

**THE EFFECT OF REALISTIC MATHEMATICS EDUCATION  
MODELS USING FRACTION CARDS ON IMPROVING  
ELEMENTARY SCHOOL STUDENTS' LEARNING OUTCOMES IN  
FRACTION MULTIPLICATION**

**PENGARUH MODEL PENDIDIKAN MATEMATIKA REALISTIK  
MENGUNAKAN KARTU PECAHAN TERHADAP PENINGKATAN  
HASIL BELAJAR SISWA SEKOLAH DASAR PADA MATERI  
PERKALIAN PECAHAN**

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**Submitted**

23 October 2025

**Accepted**

15 November 2025

**Revised**

18 December 2025

**Published**

31 January 2026

**Kata Kunci:**

Pendidikan  
Matematika  
Realistik;  
Kartu pecahan;  
Perkalian pecahan;  
Hasil belajar

**Keyword:**

Realistic  
Mathematics  
Education;  
Fraction cards;  
Multiplication of  
fractions;  
Learning outcomes

**Abstrak**

Penelitian ini dilatarbelakangi oleh rendahnya hasil belajar siswa pada materi perkalian. Penelitian ini bertujuan untuk mengetahui pengaruh penerapan model Realistic Mathematics Education berbantuan media kartu pecahan terhadap hasil belajar siswa pada materi perkalian pecahan. Model RME dipilih karena menekankan pembelajaran yang kontekstual dan bermakna melalui keterkaitan materi matematika dengan kehidupan sehari-hari. Penelitian menggunakan metode Pre-Eksperimen dengan desain One Group Pretest-Posttest Design dan melibatkan 26 siswa kelas IV SDN Leuwiliang sebagai sampel. Teknik pengumpulan data menggunakan tes hasil belajar dan observasi aktivitas siswa. Hasil penelitian menunjukkan adanya peningkatan hasil belajar siswa setelah penerapan model RME berbantuan kartu pecahan, ditunjukkan dengan rata-rata nilai pretest sebesar 64,62 dan posttest sebesar 82,88. Hasil uji Paired Sample t-Test memperoleh nilai signifikansi  $0,001 < 0,05$ , sehingga terdapat perbedaan yang signifikan antara hasil belajar sebelum dan sesudah perlakuan. Temuan ini terbukti efektif dalam meningkatkan hasil belajar siswa pada materi perkalian pecahan di sekolah dasar

**Abstract**

This study was motivated by the low learning outcomes of students in multiplication. This study aims to determine the effect of applying the Realistic Mathematics Education model assisted by fraction cards on student learning outcomes in fraction multiplication. The RME model was chosen because it emphasizes contextual and meaningful learning through the connection of mathematics material with everyday life. The research used a pre-experimental method with a one-group pretest-posttest design and involved 26 fourth-grade students at SDN Leuwiliang as samples. Data collection techniques used learning outcome tests and observation of student activities. The results showed an increase in student learning outcomes after the application of the RME model assisted by fraction cards, as indicated by a pretest average score of 64.62 and a posttest average score of 82.88. The Paired Sample t-Test obtained a significance value of  $0.001 < 0.05$ , indicating a significant difference between learning outcomes before and after the treatment. These findings prove to be effective in improving student learning outcomes in fraction multiplication in elementary school.

**Citation :**

Fauziyyah, H., Yusup, R., Samsul Pahmi. S. (2026). The Effect of Realistic Mathematics Education Models using Fraction Cards on Improving Elementary School Students' Learning Outcomes in Fraction Multiplication. *Jurnal Kiprah Pendidikan*, 5 (1), 98-105. DOI: <https://doi.org/10.33578/kpd.v5i1.p98-105>

## INTRODUCTION

Mathematics serves as an important foundation for students in understanding various developments in science and technology. Regulation of the Minister of National Education Number 22 of 2006 (in Claudia et al., 2020) states that “mathematics underlies technological progress, mathematics plays an important role in various disciplines, and advances human thinking.” Basically, mathematics is always related to daily activities because it has practical benefits in human life. In addition, mathematics also plays an important role in supporting human survival (Claudia et al., 2020). In mathematics learning, especially in fractions, students should be able to understand the concepts deeply, not just memorize formulas. This understanding will be easier to achieve if learning is done by involving real experiences and concrete media. The ability to calculate fractions, especially in multiplication and division, is an important skill that elementary school students must master. However, in reality, many students still have difficulty understanding these concepts. Learning outcomes in fractions are often low because of their abstract nature and lack of connection to students' real-life experiences. Most students are only able to solve fraction multiplication problems procedurally without understanding the meaning of the calculation process. In fraction multiplication, the role of the teacher here is to help students develop understanding by linking the learning material to their previous experiences and knowledge (Siregar et al., 2025).

Based on initial observations at SDN Leuwiliang, it was found that students still had difficulties when learning fraction multiplication. Initial observations conducted by the researcher also showed that the learning process in the classroom was still dominated by conventional teacher-centered methods, and many students still had difficulties when learning fractions, especially in fraction multiplication. Often, students can only memorize the calculation steps without understanding the meaning of the results obtained. The results of research conducted by (Novy Trisnani & Elok Fariha Sari 2021) show that the application of the Realistic Mathematics Education model assisted by the dakon media has been proven effective in improving student learning outcomes in multiplication material in grade IV at SD Gugus Srikandi Gunungpati Semarang. The average learning outcomes of students in the experimental class were higher than those in the control class, namely 83.38 for the experimental class and 79.92 for the control class. In addition, the n-gain value in the experimental class reached 0.69 (high category), while the control class only reached 0.63 (medium category). These findings show that the Realistic Mathematics Education model is able to provide a more meaningful learning experience through the presentation of contextual problems and concrete media, so that student learning outcomes are more optimal than conventional learning (Ratna Wati, 2020)

Although several studies have shown the effectiveness of the RME model in improving learning outcomes, the use of concrete media specifically designed to reinforce the concept of fraction multiplication is still rare. Therefore, this study aims to fill this gap through the application of the RME model assisted by fraction cards. It is hoped that these fraction cards will provide a more contextual and enjoyable learning experience for elementary school students and serve as an innovative alternative in efforts to improve mathematics learning outcomes, especially in fraction multiplication. Based on the problems encountered at SDN Leuwiliang, the researcher provided a solution by using a learning model that is close to the students' daily lives, namely the Realistic Mathematics Education model. This model emphasizes the importance of relating mathematics learning material to real situations that are close to the students' lives. With the application of Realistic Mathematics Education, students are not only required to memorize formulas, but are also guided to discover and build their own understanding through realistic contexts. In this study, the

application of Realistic Mathematics Education will be reinforced with the help of fraction cards, which can help students visualize the concept of fractions concretely. Through fraction cards, students can see, compare, and connect the results of fraction multiplication with real representations. Thus, it is hoped that their learning outcomes in fraction multiplication will improve.

In addition to the Realistic Mathematics Education model, other contextual learning models such as Flipped Learning have also been proven to improve multiplication skills through video-based independent learning activities prior to face-to-face learning according to (Fauziyyah & Rinaldi Yusup, 2025). Research conducted by (Pahmi et al., 2023) shows that the use of concrete media such as abacus has been proven effective in improving the arithmetic skills of first-grade students in addition and subtraction operations. The results of this study show a significant difference between the pretest and posttest results, where the average learning outcomes of students increased from 41.53 to 86.92 after learning using the abacus. If the abacus is effective in helping students understand integer operations, then the use of fraction cards in the application of RME is expected to provide a similar learning experience in the context of fraction multiplication. With concrete media, students can visualize fractions in a tangible way, making the learning process more meaningful and improving learning outcomes.

Based on the above description, the researcher argues that the use of the Realistic Mathematics Education model assisted by fraction cards is an appropriate solution to overcome the problem of low student learning outcomes in fraction multiplication in elementary schools. Through this model, students will find it easier to relate the concept of fraction multiplication to real-life situations they encounter every day, so that they not only master the calculation procedure but also understand the meaning of each process. This research is important to contribute to finding alternative effective learning models and to serve as a reference for teachers in improving the quality of mathematics learning in elementary schools.

## METHOD

[This study uses a quantitative approach with a pre-experimental design. The research design used in this study is a one-group pretest-posttest design. If the posttest score is higher than the pretest score, it can be concluded that the treatment has a positive effect on the research subjects according to Sugiono (2023:112). This study focuses on the application of the Realistic Mathematics Education learning model assisted by fraction cards in mathematics learning on fraction multiplication material and the mathematics learning outcomes of elementary school students. The research was conducted at SDN Leuwiliang, Kp. Cigarung RT 01 RW 10, Parakanlima Village, Cikembar District, Sukabumi Regency, West Java Province. The sample in this study was all 26 fourth-grade students at SDN Leuwiliang. This sample is considered representative of the population because it reflects the main characteristics being studied, in accordance with Sugiyono (2023), who states that a sample is a part of a population that can represent the entire population proportionally.

Data collection in this study involved the researchers compiling a list of questions based on competency achievement indicators in fraction multiplication material in accordance with the Merdeka Curriculum for fourth grade elementary school students. In addition, an observation sheet was compiled to record student activities and assess student engagement during the implementation of the RME model using fraction cards. The instruments that had been compiled were then validated by expert lecturers to assess the suitability of the content, construction, and language. After expert validation, the questions were first tested to determine their validity and reliability. Next, the pretest and posttest data were analyzed descriptively using the mean, standard deviation, and variance to

describe students' achievement before and after the treatment. Data normality was tested using Shapiro–Wilk. Furthermore, to test the significant difference between the pretest and posttest results, the Paired Sample t-Test was used. The variables in this study consisted of two types, namely independent variables (X) and dependent variables (Y). The independent variable in this study was the Realistic Mathematics Education learning model assisted by fraction cards (X), while the dependent variable was the learning outcomes of elementary school students in multiplying fractions (Y).

## RESULTS AND DISCUSSION

### Results

In this study, the first step taken by the researcher was to administer a pretest before implementing the Realistic Mathematics Education learning model assisted by fraction cards. The purpose of this pretest was to determine the initial level of students' ability to understand fraction multiplication material before implementing the RME learning model. After administering the pretest, the researcher then implemented the Realistic Mathematics Education learning model assisted by fraction cards in the learning process.

Table 1. Descriptive analysis table

Data	Mean	Standar Deviasi	Varians
Pretest	64,62	12,722	161,85
Posttest	82,88	6,3519	40,346

Looking at the pretest and posttest results, there is a difference of 18.26 points. This shows that after applying the Realistic Mathematics Education model assisted by fraction cards, there was an increase in student learning outcomes in fraction multiplication. Thus, the application of the Realistic Mathematics Education model assisted by fraction cards can be said to have a positive effect on improving student learning outcomes. Furthermore, to ensure that the student learning outcome data is normally distributed, a normality test was conducted using the Shapiro-Wilk test, with the criterion that if the significance value (Sig.) obtained is  $> 0.05$ , the data is declared to be normally distributed.

Table 2. Shapiro-Wilk normality test results

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest	.128	26	.200*	.955	26	.310
Posttest	.207	26	.005	.933	26	.092

\*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Based on Table 2, the results of the normality test using the Shapiro–Wilk test obtained a significance value (Sig.) of 0.310 for the pretest data and 0.092 for the posttest data. Since both significance values are greater than 0.05 (Sig.  $> 0.05$ ), it can be concluded that the student learning outcome data for both the pretest and posttest are normally distributed. Thus, the data meets the requirements for parametric statistical testing, so that the analysis can be continued using inferential testing with a Paired Sample t-test to determine whether there is a significant difference between learning outcomes before and after the application of the Realistic Mathematics Education (RME) model assisted by fraction cards.

Table 3. Paired Sample Test results

	Mean	Std. Deviation	Paired Differences		t	df	Significance	
			Std. Error Mean	95% Confidence Interval of the Difference Lower Upper			One-Sided p	Two-Sided p
Pair 1 Before the treatment – after the RME treatment assisted by media	-18.269	11.130	2.183	-22.765 -13.774	-8.369	25	<.001	<.001

Based on the results of the Paired Sample t-Test in Table 3, the mean difference value was 18.269 with a t-value of  $-8.369$  and a significance value (Sig. 2-tailed) of 0.001. Since the significance value obtained is less than 0.05 ( $0.001 < 0.05$ ),  $H_0$  is rejected and  $H_a$  is accepted. This means that there is a significant difference between students' learning outcomes before and after the implementation of the Realistic Mathematics Education model assisted by fraction cards.

Table 4. Student Observation Sheet

Category	Pre-test	Post-test
Very Good	-	24
Good	17	2
Fair	9	-
Poor	-	-
<b>Total Students</b>	<b>26</b>	<b>26</b>

Based on the results of observing student activity in the pretest and posttest stages, there was an increase in learning outcomes after implementing the Realistic Mathematics Education (RME) model assisted by fraction cards. In the pretest stage, most students were in the “Good” category (17 students) and “Fair” category (9 students). After implementing the RME learning model assisted by fraction cards, the posttest results showed a significant improvement, with 24 students achieving the “Very Good” category and 2 students in the “Good” category. These results indicate that the implementation of the Realistic Mathematics Education (RME) model assisted by fraction cards can improve student activity and learning outcomes in fraction multiplication at SDN Leuwiliang.

### Discussion

Based on the results of research conducted at SDN Leuwiliang, the application of the Realistic Mathematics Education model assisted by fraction cards was proven to have a significant effect on improving student learning outcomes in fraction multiplication material. This can be seen from the difference in the average pretest score of 64.62 and the posttest score of 82.88, with an increase of 18.26 points. The Paired Sample t-Test results showed a significance value of  $0.001 < 0.05$ , which means that there was a significant difference between learning outcomes before and after the implementation of the Realistic Mathematics Education model. In addition, the observation results show a clear change in the learning outcome category from 17 students in the “Good” category and 9 students in the ‘Fair’ category at the pretest to 24 students in the “Very Good” category and 2 students in the “Good” category at the posttest.

This improvement in learning outcomes occurred because the Realistic Mathematics Education model emphasizes contextual learning, which is linking mathematical concepts to real situations that are relevant to students' lives. In this study, fraction cards were used as a tool to visualize the concept of fraction multiplication concretely, based on the role of fraction cards used during the learning process. The media was designed in the form of cards with pictures of food pieces,

such as pizza slices, representing specific fractions. Students used these cards interactively, like playing picture cards. For example, when the researcher gave the problem “ $\frac{1}{2} \times \frac{1}{4}$ ,” students looked for fraction cards with pictures of pizza slices that represented the multiplication process. In this way, students not only memorized the formula but also saw the relationship between the parts and the whole in a tangible way. This play-based learning activity made students more active, enthusiastic, and less bored during the learning process.

Learning activities using fraction cards are in line with the main principles of Realistic Mathematics Education, which emphasizes real-world contexts (contextual problem solving) and constructive student activities in discovering mathematical concepts through direct experience. Through this approach, students build their own understanding based on visual representations and concrete situations, rather than simply following calculation procedures. This supports Skemp's theory of relational understanding, in which students understand “why” a mathematical concept works, not just “how” to do it. The results of this study are in line with the findings of Siregar, Mailani, & Saragih (2025), which show that the Realistic Mathematics Education approach is effective in improving students' ability to solve multiplication and division problems involving fractions. In that study, the average student score increased from 43.53 to 74.12 after the implementation of RME, with learning completeness increasing from 6% to 76%. Similarly, research conducted by Ayu & Syarifuddin (2021) developed teaching materials based on Local Instructional Theory (LIT) with a Realistic Mathematics Education approach. The results showed that RME-based learning was effective in significantly improving fraction problem-solving skills.

Overall, the results of the study at SDN Leuwiliang reinforced previous findings that the Realistic Mathematics Education (RME) model is a relevant and effective approach to mathematics learning in elementary schools, especially for abstract material such as fractions. Through the application of RME combined with fraction cards, students were not only able to improve their learning outcomes quantitatively, but also gained a deeper conceptual understanding. The use of real-life contexts in each learning activity helped students connect the concept of fraction multiplication with their daily experiences, while the fraction cards served as visual aids that made it easier for them to understand the meaning of multiplication operations concretely. Thus, learning becomes more meaningful, interesting, and able to foster students' confidence in solving math problems. These findings indicate that RME assisted by concrete media such as fraction cards can be an effective alternative to improve the quality of mathematics learning in elementary schools.

## CONCLUSIONS AND RECOMMENDATIONS

Based on the results of research and data analysis, it can be concluded that the application of the Realistic Mathematics Education model assisted by fraction cards is effective in improving the learning outcomes of fourth-grade students at SDN Leuwiliang in the subject of fraction multiplication. This is evidenced by an increase in the average score from 64.62 on the pretest to 82.88 on the posttest and the results of the Paired Sample t-Test, which showed a significance value of  $0.001 < 0.05$ , indicating a significant effect. Through learning based on real contexts and the use of concrete media in the form of fraction cards, students find it easier to understand the concept of fraction multiplication in a meaningful way. The Realistic Mathematics Education model also encourages students to think actively, discuss, and discover concepts for themselves through enjoyable learning experiences. Therefore, the Realistic Mathematics Education model assisted by fraction cards is suitable to be implemented as an effective learning alternative to improve mathematics learning outcomes in elementary schools.

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