



The Effect of Realistic Mathematics Education Implementation in Mathematics Learning in Elementary School

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Abstract:

Until now, mathematics is still a difficult subject for students. This is one of the implications of the abstract nature of mathematics. For this reason, mathematics learning is designed in such a way by bringing mathematics closer to the real-life context and student experience. Realistic Mathematics Education (RME) is an alternative learning approach that is able to reduce the gap between abstract mathematics and real life. This research was conducted using a quasi-experimental method that aims to test the effectiveness of RME in mathematics learning in elementary schools. The study used one group pretest-post test design. A study sample of $N = 19$ was selected from class V of SD Negeri 2 Labalawa, Baubau City. Data analysis was performed using descriptive statistics and non-parametric inferential statistics. The results showed that the average gain score of pretests and post-tests reached 44.09 with a Standard Error of Mean of 3,763 and 4,811, respectively. The test results of the average difference between the pretest and post-test were declared significant at a confidence level of 95% or $\alpha=0.05$. The indication is indicated by a Mann-Whitney test value of 23,000 with a 2-tailed asymptotic p-value of $0.000 < 0.05$. The results of the data analysis of this study concluded that the implementation of RME has a significant effect on mathematics learning outcomes in elementary schools. The results of this study have positive implications for changing the teaching style and learning style of students from teacher oriented to students oriented.

Keywords:

Effect, RME, Mathematics, Elementary School Students

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INTRODUCTION

Mathematics has a great influence on the development of human thinking skills. Through learning mathematics the skills of rational, logical, analytical thinking, creative thinking and communication skills, as well as problem-solving skills of students can be formed. School mathematics is designed in such a way with a spiral concept structure that is expected to be able to understand the mindset of students.

One of the characteristics of mathematics is that its objects are abstract so often mathematics is difficult for students to understand. In fact, the difficulty of students learning a mathematical material can result in learning difficulties in the next material. Teachers as learning facilitators, should be able to create learning designs (Nasution et al., 2020) that not only pursue curriculum completion targets but also must think of strategies or approaches that can lead students to understand the learning material.

The learning approach is a way to facilitate students learning activities so that learning objectives can be able to achieve. Realistic Mathematics Education (RME) is a learning approach that conceptually brings real life closer (Rohmah et al., 2017) and

students' experience with mathematics. This concept will lead students to understand and construct mathematical concepts so that they feel the benefits of the concepts they learn (Nuraina et al., 2021). This approach was initiated by Freudenthal in the 1970s in the Netherlands who viewed mathematics as a human activity and related to the real world (Benedict Tanujaya et al., 2017).

RME has five characteristics and three basic principles that distinguish it from other approaches. These characteristics are phenomenological exploration, bridging with vertical instruments, student contribution, interactivity and interrelationship and the three principles referred to are guided reinvention through progressive mathematizing, didactical phenomenology, and self-developed models (Gravemeijer, 1994). These characteristics and principles should be shown in the implementation of mathematics learning. In its implementation, RME wants learning to begin with the presentation of mathematical problems using real-life contexts. According to these characteristics and principles, in learning students must understand problems, solve problems, dictate and compare the results they obtain, and make conclusions resolution of a given problem. Through this contextual problem-solving activity students will discover mathematical concepts under the guidance of the teacher—as experts find them—not given directly by the teacher nor the interaction between students and with teachers are increase.

In learning mathematics that uses realistic mathematics, the teacher must make a careful plan. Learning materials are designed so that students are facilitated to discover mathematical concepts. The teacher must position himself as a facilitator. As a facilitator, the teacher must understand the right moments to provide assistance to students. In this context, learning needs to be designed in the form of heterogeneous groups, especially from the aspect of each student's learning speed. Heterogeneous placement of group members will allow students to help each other in completing their assignments.

RME characteristics are very much in line with the characteristics of elementary school students who are in the stage of concrete operational development and early formal operations (ages 7-13 years). At this stage, students will be younger and learn mathematical concepts if the learning is brought closer to the surrounding nature. The use of contextual problems at the beginning of learning, as characteristic of RME, is very important for teachers to do so that students learning outcomes can be maximized. For learning to be engaging those contextual issues must be challenging. The presentation of challenging problems in realistic mathematics education can affect the development of students' imagination and creative thinking skills (Kusmaryono & Maharani, 2021). In addition, students love mathematics as a challenge to influence their learning success (Kusmaryono et al., 2019).

Several studies on the implementation of Realistic Mathematics Education in the classroom have been conducted. These studies concluded that the application of Realistic Mathematics Education can improve learning achievement (Nguyen et al., 2020; Ulandari et al., 2019), learning achievement of RME learning outcomes is better than classical learning outcomes (Yetim Karaca & Özkaya, 2017). The results of these studies have not reached schools in the island region. Therefore, research on the implementation of RME needs to be expanded to determine its effect on learning outcomes in primary schools in the Buton Islands region.

METHODS

This research is a quantitative research that applies the Experiment method. This research is classified as a Quasi-Experiment research with which examines the effectiveness of RME implementation in Mathematics Learning in Class V Elementary School. The research design uses the One Group Pre-Post Design type. The application of RME is an independent variable while student learning outcomes are dependent variables. The design of this study is presented in Table 1.

Table 1. Design Research

Pre-Test	Treatment	Post-Test
O1	X	O2

Description:

- X : Implementation of RME in Fractional Learning
- O1 : Student Learning Outcomes before RME Implementation
- O2 : Student Learning Outcomes after RME Implementation

This research was conducted at SDN Negeri 2 Labalawa, one of the schools in the Buton Islands area. The population of this study is grade V students of SDN 2 Labalawa. Since the school has only one class, the overall population is used as a sample. This research procedure goes through the preparatory stage, treat, and data collection, and the analysis stage is data. In the preparation stage, the activities carried out are choosing materials, compiling learning design, compiling observation sheets, compiling tests, and compiling LKS, then validating to expert judgement. The subject matter selected in this study is Fractional. The preparation of the learning design refers to the syntax: (a) understanding everyday problems/contexts, (b) explaining contextual problems, (c) solving contextual problems, (d) comparing and discussing answers, and (e) concluding (Wahyudi, 2016). The next stage is carrying out mathematics learning to implement RME and data collection. Learning implementation data was collected using Observation Sheets and Learning Outcomes Data was collected using tests. The test was carried out twice, namely before and after the implementation of the RME. After the data is collected, data analysis is then carried out.

The data collection of this study used test and observation techniques. Test techniques are used to collect data on students' abilities. The test is carried out twice, namely before and after the implementation of RME in Fractional learning. The test used is in the form of an essay test consisting of 5 (five) items. The test items used have been declared valid by the expert judgement. Each item has a score in the range of 0 – 20. To ensure that learning takes place according to a predetermined plan, during the learning process, observation of teacher activities and student activities is carried out. Observation is carried out directly by the observer. The observation sheet, refers to the learning steps drawn up in the Fractional Learning Implementation Plan. The influence of RME implementation in mathematics learning is analyzed quantitatively. Data analysis techniques use descriptive statistics and inferential statistics. Descriptive statistics are used to describe data on the achievement of learning outcomes or student's abilities from the aspect of central tendency. Meanwhile, inferential statistics are used to test the significance of the effectiveness of RME implementation in mathematics learning in grade V of SD Negeri 2 Labalawa. Inferential analysis is preceded by test prerequisite tests namely Homogeneity Test and Normality Tests to ascertain the type of statistical test. Data analysis of learning outcomes was carried out with the help of the SPSS 18 Computer Application. Meanwhile, the observational data were analyzed descriptively using percentages.

RESULTS & DISCUSSION

Results

The results of this study include learning outcomes before (pre-test) and after (post-test) treatment as well as data on observation results during treatment. Table 2 presents a description of the pre-test and post-test t results consisting of the lowest data, highest data, mode, median, average, and standard deviation.

Table 2. Description of Statistical Data of Pre-Test Results t

No	Descriptive Size	Value
1	Minimum	20
2	Maximum	60
3	Mode	20
4	Median	20
5	Mean	33,68
6	Std. Deviation	16,401
7	Standard Error of Mean	3,763

Based on Table 2, it is known that the average basic ability of students before learning who apply RME is at 16.20 below the average expectation ($E[X]=50$) with a standard deviation of 16.401. This shows that students' basic abilities before learning are very low and varied. Table 2 also shows that the range of students' abilities is quite wide with a Gain Score of 40.

Table 3. Description of Post-Test Results Statistics Data

No	Descriptive Size	Value
1	Minimum	40
2	Maximum	100
3	Mode	100
4	Median	80
5	Mean	77,89
6	Std. Deviation	20,971
7	Standard Error of Mean	4.811

Table 3 shows that the average student learning outcome after RME implementation is at 27.89 above the average expectation ($E[X]=50$). This shows that students' basic abilities after learning improve when compared to before treatment. In Table 3, it is also seen that the range of students' abilities is quite wide with a Gain Score of 60 with higher variations compared to before treatment. Standard deviation from pre-test and post-test resulted in an increase in Standard Error Mean (SEM) of 1,081.

The implementation of RME in mathematics learning is accompanied by observation. The results of the observation of learning implementation show the ability of teacher to manage learning which is measured using a percentage of teacher activity. Meanwhile, the results of activity observations show students activity in learning which is measured using a percentage of student activity. The observational data of both are presented in Table 4. In Table 4, it can be seen that there are differences in the ability of teachers to manage learning at the First Meeting and the Second Meeting. The ability to manage learning at the second Meeting increased by 18.47% compared to the first meeting. This increase indicates an improvement in learning management. The activeness of the

students at the two meetings is also different. Similar to the ability of teachers to teach, student activity also increased by 21.54%.

Table 4. Description of Observation Results

	Meeting I	Meeting II
Teacher Activities	61,53%	80%
Student Activities	55,38%	76,92%

Statistical Test Results

To test the effectiveness of the implementation of RME in mathematics learning in Class V of SDN Labalawa, it begins with prerequisite testing. The Prerequisite Testing of Homogeneity Variance is used Levene Test, while Normality Requirement Test is used Shapiro-Wilk Test. The results of the Test of Homogeneity of Variances show that the significance of the test results exceeds 0.05. The value of such significance gives the decision of accepting the Null Hypothesis and rejecting the Alternative Hypothesis. This shows that the data on learning outcomes before and after RME implementation have similar variance or homogeneous similarities.

The Test of Normality used a 95% confidence level or $\alpha=0.05$. The Test of Normality results show that the Pre-Test Result Data has a Sig. of $0.000 < 0.05$. Likewise, the Post-Test Result Data has a Significance value of $0.007 < 0.05$. The decision taken from the results of such tests is to accept Null Hipotesis or reject Alternative Hipotesis. This result means that both pre-test data and post-test data are not normally distributed.

Based on the results of the analysis of the Test of Homogeneity of Variances and the Test of Normality above, it is known that the parametric statistical test requirements are not met. With the non-fulfillment of these test requirements, the test of the effectiveness of RME implementation in mathematics learning in elementary schools cannot be analyzed with parametric statistics. Therefore the effectiveness of the implementation of RME in Elementary School should be tested using non-parametric statistics. The test was conducted using the Mann-Whitney Test.

The average difference test results show that the Asymptotic Significance (2-tailed) is $0.000 < 0.05$ (α). Since Asymptotic Significance (2-tailed) = $0.000 < 0.05$ then the decision taken is to reject the Null Hipotesis (mean similarity) or accept the Alternative Hipotesis (mean difference). Thus the results of non-parametric statistical testing show a significant difference between the average pre-test results and the average post-test results

Discussion

This research is preceded by a pre-test to determine the student's experience of the mathematics learning material used (fractions). Based on the results of the pre-test, it is known that before the implementation of the experiment, students already have preliminary knowledge which is their experience. The basic knowledge of students can be seen from the pre-test results. The pre-test results in Table 2 showed that none of the students obtained a score of 0. The results of the study of the student's experience of studying fractional recognition are found in grades III and IV. The student experience is very useful in the implementation of Realistic Mathematics Education in the classroom.

In RME, effective learning must be supported by learning management that utilizes the realities of a student's life or experience. Student reality and experience are used as starting points for learning (Febriyanti et al., 2019) to help students construct new knowledge. The implementation of RME in this study has leveraged the student experience. In addition, the prepared learning materials have used objects around the students. The use

of surrounding objects also makes it easier for students to understand the contextual problems presented.

The use of the student's daily context as one of the characteristics of RME has implications for increasing students activity in learning. The level of student activity or participation is different from before the implementation of learning that applies RME. From the results of the initial survey, students tend to be passive in the learning process. The habit of students who tend to be passive in previous learning, is still carried over to the implementation of learning using RME approach. This can be seen in the level of student activity at the first meeting only reached 55.38%, although this achievement was already in the high category. Likewise, the ability of teachers to manage learning that is accustomed to conventional methods, at the first meeting the application of RME still has an effect. This is illustrated by the achievement of learning management ability of 61.53%. The main weaknesses of learning management at the first meeting include: teachers still tend to rush to explain learning materials when students have difficulties, The teacher's attention has not been drawn to all groups of students, the teacher has difficulty in providing assistance to students who are experiencing difficulties.

The weaknesses found in the management of learning are influenced by the teacher's knowledge of Realistic Mathematics Education. The teacher's knowledge of RME is inadequate so that it affects his ability to manage learning (Güler, 2018). The experience of managing learning at meeting I was used as a discussion between the observer and the teacher. The discussion material focused on the role of teachers in the implementation of Realistic Mathematics Education. This discussion was carried out in an effort to maintain the learning process in accordance with the characteristics of Realistic Mathematics Education. The results of these discussions have changed the ability of teachers to manage learning. As the result of observations at the second meeting, the weaknesses that appeared at the previous meeting have been significantly reduced. At the second meeting, the ability to manage learning increased and was in a very high category, namely 80%. The improvement of learning management ability also affects student activities during the learning process also increased to 76.92%. This means that learning activities have been dominated by student activities.

After the implementation of learning, a post-test is carried out. Based on the analysis of post-test results (Table 2) and pre-test (Table 3) it is known that after treatment, the average learning outcomes have increased by 44.09 points above the average learning outcomes before treatment. The change in the average learning outcomes shows the effective application of Realistic Mathematics Education. To ensure that changes in learning outcomes are influenced by action, a correlation analysis of pre-test and post-test is carried out. The results of the analysis showed that the pre-test and post-test did not have a significant correlation. Based on the results of the analysis, it was obtained that the Correlation Index of the two test results was 0.347 with a significance level of $0.146 > 0.05$.

The results of this descriptive analysis are supported by statistical test results. Inferential statistical testing was performed with 95% confidence level or a probability of error of 0.05 (α). The results of the statistical test show that the implementation of Realistic Mathematics Education has a significant effect on mathematics learning outcomes in fractional materials in Grade V elementary school. The findings of this study are in accordance with the findings of previous studies which stated that the results of learning mathematics using RME are different from other approaches (Palunisa, 2020; Tanujaya et al., 2017; Febriyanti et al., 2019). The increase in student activity and learning outcomes in the application of RME shows that this approach is able to produce quality and learning outcomes. Thus, Realistic Mathematics Education can be used as an alternative approach (Susilowati, 2018).

The findings of this study have an impact on changing the teaching style and learning style of students from teacher oriented to students' oriented. The role of teachers in realistic mathematics education is as a facilitator, scaffolding, and connecting mathematics with the real world (Habsah, 2017). The change in learning orientation from teacher oriented to students' oriented contributes to the development of students' potential skills not only in the ability to remember learning materials. Student oriented gives students an experience of how to integrate real-world contexts into mathematics. In addition, students also understand the process of discovering a mathematical concept through guided reinvention also they understand the application of mathematics in real life under the guidance of the teacher.

CONCLUSION

Based on the results of the analysis, it was concluded that the implementation of Realistic Mathematics Education has a significant effect on student learning outcomes in elementary schools. Research is still limited to fractional material in grade V schools. Therefore, research still needs to be carried out further research on other materials and at other grade levels.

CONFLICT OF INTEREST

The authors have no conflict of interest in the study of this study.

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REFERENCES

- Febriyanti, F., Bagaskorowati, R., & Makmuri, M. (2019). The effect of the realistic mathematics education (RME) approach and the initial ability of students on the ability of student mathematical connection. *International Journal for Educational and Vocational Studies*, 1(3), 153–156. <https://doi.org/10.29103/ijevs.v1i3.2117>.
- Gravemeijer, K. (1994). *Developing Realistic Mathematics Education*. Utrecht: Freudenthal Institute.
- Güler, H. K. (2018). Activities written by prospective primary teachers on realistic mathematics education. *International Journal of Evaluation and Research in Education (IJERE)*, 7(3), 229. <https://doi.org/10.11591/ijere.v7i3.14267>
- Habsah, F. (2017). Developing teaching material based on realistic mathematics and oriented to the mathematical reasoning and mathematical communication. *Journal of Research in Mathematics Education*, 4(1), 43–55. <https://doi.org/10.21831/jrpm.v4i1.10199>
- Kusmaryono, I., & Maharani, H. R. (2021). Imagination and creative thinking skills of elementary school students in learning mathematics: a reflection of realistic mathematics education. *ELEMENTARY: Islamic Teacher Journal*, 9(2), 287. <https://doi.org/10.21043/elementary.v9i2.11781>

- Kusmaryono, I., Suyitno, H., Dwijanto, D., & Dwidayati, N. (2019). The effect of mathematical disposition on mathematical power formation: review of dispositional mental functions. *International Journal of Instruction*, 12(1), 343–356. <https://doi.org/10.29333/iji.2019.12123a>
- Nasution, Y. S., Syahputra, E., & Mulyono, M. (2020). The development of learning instrument using problem based learning model to improve critical thinking of junior high school students. *Budapest International Research and Critics in Linguistics and Education (BirLE) Journal*, 3(3), 1501–1508. <https://doi.org/10.33258/birle.v3i3.1223>
- Nguyen, T. T., Trinh, T. P. T., Ngo, H. T. V., Hoang, N. A., Tran, T., Pham, H. H., & Bui, V. N. (2020). Realistic mathematics education in Vietnam: recent policies and practices. *International Journal of Education and Practice*, 8(1), 57–71. <https://doi.org/10.18488/journal.61.2020.81.57.71>
- Nuraina, N., Fauzi, K. M. A., & Simbolon, N. (2021). The effect of realistic mathematics educations (RME) approach based on ethnomatics on the improvement of concept understanding ability and students' learning motivation in elementary school Al-Kausar City of Langsa. *Budapest International Research and Critics in Linguistics and Education (BirLE) Journal*, 4(1), 543–554. <https://doi.org/10.33258/birle.v4i1.1707>
- Palinusa, A. L. (2020). Comparison of algebra learning outcomes using realistic mathematics education (RME), team assisted individualization (TAI) and conventional learning models in junior high school 1 masohi. *Infinity: Journal of Mathematics Education*, 9(2), 173-182. <https://doi.org/10.22460/infinity.v9i1.p173-182>
- Rohmah, N., Hobri, H., & Yuliati, N. (2017). The analysis on students' critical thinking in solving the problem on one-variable linear equation based on realistic mathematics education with local wisdom. *International Journal of Advanced Research*, 5(10), 193–199. <https://doi.org/10.21474/ijar01/5522>
- Susilowati, E. (2018). Increasing activity and mathematics learning outcomes of elementary school students through the realistic mathematical education (RME) model in class IV semester I students at SD Negeri 4 Kradenan, Kradenan District, Grobogan Regency, 2017/2018 Academic Year. *PINUS Journal*. 4(1), 44-53. <http://ojs.unpkediri.ac.id/index.php/pinus>. 4(1), 44-53.
- Tanujaya, B., Prahmana, R.C.I., & Mumu, J. (2017). Mathematics instruction, problems, challenges and opportunities: A case study in Manokwari Regency, Indonesia. *World Transactions on Engineering and Technology Education*, 15(3), 287–291.
- Ulandari, L., Amry, Z., & Saragih, S. (2019). Development of learning materials based on realistic mathematics education approach to improve students' mathematical problem solving ability and self-efficacy. *International Electronic Journal of Mathematics Education*, 14(2), 375–383. <https://doi.org/10.29333/iejme/5721>
- Wahyudi. (2016). Pengembangan model realistic mathematics education (RME) dalam peningkatan pembelajaran matematika bagi mahasiswa pendidikan guru sekolah dasar. *Jurnal Pedagogik Pendidikan Dasar*, 4(1), 47–57.
- Yetim Karaca, S., & Özkaya, A. (2017). The effects of realistic mathematics education on students' math self reports in fifth grades mathematics course conditions of the creative commons attribution license (CC BY-NC-ND). *International Journal of Curriculum and Instruction*, 9(1), 81–103.