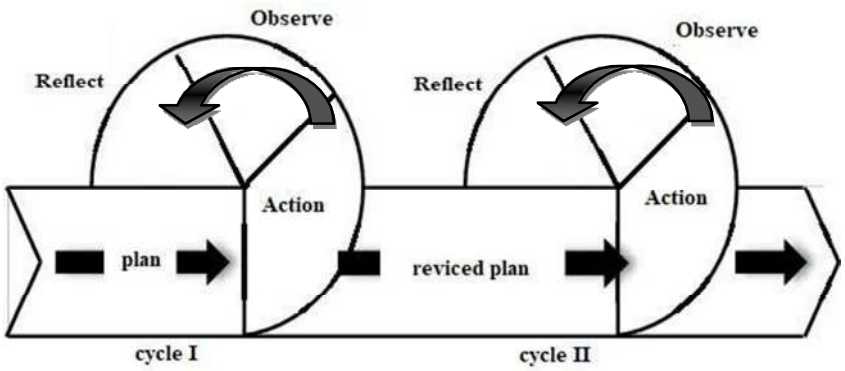

Figure 1. Classroom Action Research Cycle of Kemmis and Taggart Models

The issues were identified and felt by the fifth-grade teachers at SDN Ukirsari in their professional practice, so the 24 fifth-grade students of SDN Ukirsari tend to be the subjects of this study. The research activities were conducted in the even semester of the 2022/2023 academic year.

Data used to address the research questions were collected from multiple sources, including teachers and students. Data were gathered through observation and tests. Data collection was conducted in each cycle, with observations providing data on student and teacher activities during the RME-based learning (action stage). Tests provided data on students' understanding of the concepts being studied.

Data collected in each cycle were processed qualitatively and quantitatively before proceeding to the next cycle. Data related to the implementation of the learning (actions) were analyzed descriptively, while data on students' understanding of the concepts were processed using descriptive statistics, specifically the average (X) and the percentage of mastery (P).

X = Total scores of all students : Total Number of students

= (Number of students who achieved mastery : Total number of students) × 100%

The indicators of success for this research are determined the learning process and learning outcomes. The CAR cycle will be stopped if:

1. The learning process aligns with the lesson plan; in other words, the activities of students and teachers during the learning process follow the steps and characteristics of RME.
2. The scores obtained by students after the intervention reach a minimum average of 75 with an 80% mastery percentage.

RESULTS AND DISCUSSION

1. Results of Cycle I

Before implementing cycle I, the information is first calculated in the pre-cycle phase, they are: a) The minimum level criteria established by the school are not reached by the majority of pupils. Of all the students, only 25% of the students are not fully qualified, b) the mathematical learning activities are carried out only using conventional methods and do not use the tools/media. c) When the learning process most students do not focus on following the learning only a few students listen to the teacher's explanation.

Initial information in the pre-cycle then became the basis of the implementation of cycle I's learning (action), which consists of planning, implementing action, observation, and reflection.

- *Planning stage*

At the planning stage, researchers and teachers design the Learning Implementation Plan (RPP) of adding fractions with different denominators using the RME approach, design the data collection instrument, and establish the indicators of action accomplishment.

- *Implementation stage*

At this stage, learning is carried out as the first action effort performed by teachers concerning the RPP already designed in the planning phase. In addition to learning activities, in this phase also conducted test cycle I to see the availability of competence of the students. The results of the I cycle test showed a student's presentation that achieved an accuracy of only 37.5%.

Table 1. Test results of cycle I

Number of Students	Percentage	Notes
9	37.5 %	Incomplete
15	62.5 %	Complete

- *Observation stage*

At this stage, the observer observes the implementation of learning (action) of the cycle I to see the compatibility of action with RPP. Data collected from the observation results relate to the activity of pupils, teachers, the use of media, and the student worksheet (LKPD) at the time of learning using the approach of RME. Information gathered from the results of its observation diary: students are still not focused, students are not yet enthusiastic about the presence of media, less learning by the scheduled time, and some activities on RPP have not been completed.

- *Reflection stage*

After the execution of the action and observation is completed, the next stage is the reflection, such as processing and interpreting the data obtained from the test cycle I as well as

the results of the observation during the operation. The result of the interpretation is then used as the basis for the development of the next cycle plan. Based on the results of the tests and observations, some records are obtained as follows:

Students of the first cycle who have already said that they have studied as many as 9 students with a presentation of accuracy of 37.5% while still inaccurate as many as 15 students with a presentation of inaccuracy of 62.5%. This indicates that the action has not reached the target because it has not achieved the overall indicator of success of learning outcomes of at least 65%. The factors identified are due to the less conducive class atmosphere so that only a few materials are caught by the students.

a. Media and LKPD is still less attractive to student interest so it needs to be improved and made more interesting.
b. Students are still less focused on the time of learning and more on playing and chatting with friends in their group. It's the teacher's lack of clarity in informing the rules of learning.
c. The allocation of time is not in line with the planning.

Based on the above reflections, it is concluded that the indicators of success of the aspect of learning outcomes and learning processes are still not achieved. So corrective action still needs to proceed to cycle II.

2. Results of Cycle II

The implementation of cycle II is carried out based on the reflective results of the cycle I. As in the case of Cycle I, in the second cycle, the activities consist of planning, action implementation, observation, and reflection.

- *Planning stage*

In this phase, researchers and teachers re-create the learning implementation plan (RPP). RPP is made by revising some parts of RPP cycle I concerning the reflection results of Cycle I. Some of the revised parts are media made to be more interesting, LKPD is made with simpler instructions and accompanied by illustrations, at the learning step added ice breaking and rewarding so that students are more enthusiastic and motivated in learning to work on the task (LKPD).

- *Implementation stage*

At this stage, learning is carried out as a second improvement attempt by the teacher about the RPP that was already planned at the planning stage. In addition to learning activities, the second cycle test is also carried out to see the competence of the student after the second action is given. Cycle II test results can be seen in the following table.

Table 2. Test results of cycle II

Number of Students	Percentage	Notes
21	87.5 %	Complete
3	12.5 %	Incomplete

- *Observation stage*

At this stage, the observer observes the implementation of learning (action) of Cycle II to see the compatibility of action with the RPP of Cycle II. Data collected from the observation results relates to the activity of pupils, teachers, media utilization and LKPD at the time of learning using the RME approach.

- *Reflection stage*

In this phase, the data obtained from the test cycle II as well as the observation results during the execution of the action are processed and and interpreted. The interpretation results are then used as a basis for the preparation of the next cycle plan. Based on the results of the test and observation, the following records are obtained:

a. The average test value of the second cycle is 60. The average value in the second Cycle is seen to increase compared to the average value at I. This value has reached KKM.
b. Students of the 2nd cycle who have already said to have studied as many as 21 pupils with a presentation of completion of 87.5% while still unfinished as many pupils as 3 students with a presentation of inexactitude of 12.5%.
c. The students have better understood the instructions of the LPD and utilized the expected tool of self-control.
d. Students have already focused sufficiently on learning especially when working with LKPD friends of one group.
e. Learning is still not fully by the allocation of time provided. Based on the above reflections, it appears that the percentage of students who reached the target success of the action because of exceeding 65%.

From the aspect of the learning process, students and teachers began to be able to adapt to the learning patterns of RME and presentation of completion by more than 80%. So based on the two things it was concluded that the indicators of success from the aspects of learning outcomes and learning process have been achieved. Thus, after going through two cycles it was concluded that the use of the Realistic Mathematics Education (RME) approach was effective in improving the learning outcomes of students of the State of Ukirsari's fifth grade of adding fractions with different denominators.

3. Discussion

The results of this research indicate that the implementation of Classroom Action Research (CAR) can encourage teachers to reflect and be sensitive to problems in their classrooms. CAR has proven to have a positive impact on the results and quality of the learning process. According to Suroso, classroom action research can be defined as a research activity carried out by educators or teachers in the context of learning that has already occurred in the classroom. This research activity is not manipulated for the sole benefit of the teacher as a researcher but rather to improve the situation or condition of the learning process to make it more conducive, better, and of higher quality (Gonzaga & Kase, 2020). Furthermore, Wardhani stated that classroom action research (CAR) is research conducted by teachers in their classrooms through self-reflection aimed at improving their performance and enhancing student learning outcomes (Aribowo et al., 2020).

In this study, the implementation of actions in cycle I did not achieve the target of success. Several contributing factors include insufficient lesson planning, particularly in the group learning phase. The steps of learning and the strategy for managing group learning activities were not well-prepared, resulting in a non-conducive classroom atmosphere. Yet, group learning, especially in mathematics, is highly recommended. As per Nafi'ah's research, the mathematics learning outcomes of elementary school students can be improved through group learning (Nafi'ah, 2023)

Additionally, in cycle I, the teaching aids used were too simple, merely origami paper sheets, making the media less attractive to students. In other words, the role of media in learning is equally important as the learning method. According to Kemp & Dayton (1985), one of the

functions of media is to motivate and stimulate interest (Hidayat, 2017). Therefore, the provision of media in learning needs to be well-planned. Regarding the student worksheets (LKPD), students were directed to discover the formula for adding fractions using real-world contexts accompanied by teaching aids. However, the instructions on the worksheets were not fully understood by the students, resulting in a lengthy completion time. The problems identified in Cycle I were used as a basis for planning in Cycle II.

The action plan for cycle II, which was created more carefully and taking into account the notes from cycle I, had a significant impact on the quality of both the process and learning outcomes. In cycle II, the learning implementation could be carried out more conducive and by the prepared plan. With clear group rules given by the teacher at the beginning of the lesson, students were better able to follow the stages of Realistic Mathematics Education (RME) in group work, even though it seemed noisy, they were able to complete their tasks. The learning media were made more attractive with semi-concrete forms, such as pictures of objects that could be cut and reassembled.

The above changes specifically indicate that the efforts to improve the learning of the concept of adding fractions with different denominators in grade V of SDN Ukirsari using the RME approach have been successful. This research result is relevant to other studies showing that the application of the Realistic Mathematics Education (RME) approach has a positive effect on students' mathematics learning outcomes in elementary schools (Kurnio, 2017) and can develop problem-solving skills (Maulida & R., 2015). The success of this action can certainly be traced to several reasons. Some reasons why RME is effective in improving students' understanding of the concept of adding fractions with different denominators are:

1. The gradual learning stages from concrete to abstract situations, where students first encounter fractions through real-world contexts, then gradually move to more abstract (symbolic) representations. In the concrete stage, students are given problems related to real-world situations relevant to their experiences and complemented with manipulable media, enabling them to see how fractions are used in everyday life, making it easier for them to understand the meaning and use of adding fractions ((Setyowati, 2023), (Arita, Putri, 2019)).
2. The concrete presentation of RME makes students more interested and motivated to learn mathematics, so that student learning outcomes improve ((Zulaikha et al., 2021), (Soleha& Tendri, 2010), (Tanjung, 2022)).
3. Students are guided to discover the concepts and rules of fractions through exploration and problem-solving, making learning more meaningful as students are involved in the process of forming their own knowledge ((Mulyati, 2016), (Nurasyiafitriani et al., 2020), (Cahyanto & Prabawati, 2019)).
4. During learning, students are encouraged to discuss and share thoughts with their peers, helping clarify understanding, answer questions, and find solutions together (Nafi'ah, 2023).

Based on the evaluation results of the pre-cycle, cycle I, and cycle II, it can be generally concluded that the implementation of the RME approach in grade V of SDN Ukirsari has led to a transformation from a teacher-centered learning approach to a student- centered approach. This change has positively impacted students' understanding of the operations of adding fractions with different denominators. As Mukwabo et al. found, involving student-centered teaching and learning can prevent the abstraction of the concept of fraction operations (Mukwambo et al., 2018).

CONCLUSION

The learning problems related to students' competencies in the concept of adding fractions with different denominators in grade V of SDN Ukirsari can be resolved by implementing the RME approach as an improvement effort. This is evident from the change in the percentage of learning completeness, which increased from 37.5% in cycle I to 87.5% in cycle II. Additionally, the learning process using the RME approach became more meaningful and enjoyable because students were encouraged to actively construct their own understanding through facilitation provided by the teacher with the help of manipulable media. Based on the findings obtained during the implementation of RME in this study, there are several important suggestions for teachers who will use RME to ensure its effective implementation, they are: the establishment of clear and firm group work rules at the beginning of the lesson, the instructions on the student worksheets should be made simple yet related to the concept, and the learning media should be attractive and easy for students to manipulate.

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