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# META ANALYSIS: REALISTIC MATHEMATICS EDUCATION (RME) IN IMPROVING STUDENT'S MATHEMATICAL PROBLEM SOLVING ABILITIES

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**ABSTRACT**
Ability breakdown problem is the ability that must be owned by participants to educate . Research This aims to analyze an article journal with the theme influence of learning models in RME in increase the ability breakdown problems in mathematical participants educate. Research This uses method meta analysis. Results from five articles journal obtained One article in the category effect size medium , one article in the category medium, and three effect sizes article journals with effect size is very large. The average value of effect size of five articles journal the namely of 1.11. Based on the table's interpretation effect size, the average of five article journals shows that the RME model has a very big influence in increase ability breakdown problem mathematical participant educate . In addition t-test results were obtained $t_{hitung} = 10{,}16 > 1{,}96 = t_{table}$ so $H_0$ is rejected. This means that there is a significant influence between the average mathematical problem solving ability of students who use RME learning and the average problem solving ability of students who don't use RME learning. The implication obtained is that the RME model can made into references by educators in activity learning mathematics in an effort to increase the ability breakdown problems mathematical participants educate.
**Keywords** : mathematical problem solving ability; rme model.

***ABSTRAK***
*Kemampuan pemecahan masalah merupakan kemampuan yang harus dimiliki oleh peserta didik. Penelitian ini bertujuan untuk menganalisis artikel jurnal dengan tema pengaruh model pembelajaran RME dalam meningkatkan kemampuan pemecahan masalah matematis peserta didik. Penelitian ini menggunakan metode meta analysis. Hasil dari lima artikel jurnal diperoleh satu artikel dalam kategori effect size sedang, satu artikel dalam kategori effect size sedang dan tiga artikel jurnal dengan effect size sangat besar. Nilai rata-rata effect size dari lima artikel jurnal tersebut yakni sebesar 1,11. Berdasarkan tabel interpretasi effect size, rata-rata dari lima artikel jurnal menunjukkan bahwa model Realistic Mathematics Education memiliki pengaruh yang sangat besar dalam meningkatkan kemampuan pemecahan masalah matematis peserta didik. Selain itu hasil uji-t diperoleh diperoleh $t_{hitung} = 10{,}16 > 1{,}96 = t_{tabel}$ sehingga $H_0$ ditolak Artinya, terdapat pengaruh yang signifikan antara rata-rata kemampuan pemecahan masalah matematis peserta didik yang menggunakan pembelajaran RME dan rata-rata kemmapuan pemecahan masalah peserta didik yang tidak menggunakan pembelajaran RME. Implikasi yang didapat adalah model Realistic Mathematics Education (RME) dapat dijadikan referensi oleh pendidik dalam pembelajaran matematika dalam upaya meningkatkan kemampuan pemecahan masalah matematis peserta didik.*
***Kata kunci**: kemampuan pemecahan masalah matematis; model rme.*

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## Introduction

Problem solving skills are important skills that students must have to master mathematics learning and solving a problem (Aprida et al., 2021; Isbandini, 2021). According to Hidayat and Sariningsih, (Isbandini, 2021), problem solving skills are the core of learning which are basic skills in the learning process (Agustina et al., 2021). Polya (1973) (Aprida et al., 2021) in dealing with problems there are several stages taken by students, namely: (1) understanding the problem; (2) planning a strategy for solving a problem; (3) implementing the problem-solving strategy and (4) re-examining the results that have been obtained. According to PISA 2015, Indonesia is ranked 63 out of 70 countries with an average score of 386 with an international average score of 490. (Tantra et al., 2022)The results of PISA 2018 Indonesia are ranked 73 out of 79 participating countries (Shofa et al., 2023).

Problem solving ability is also an important part of the mathematics curriculum because the learning process and its solution, the possibility of students gaining experience, knowledge and skills that can be applied to non-routine problems (Tantra et al., 2022; Aprida et al., 2021b; Isbandini, 2021). One of the factors causing low mathematical problem solving ability of students is the selection of inappropriate learning models that are not in accordance with the conditions of students (Tantra et al., 2022; Rohim & Yulfianto, 2021; Putri, 2024; Khairi et al., 2024; Mardika & Maulidya, 2023; Rini & Parida, 2021). The learning model that can be applied in improving problem solving ability is the RME model. This is in accordance with several studies that have results that the RME model can improve students' mathematical problem solving ability (Amalia & Sulistyorini, 2022; Anggraini & Fauzan, 2020; Noviyana et al., 2018; Salsabila et al., 2020; Sari, 2019; Syaputra et al., 2020).

The RME learning model uses an approach that links real events for students so that they can easily solve mathematical problems by analyzing, using solution strategies, so that students are better at understanding mathematical problem solving strategies (Amrina & Kumaharti, 2024; Shofa et al., 2023; Hasim et al., 2025; Noviyana et al., 2018; Syafitri et al., 2025). The syntax of RME model based on (Ristiningsih et al., 2021) is: (1) understanding the problem; (2) solving contextual problems; (3) comparing and discussing answers and (4) concluding answers. The RME model places the reality and experience of students as the starting point for learning. Realistic problems are used as a source of the emergence of mathematical concepts or formal mathematical knowledge that can encourage problem solving activities, finding problems and organizing problems (Nafsiah & Siregar, 2023; Noviyana et al., 2018).

This study aims to analyze journal articles themed on the influence of the RME model in improving students' mathematical problem-solving abilities. The use of the RME model on students' mathematical problem-solving abilities has been widely studied and has obtained varying results. From this information, in-depth and comprehensive information is needed regarding the RME model in improving students' mathematical problem-solving abilities by analyzing the results of existing research.

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## Research methods

This study uses a meta-analysis method. The meta-analysis method is a technique used to summarize the findings of two or more studies that aim to combine, review, and summarize previous studies (Mansyur & Iskandar, 2017). The steps of the meta-analysis method research according toSari (2019) among others; determining inclusion criteria; data collection and variable coding, and statistical analysis. The inclusion criteria used are research articles or journals that meet the criteria (a) articles/journals included in the 2018-2024 time frame, (b) articles written by Indonesian authors and published in SINTA-indexed journals or national proceedings, and (c) research articles/journals contain statistical data such as number of samples (n), average (mean) and standard deviation (standard deviation).

Empirical data were found from the Google Scholar, Research Gate, and Academia databases that have been checked to achieve research criteria that are relevant to the researcher's variables, namely *the* RME Model and students' mathematical problem-solving abilities. Based on these criteria, there are 5 journal articles that will be analyzed in this study. The results of the collection and analysis of journal articles found by the author with coding criteria are shown in Table 1.

Table 1Results of journal article analysis based on criteria

| No. | Title | Results | Source |
|---|---|---|---|
| **1** | *the Realistic Mathematics Education (RME)* Model on the Mathematical Problem Solving Ability of Grade VIII Junior High School Students | The purpose of this study was to determine the effect of the *Realistic Mathematics Education* (RME) model on the mathematical problem solving ability of grade VIII students in the Even Semester of SMP Negeri 1 Sendangagung. The method used in this study was the experimental method. It was carried out in two classes as research samples. The number of samples in this study was 25 students in the experimental class and 23 students in the control class. With an average of 82.40 for the experimental class and a standard deviation of 11.91. The average for the control class was 50.70 with a standard deviation of 15.10. Statistical calculations were also carried out and the t count was 8.13. | Hesti Noviyana, Dewi Fitriani,. The Influence of *Realistic Mathematics Education* (RME) Model on the Mathematical Problem Solving Ability of Grade VIII Junior High School Students. Proceedings of the National Seminar on Mathematics and Mathematics Education. p-ISSN: 2579-941X, e-ISSN: 2579-9444 |
| **2** | *the Realistic Mathematics Education* Approach on Students' Mathematical Problem Solving Ability | This study aims to determine the effect of the *Realistic Mathematics Education* (RME) approach on students' mathematical problem solving abilities on the subject of social arithmetic of class VII MTs Al- | *Realistic Mathematics Education (RME)* Approach on Students' Mathematical Problem Solving Ability. Prismatika: Journal of Mathematics Education and Research Vol. 5 No. 1 (2022) |

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| No. | Title | Results | Source |
|---|---|---|---|
| | | Ihsan. This study is an experimental study where the experimental and control groups are selected randomly. Consisting of 24 students as the experimental group and 24 students as the control group. The average value of the experimental group is 81.750 and the standard deviation is 4.306. Meanwhile, the average of the control group is 76.417 and the standard deviation is 4.169. With the results of t count 4.359 and t table 2.013 in the t-test. | p-ISSN: 265-6140, e-ISSN: 2656-4181 |
| **3** | The Influence of *the Realistic Mathematics Education* (RME) Approach with the Concept Map Strategy on the Mathematical Problem Solving Ability of PGMI IAIN Bengkulu Students | This study aims to determine the effect of realistic mathematics education (RME) with the Concept Map Strategy on students' problem-solving abilities. The type of experimental research with a quasi-experimental design was carried out at IAIN Bengkulu. The research sample consisted of 35 students as the experimental class and 34 students as the control class. The average post-test score of the experimental class was 78.76 with a standard deviation of 9.59. Meanwhile, the average for the control class was 71.53 with a standard deviation of 8.99. | Shinta Maya Sari (2019) The Influence of *Realistic Mathematics Education* (RME) Approach with Concept Map Strategy on Mathematical Problem Solving Ability of PGMI IAIN Bengkulu Students. Raflesia Mathematics Education Journal. Vol. 04 No. 01, June 2019 |
| **4** | *the Realistic Mathematics Education (RME)* Model on Problem Solving Ability in Using Story Questions in Class VII of SMP Negeri 1 Sei Kepayang | The purpose of this study was to determine the effect of the RME Model on problem-solving abilities in using story problems in grade VII of junior high school. The study used the Quasi Experiment method. With 32 students in the control class and 32 students in the experimental class. With an average of 79.66 for the experimental class and a standard deviation of 10.14. Meanwhile, the average for the control class was 66.34 and a standard deviation of 8.05. | Dedi Ahmad Syaputra, Cini Nurani, Reza Umami. (2020) The Influence of *the Realistic Mathematics Education* (RME) Model on Problem Solving Ability in Using Story Questions in Class VII of SMP Negeri 1 Sei Kepayang. National Seminar on Mathematics and Mathematics Education (5th SENATIK ). |
| 5 | The Effect of Realistic Mathematics Education Approach on Mathematical | The purpose of this study is to improve mathematical problem solving skills through the application of the *Realiastic* | Reri Seprina Anggraini, Ahmad Fauzan. The Effect of Realistic Mathematics Education Approach on |

e-ISSN 2746-5594
p-ISSN 2746-5608

| No. | Title | Results | Source |
|---|---|---|---|
| | Problem Solving Ability | *Mathematics Education* (RME) approach compared to classes that apply conventional learning according to the level of student self-efficacy. The research method used quasi-experimental where there were 31 students in the experimental class and 37 students in the control class. The average for the experimental class was 78.60 and the standard deviation was 14.06. While the average for the control class was 65.86 and the standard deviation was 17.43. | Mathematical Problem Solving Ability. EDUMATIK: Journal of Mathematics Education Research Volume 3, Number 2, November 2020. e-ISSN: 2620-8911, p-ISSN: 2620-8903 |

This meta-analysis research was conducted by collecting data by coding journal articles to find *the effect size or magnitude of influence. The variables used in coding are article data consisting of the researcher's name, research title, journal name, and year of publication. In determining the magnitude of the influence of a research variable, the effect size* value is calculated using the Cohen's formula (Cohen, 1992)as follows:

$$d = \frac{\bar{x}_1 - \bar{x}_2}{s} \ldots (1)$$

with :
$d$: *effect size*
$\bar{x}_1$: average of the experimental group
$\bar{x}_2$: control group average
$s$: combined standard deviation

*Effect size* calculation interpreted using the classification according to Aprilianingrum & Wardani (2021) are shown in Table 2.

Table 2Interpretation of effect size

| ***Effect Size*** | **Interpretation** |
|---|---|
| $\mathbf{0 \leq d \leq 0,2}$ | Small |
| $\mathbf{0,2 < d \leq 0,5}$ | Currently |
| $\mathbf{0,5 < d \leq 0,8}$ | Big |
| $\mathbf{d > 0,8}$ | Very large |

Hypothesis testing is a test to determine whether there is a difference in the average of the experimental group and the average of the control group. The test is carried out using the *t- test statistical test* . The test hypothesis is as follows:

$H_0: \mu_1 \leq \mu_2$(The average problem-solving ability of students who use RME learning is less than the same as the average problem-solving ability of students who do not use RME learning)

$H_0: \mu_1 > \mu_2$(The average problem-solving ability of students who use RME learning is greater than the average problem-solving ability of students who do not use RME learning)

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By determining the level of significance used, namely$\alpha = 0{,}05$
The research testing criteria are rejected $H_0$ if $t_{hitung} > t_{tabel}$
Determination $t_{tabel}$

$$t_{tabel} = t_{1-\frac{1}{2}(0{,}05)} \ldots (2)$$

And

$$dk = n_1 + n_2 - 2 \ldots (3)$$

The *t-test* in this study is a test of two means which is carried out using the formula according to Sudjana (2013) as follows:

$$\boldsymbol{t} = \frac{\bar{x}_1 gab - \bar{x}_2 gab}{s_{gab}\sqrt{\frac{1}{n_{eks}} + \frac{1}{n_{kontrol}}}} \ldots (4)$$

with

$$\boldsymbol{s_{gab}}' = \sqrt{\frac{((n_{eks}-1)s_{1gab}^2 + (n_{kontrol}-1)s_{2gab}^2}{(n_{eks}+n_{kontrol}-2)}} \ldots (5)$$

Information :
$t$: $t$ count
$\bar{x}_1 gab$: average of combined experimental groups
$\bar{x}_2 gab$: average of the combined control group
$n_{eks}$: number of experimental group samples
$n_{kontol}$: number of control group samples
$s_{1gab}^2$: combined experimental group variance
$s_{2gab}^2$: combined control group variance

## Results and Discussion

This study was conducted to determine the extent of the influence of RME in improving students' mathematical problem-solving abilities. Five journal articles were studied according to the inclusion criteria. Coding for each article was based on the name of the researcher, title of the research, publication source and year of publication. The influence of RME in improving mathematical problem-solving abilities can be seen from *the effect size* of each journal article that has been calculated by the researcher in the following Table 3.

Table 3Results of calculation of journal article effect size

| J | n | | Average | | Standard Deviation | | $S^2$ | | Effect Size | Interpretation |
|---|---|---|---|---|---|---|---|---|---|---|
| | Ex | Ko | Ex | Ko | Ex | Ko | Ex | Ko | | |
| **J1** | 25 | 23 | 82.4 | 50.7 | 11.91 | 15.1 | 141,8481 | 228.01 | 2.632298 | Very large |
| **J2** | 24 | 24 | 81.75 | 76,417 | 4,306 | 4,169 | 18.54164 | 17,38056 | 0.442841 | Currently |
| **J3** | 35 | 34 | 78.76 | 71.53 | 9.59 | 8.99 | 91,9681 | 80,8201 | 0.600363 | Big |
| **J4** | 32 | 32 | 79.66 | 66.34 | 10.14 | 8.05 | 102,8196 | 64,8025 | 1,106063 | Very large |
| **J5** | 31 | 37 | 78.6 | 65.86 | 14.06 | 17.43 | 197,6836 | 303,8049 | 1.057902 | Very large |
| **Combined** | 147 | 150 | 80.02 | 66.61 | 10.63 | 12.04 | 112.9969 | 144,9616 | 1.11 | Very large |
| | | | | | 11.37 | | | | | |

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Table 3 shows the number of experimental group samples, namely 147 students, and the number of control group samples, 150 students. With an average of the experimental group of 80.02 and an average of the control group of 66.61. The data is used to test the hypothesis of whether there is a difference in the average mathematical problem solving ability of students in the experimental and control classes. Testing two averages using the right-hand test as follows:

1. *Determine hypothesis*
   $H_0: \mu_1 \leq \mu_2$(The average problem-solving ability of students who use RME learning is less than the same as the average problem-solving ability of students who do not use RME learning)
   $H_0: \mu_1 > \mu_2$(The average problem-solving ability of students who use RME learning is greater than the average problem-solving ability of students who do not use RME learning)

2. *Determine level significantly*
   Significant levels used that is $\alpha = 0{,}05$

3. *Criteria testing*
   Reject $H_0$if $t_{hitung} > t_{tabel}$

4. *Determine* $t_{tabel}$
   $t_{tabel} = t_{1-\frac{1}{2}(0{,}05)} = t_{0{,}975}$
   And $dk = n_1 + n_2 - 2 = 147 + 150 - 2 = 295$obtained$t_{tabel} = 1{,}96$

5. *Determine* $t_{hitung}$
$$t_{hitung} = \frac{\bar{x}_1 - \bar{x}_2}{S_{gab}\sqrt{\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} = \frac{80{,}0 - 66{,}6}{11{,}37\sqrt{\left(\frac{1}{147} + \frac{1}{150}\right)}} = 10{,}16$$

6. *Interesting conclusion*
   From the data calculations obtained $t_{hitung} = 10{,}16 > 1{,}96 = t_{tabel}$so that$H_0$ rejected This means that there is an average ability breakdown problem mathematical participant students who use RME learning more than average ability breakdown problem participant educate who does not use RME learning . So , there is the influence of the RME learning model on ability breakdown problem mathematical participant educate

Based on Table 3, the average effect size of 5 journal articles is 1.11 with the largest effect size of 2.63 and the smallest effect size of 0.44. The results of the meta-analysis of this study show an average effect size of 1.11 which is included in the interpretation of a very large effect. This means that the RME model has a major influence in improving students' mathematical problem-solving abilities.

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p-ISSN 2746-5608

*Effect Size Medium*

Effect size category was obtained by one journal article, namely research conducted by Amalia & Sulistyorini (2022)which obtained an effect size value of 0.44. Based on the effect size interpretation table , this value is included in the medium category. In his research, it showed the influence of RME on the mathematical problem-solving ability of students in the subject of social arithmetic of class VII MTs Al-Ihsan. This was proven by the acquisition of a t-test with a significance level of 5% obtained a t- count of 4.359 and a t - table of 2.013. Then with the acquisition of t-count = 4.359> 2.013 = t-table then reject H0. The researcher also provided suggestions; further for other researchers to be able to conduct research on other materials and other aspects that can help students better understand the material in mathematics lessons.

*Big Effect Size*

Effect size category was obtained by one journal article, namely research conducted by Sari (2019)which obtained an effect size value of 0.60. Based on the effect size interpretation table , this value is included in the large category. In his research, it showed that there was an influence of Realistic Mathematics Education Learning with the Concept Map strategy on students' mathematical problem solving abilities with the value of students' mathematical problem solving abilities increasing by 0.416 (41.6%) with the help RME learning with the Concept Map strategy. In the study, the researcher also provided suggestions in the form of Realistic Mathematics Education can bring students closer to interaction in class. Be it interaction between students and students, students and lecturers, as well as interaction between students and material. Because the ability to solve mathematical problems can be achieved by students as a result of the interaction process.

*Effect Size Very Large*

Effect size category was obtained by three journal articles out of a total of five journal articles. This means that the RME learning model has a significant influence on improving students' mathematical problem-solving abilities. The research conducted by (Noviyana et al., 2018)obtained an effect size value of 2.63. Based on the effect size interpretation table , this value is included in the moderate category. In his research, it showed the influence of the Realistic Mathematics Education (RME) learning model on the mathematical problem-solving abilities of grade VIII students in the even semester of SMP Negeri 1 Sendangangung in the 2017/2018 academic year with an average mathematical problem-solving ability of students using the RME model higher than the average mathematical problem-solving ability of students using the conventional model. The results of this study are strengthened by the use of RME in the experimental class which strongly emphasizes the habits of students to form a concept from an informal state to a formal state of mathematics. Thus, students actively construct their own knowledge through the real-world context of students' lives in their interactions with the study groups that have been formed. It also makes students in the experimental class look very active and independent when presenting material to other groups and there is a positive question and answer interaction, complementing each other between groups and

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there is a process of constructing mathematical knowledge through independent learning group efforts and close to the lives of students. The presentation process carried out can foster a positive attitude towards mathematics, can also be an inspiration to understand and interpret the real world, and thinking activities.

The research conducted (Syaputra et al., 2020)by obtained an effect size value of 1.10. Based on the effect size interpretation table , the value is included in the very large category. The results of the study stated that there is an influence of the RME model on problem-solving skills in solving story problems on the comparative material of class VII of SMP Negeri 1 Sei Kepayang. This can be seen from the fact that the identification that learning using the RME model is better and more effective in mathematics learning, especially probability material, because it has been proven to improve students' mathematical problem-solving skills. In learning mathematics on comparative material using the RME model, students are trained to discuss together with partners given by the teacher, learning using this RME model is more about real forms in everyday life.

The research conducted by with (Anggraini & Fauzan, 2020) had an effect size value of 1.05. Based on the effect size interpretation table , the value is included in the very large category. The results of his research stating that the mathematical problem solving ability of students who use RME learning is better than students who learn with conventional learning. Another finding in this study is that for students who have high self-efficacy , learning using RME provides them with the opportunity to improve their mathematical problem solving abilities. Likewise, the mathematical problem solving ability of students who have low self- efficacy and learn using RME is higher than students who learn using conventional learning. So it can be concluded that the RME model contributes to improving students' mathematical problem solving abilities.

## Conclusion and Suggestions

Based on the the results analysis of five articles journal obtained that there is a significant influence between the average mathematical problem solving ability of students using RME learning and the average mathematical problem solving ability of students using RME learning. Breakdown problem participants educate who do not use learning RME. Implications obtained are that RME model can made into a reference for educators in activity learning mathematics in an effort to increase the ability to break problem mathematical participants educate .

In the research that has been done , then given advice as following a) For teachers can using the RME model in learning mathematics at school in increase ability breakdown problem mathematical participant educate ; b) For participants educate to be able to build trust self For more active , optimistic and persistent give up in follow learning with using the RME model and can finish problem related mathematics with breakdown problem ; c) For readers , next can become input and overview regarding the RME model and abilities breakdown problem mathematical, and can made into as reference study to Topic appropriate problem with notice aspect Supporter ability breakdown problem mathematical participants educate , and can add outlook in field writing and also study .

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