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The Influence of the Realistic Mathematics Education Approach with Metacognitive Strategy Towards Mathematics Literacy Ability and Adversity Quotient Students

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Abstract

This research aims to describe the influence of the Realistic Mathematics Education (RME) approach combined with Metacognitive Strategies in mathematics learning on students' mathematical literacy and adversity quotient in class VII at a private junior high school in Yogyakarta City. This type of research is a quasi-experiment with population design of all clas VII students. Data collection for this research used test and non-test (questionnaires) The test was used to measure students' mathematical literacy skills, and the questionnaire was used to measure students' adversity quotient, with reliability coefficients of 0.67 and 0.77, respectively, falling within the high reliability qualification. The data analysis technique used are descriptive and inferential. Test Hotteling's T^2 used to determine the effect of realistic mathematics education approach and metacognitive strategy on the dependent variable, and test two independent sample t-test used to find out what the realistic mathematics education approach and metacognitive strategy influence one each dependent variable. Based on hypothesis testing at significant level of 5%, it is found that realistic mathematics education approach influence the ability to mathematics literacy and adversity quotient students together. This research result also shows that realistic mathematics education approach influence on each dependent variable in terms of the average score of mathematics literacy and adversity quotient students. In addition, the inference of 95% confidence interval for the mean difference show that the RME approach with metacognitive strategy is better than the saintific approach.

Keywords: *Realistic Mathematics Education; Metacognitive Strategy; Mathematic Literacy; Adversity Quotient*

Introduction

Mathematical literacy refers to an individual's capacity to formulate, employ, and interpret mathematics in a variety of contexts. This encompasses mathematical reasoning as well as the use of concepts, procedures, facts, and mathematical tools to describe, explain, and predict phenomena (OECD, 2017). This definition implies that mathematical literacy is not limited merely to the mastery of subject matter, but extends to the ability to formulate, employ, and interpret mathematical ideas. These three dimensions are known as the process components of mathematical literacy. Process components are understood as the steps or actions taken by an individual to solve a problem within a given situation or context, using mathematics as a tool to reach a solution.

Mathematical literacy is also defined as the knowledge required to understand and apply fundamental mathematics in everyday life (Manizade et al., 2023). When an individual possesses this ability, they are more capable of solving problems they encounter, as they can reason mathematically. The importance of mathematical literacy is further emphasized by the Programme for International Student Assessment (PISA), which includes this competency as one of the aspects measured on a global scale. In the Indonesian context, the significance of mathematical literacy has also been highlighted in the *Kurikulum Merdeka* policy document.

The urgency of mathematical literacy skills has been strongly emphasized by the Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia, as stated in Regulation No. 5 of 2022 concerning the Standards of Graduate Competence in Secondary Education. The regulation aims to ensure that students are able to demonstrate the capacity to reason by applying mathematical concepts, procedures, facts, and tools to solve problems related to themselves, their immediate environment, their communities, and the broader global society. With adequate mastery of mathematical literacy, individuals are expected to reflect mathematical logic in ways that allow them to actively participate in their personal lives, communities, and wider society (Masjaya & Wardono, 2018).

Prior to the implementation of the *Kurikulum Merdeka*, which places a strong emphasis on mathematical literacy, Indonesia had consistently participated in the Programme for International Student Assessment (PISA) from 2000 through 2022. PISA is an international assessment involving 79 countries worldwide, designed to measure the competencies of 15-year-old students in reading literacy, mathematical literacy, science, and global competence (Hewi & Shaleh, 2020). However, since 2000, Indonesia’s PISA scores—particularly in mathematical literacy—have consistently remained well below the average scores of both Organisation for Economic Co-operation and Development (OECD) member and non-member countries that participate in the assessment. In 2022 specifically, Indonesia’s average PISA score in mathematical literacy stood at only 366, compared to the highest international average of 575 (OECD, 2024).

As a result, the majority of Indonesian 15-year-olds are only able to perform at Level 1 in numeracy skills, meaning they are capable merely of “answering questions in familiar contexts where all relevant information is clearly available.” This stands in stark contrast with the average PISA participants, who are generally able to “interpret and use representations based on different sources of information” (Pratiwi et al., 2022). These findings underscore that Indonesian students’ mathematical literacy remains considerably below the global standards required in today’s interconnected world.

In addition to PISA, Indonesia also assesses students’ mathematical literacy through the *Asesmen Kompetensi Minimum* (AKM/Minimum Competency Assessment). In July 2023, the Ministry of Education, Culture, Research, and Technology released the 2023 National Education Report (*Rapor Pendidikan Nasional 2023*), which evaluated the quality of education in Indonesia based on data collected in 2022. Among the basic competencies assessed was mathematical literacy, and the findings revealed that in 2023 only 40.63% of students achieved mathematical literacy levels above the minimum standard (Kemdikbud, 2023). Beyond the results of PISA and the National Education Report, previous studies have also indicated that Indonesian students’ mathematical literacy remains low. For example, research by Novalia & Rochmad (2017) concluded that the mathematical literacy skills of Indonesian children are still at an unsatisfactory level. Putri et al. (2020) found that one of the main students' low mathematical literacy is challenges lies in students’ difficulties in formulating mathematical models from real-life problems. Furthermore, Rahmawati et al. (2021) revealed that another cause of students' low mathematical literacy skills is factor is students' struggle to communicate and represent their answers within the context of given problems.

Research on mathematical literacy in Yogyakarta has also revealed low levels of achievement. A study conducted by Rifai & Wutsqa (2017) reported that the mathematical literacy skills of junior high school students in Bantul Regency fell into the very low category. Students' ability to interpret and use information was classified as low, whereas their ability to formulate problems was categorized as high. Similarly, research by Nisa, F. K., & Arliani (2023) involving 436 eighth-grade students in Yogyakarta, found that students' mathematical literacy skills remained within the low category. These findings are further supported by a study involving 400 fifteen-year-old students in Yogyakarta, which concluded that their mathematical literacy proficiency was also low (Wulandari, 2018).

Other factors contributing to the low level of students' mathematical literacy include the lack of habituation in solving literacy-oriented problems, students' limited mathematical ability, and their low interest in mathematics, as the subject is often perceived as difficult and seldom connected to everyday life (Maulyda, 2023). Additional challenges that hinder students from solving mathematical literacy problems are the fact that they are not accustomed to tackling literacy-based tasks (Wijaya et al., 2014), the limited number of teachers who incorporate literacy-oriented problems in their instruction (Putri & Zulkardi, 2018), the scarcity of mathematical literacy problem resources available in school libraries or bookstores (Wijaya et al., 2015), and students' difficulties in understanding narrative problems and transforming them into mathematical models (Holis et al., 2016).

Furthermore, research has shown that teacher-centered learning is a major factor underlying students' low achievement in mathematical literacy (Syukur, 2014). This is because teacher-centered approaches generally result in students merely receiving information, with little opportunity to understand how concepts are interconnected, while also less to motivate them to construct their own knowledge. Therefore, selecting appropriate learning approaches is essential for teachers to enhance students' mathematical literacy skills.

One approach that directly relates to everyday life is Realistic Mathematics Education (RME) (Ningsih, 2014). RME, in this context, refers to an instructional approach that places students' realities and experiences as the starting point of the learning process (Freudenthal, 2006). Realistic problems are employed as the foundation from which mathematical concepts or formal mathematical knowledge emerge, thereby fostering activities such as problem-solving, problem-posing, and organizing core issues (Lestari & Yudhanegara, 2015). Several studies have investigated the use of RME and confirmed its effectiveness in improving mathematical literacy. For example Ayunis & Dorisno, (2022); Agustina et al., (2022); Belia, (2021) demonstrated that the RME approach can enhance students' mathematical literacy skills. Likewise, Budiono & Wardono (2014) found that RME not only improves learning outcomes but also increases student engagement by presenting materials in contexts that align with everyday life. Since mathematical literacy problems inherently involve real-life or authentic contexts, they align well with the principles of RME, which begins instruction with real-world problems. Therefore, the RME approach holds strong potential for improving students' mathematical literacy skills.

Although RME has previously been examined as an instructional approach, the present study seeks to combine it with a specific learning strategy, namely the metacognitive strategy. RME is an approach that begins with students engaging in and understanding contextual problems provided by the teacher. Meanwhile, the metacognitive strategy refers to a set of activities designed to help students become aware of how they learn, fostering awareness of both the processes and outcomes of their thinking. The stages of the metacognitive strategy include planning, monitoring, and evaluation (Flavell, 1979). By applying metacognitive strategies, students can be help to become more focused and controlled in developing their thinking processes.

In addition to selecting appropriate approaches and learning strategies to enhance mathematical literacy, teachers are also expected to foster the affective aspects of students. One important aspect discussed in this study is students' Adversity Quotient (AQ). According to Stoltz (2007) in his book *The Quantum Quotient*, AQ reflects how well an individual is able to endure difficulties and overcome them. AQ has a significant influence on students' achievement in mathematics. Students with a high AQ tend to achieve better and more satisfactory results, particularly in mathematics, which requires discipline. Such discipline enables students to value time, approach problems in an organized manner, and overcome learning obstacles more effectively (Amir, 2015).

The combination of the Realistic Mathematics Education (RME) approach with metacognitive strategies offers several advantages in its implementation. For instance, when students attempt to understand and model real-life problems, they will find it easier to select appropriate solution plans, since metacognitive strategies involve managing learning plans that facilitate students in working through and solving such problems. Therefore, the integration of the RME approach with metacognitive strategies is expected to be effectively applied in mathematics classrooms.

Based on the above discussion, the implementation of *Realistic Mathematics Education* combined with metacognitive strategies has the potential to improve students' Mathematical Literacy and Adversity Quotient (AQ). The rationale for conducting this study is to examine the effect of applying Realistic Mathematics Education with metacognitive strategies on students' Mathematical Literacy and AQ. To date, there has been no empirical evidence confirming whether the integration of RME and metacognitive strategies has a positive effect on enhancing Mathematical Literacy and AQ, particularly among Grade VII junior high school students.

Method

The type of research employed in this study is an experimental study with a quantitative approach. A quantitative method was chosen because the data to be processed consist of numerical values obtained from administering objective tests to respondents. The research design applied is a Quasi-Experimental Design.

This instructional study involves two levels of factors: the experimental class, which applies the *Realistic Mathematics Education* (RME) approach combined with metacognitive strategies, and the control class, which applies the scientific approach. The observed responses are students' mathematical literacy and adversity quotient. The study uses a pretest–posttest design, which requires administering a test before and after the treatment. The results of both tests are then calculated and analyzed using appropriate data analysis techniques. The interpretation of results is presented in terms of the effects of the treatment, both multivariate and univariate.

This research was conducted at MTs N 8 Sleman, Yogyakarta, during the odd semester of the 2023/2024 academic year. The study took place from May to June 2024 and consisted of six meetings, with the learning material focused on data and diagrams. The population of this study comprised all seventh-grade students of MTs N 8 Sleman, Yogyakarta, totaling six classes, which served as the population. The sample was selected using a random sampling procedure.

The data analysis techniques employed in this study were both descriptive and inferential. Hotelling's T^2 test was used to determine the overall effect of the Realistic Mathematics Education approach combined with metacognitive strategies on the dependent variables. In addition, independent samples t-tests were applied to examine the effect of the RME approach and metacognitive strategies on each dependent variable separately. If a significant difference was found, the analysis proceeded with a 95% confidence interval for the difference between the two population means. All analyses were conducted using the R software (R Core Team., 2024) and the RStudio program.

Result Data Test and Discussion

1. Learning Implementation Outcomes

The outcomes of learning implementation in each meeting were obtained through observation sheets completed by the observer. In this study, the observer was the mathematics teacher of the class. The teacher acted as an observer of the learning process, recording the tasks and activities carried out by both the teacher and students during the lesson in the observation sheet. The results of the achievement of learning activities between teachers and students are presented in the following Table 1.

Table 1. Achievement Results of Implementation of Learning Activities

Meeting	Persentase			
	Experimental Class		Control Class	
	Teacher Activities	Student activities	Teacher Activities	Student activities
1	85	85	82	76
2	95	85	76	82
3	90	90	88	82
4	95	90	94	88
Average	91,25	87,5	85	82

Based on Table 1, it can be seen that the average percentage of teacher and student activities in the experimental class was higher than in the control class. Moreover, the average implementation of learning on data and diagram materials from the first to the fourth meeting exceeded 80%. Therefore, it can be concluded that the learning steps contained in the teaching module were well implemented by the teacher and students during classroom learning.

2. Data on Mathematical Literacy Skills

Students' mathematical literacy skills in this study were measured using pretest and posttest instruments in the form of descriptive questions consisting of six items. The descriptive statistical data for students' mathematical literacy skills in the experimental and control classes are presented in Table 2.

Table 2. Descriptive Statistics of Mathematical Literacy of Experiment and Control Class

Description	Experimental Classes		Control Classes	
	pretest	*posttest*	*pretest*	*posttest*
Number of Students	29	29	29	29
Average	17,43	80,45	16,67	75,86
Maximum Value	44	94	44	89
Minimum Value	0	67	0	61
Ideal Maximum Score	100	100	100	100
Ideal Minimum Score	0	0	0	0
Standard Deviation	12,74	6,90	11,87	7,61

Based on Table 2, it can be observed that the average score of students' mathematical literacy in the experimental class using the RME approach with metacognitive strategies increased from 17.43 to 80.45. Similarly, the average score of students' mathematical literacy in the control class using the scientific approach also increased, from 16.67 to 75.86. Therefore, it can be concluded that the posttest average score of mathematical literacy in the experimental class was higher than that of the control class.

3. Data on Adversity Quotient Students

In this study, students' adversity quotient was measured using pretest and posttest questionnaires consisting of 20 items. The descriptive statistical results of students' adversity quotient in the experimental and control classes are presented in Table 3.

Table 3. Descriptive Statistics of Adversity Quotient Student of Experimental and Control Class

Description	Experimental Classes		Control Classes	
	pretest	*posttest*	*pretest*	*posttest*
Average	67	86	64	78
Maximum Value	78	96	75	88
Minimum Value	61	80	54	68
Ideal Maximum Score	100	100	100	100
Ideal Minimum Score	20	20	20	20
Standard Deviation	4,03	4,12	4,74	4,53

Based on the descriptive statistics in Table 3, it can be observed that the average adversity quotient score in the experimental class applying RME with metacognitive strategies increased from 67 (pretest) to 86 (posttest). Similarly, in the control class using the scientific approach, the average score also increased from 64 to 78. Therefore, it can be concluded that the posttest average score of the adversity quotient in the experimental class was higher than in the control class.

Before analyzing the data, assumption tests were carried out to ensure the validity of further analysis. The tests included:

1. Verifying that the research data were normally distributed both multivariately and univariately.

2. Confirming that the population covariance matrices for mathematical literacy and adversity quotient in both the experimental and control classes were equal.

3. Ensuring that the population variance for mathematical literacy and adversity quotient in the experimental class was the same as that in the control class.

After meeting these assumptions, the next step was to test the influence of the learning model in each class to determine its effectiveness, based on students' mathematical literacy and adversity quotient.

4. Comparison of the Realistic Mathematics Education (RME) approach combined with Metacognitive Strategies in mathematics learning on students' mathematical literacy and adversity quotient

Table 4. Hotteling's $\boldsymbol{T^2}$ Test Statistic Results

Description	***Hotteling's $\boldsymbol{T^2}$***	***p-value***
Before Treatment	5,664	0,058
After Treatment	57,377	0,000

Based on the Hotelling's T^2 results in Table 4, the p-value before treatment was 0.058, which is greater than 0.05. This indicates no significant difference in the pretest mean scores of the experimental and control classes, showing that both groups had equivalent initial conditions. After treatment, however, the p-value was 0.000, which is less than 0.05, indicating a significant difference in posttest results. This suggests that the implementation of RME with metacognitive strategies had a significant positive impact on students' mathematical literacy and adversity quotient compared to the scientific approach.

Since there is a difference between the RME and saintific classes after treatment, further testing is needed using the Two Independent Sample t-Test, as presented in Tabel 5.

Table 5. Two Independent Sample t-Test Statistic Result

Variable	*t*	*p-value*
Mathematical Literacy	2,409	0,019
Adversity Quotient	7,174	0,000

Based on Table 5, the p-value for mathematical literacy was 0.019. Since *p-value* < 0.05, the null hypothesis is rejected. Thus, at the 0.05 significance level, it can be concluded that there is a significant difference in the mean mathematical literacy scores between students taught using the RME approach with metacognitive strategies and those taught using the scientific approach.

Table 5 also shows that the p-value for adversity quotient was 0.000. Since *p-value* < 0.05, the null hypothesis is again rejected. This indicates that there is a significant difference in the mean adversity quotient scores between the experimental class (RME with metacognitive strategies) and the control class (scientific approach).

Because the two independent sample t-tests indicated significant differences, further inference was carried out using 95% confidence intervals for the difference in population means.

Table 6. 95% Confidence Interval Result

Variable	*Test Statistic*
Mathematical Literacy	$0,775 \leq \mu_1 - \mu_2 \leq 8,420$
Adversity Quotient	$5,890 \leq \mu_1 - \mu_2 \leq 10,454$

Based on the R output, the 95% confidence interval for mathematical literacy $\mu_1 - \mu_2$ is $0,775 \leq \mu_1 - \mu_2 \leq 8,420$ suggests that the mean score for students taught with RME and metacognitive strategies is significantly higher than that of students taught with the scientific approach.

Similarly, the 95% confidence interval for adversity quotient for $(\mu_1 - \mu_2)$ is $5,890 \leq \mu_1 - \mu_2 \leq 10,454$ indicates that the experimental group also outperformed the control group in this aspect.

Since all the confidence intervals have positive values, it can be concluded that the average population scores of both mathematical literacy and adversity quotient of students taught using the RME approach combined with metacognitive strategies were higher than those of students taught using the scientific approach.

Discussion

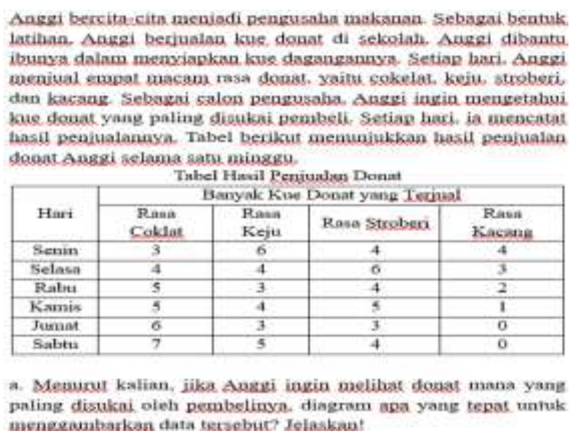
1. The Effect of Realistic Mathematics Education with Metacognitive Strategies on Students' Mathematical Literacy and Adversity Quotient

This study demonstrated that, prior to treatment, students' mathematical literacy skills and adversity quotient (AQ) in both the experimental class (taught using the Realistic Mathematics Education approach with metacognitive strategies) and the control class (taught using the scientific approach) were equally at low levels. Following treatment, both abilities showed significant improvement, with the experimental class achieving notably higher gains.

The RME approach emphasizes contextual problem-solving rooted in everyday life, which makes mathematical content more accessible and enhances students' motivation to learn. The integration of metacognitive strategies within RME enables students to plan, monitor, and evaluate their thought processes during problem-solving. This not only strengthens mathematical literacy but also supports the development of adversity quotient by fostering self-control, responsibility, persistence, and resilience in dealing with challenges. The learning process was carried out through group discussions, real-world problem-solving, and self-evaluation activities, all of which gradually increased student engagement. The successful implementation of RME with metacognitive strategies in the experimental class reached more than 80% effectiveness, despite initial challenges such as adaptation to a new method and time allocation. These results are consistent with previous studies reporting the effectiveness of RME in improving mathematical literacy (Herliani & Wardono, 2019; Melda Maulyda, 2023). Overall, the integration of RME and metacognitive strategies was proven to significantly enhance students' mathematical literacy and adversity quotient compared to the traditional scientific approach.

2. The Effect of the Realistic Mathematics Education Approach with Metacognitive Strategies on Students' Mathematical Literacy

The posttest results of students' mathematical literacy were assessed across three indicators of mathematical literacy. The first indicator is the ability to formulate problems in mathematical language or to represent them mathematically using symbols, diagrams, or mathematical models. In this aspect, students demonstrated the ability to translate real-life problems into mathematical representations through the use of appropriate diagrams. During the learning process, the use of contextual problems that were relevant and aligned with students' initial conditions facilitated the construction of knowledge into appropriate mathematical representations (Kadir & Masi, 2014). The following presents an excerpt of a posttest item designed to measure this first indicator of mathematical literacy.


Anggi bercita-cita menjadi pengusaha makanan. Sebagai bentuk latihan, Anggi berjualan kue donat di sekolah. Anggi dibantu ibunya dalam menyiapkan kue dagangannya. Setiap hari, Anggi menjual empat macam rasa donat, yaitu cokelat, keju, stroberi, dan kacang. Sebagai calon pengusaha, Anggi ingin mengetahui kue donat yang paling disukai pembeli. Setiap hari, ia mencatat hasil penjualannya. Tabel berikut menunjukkan hasil penjualan donat Anggi selama satu minggu.

Tabel Hasil Penjualan Donat

Hari	Banyak Kue Donat yang Terjual			
	Rasa Coklat	Rasa Keju	Rasa Stroberi	Rasa Kacang
Senin	3	6	4	4
Selasa	4	4	6	3
Rabu	5	3	4	2
Kamis	5	4	5	1
Jumat	6	3	3	0
Sabtu	7	5	4	0

a. Menurut kalian, jika Anggi ingin melihat donat mana yang paling disukai oleh pembelinya, diagram apa yang tepat untuk menggambarkan data tersebut? Jelaskan!

Figure 1. Excerpt from Formulate Indicator Posttest Questions

Some of the answers of students in the experimental class for the questions in Figure 2.

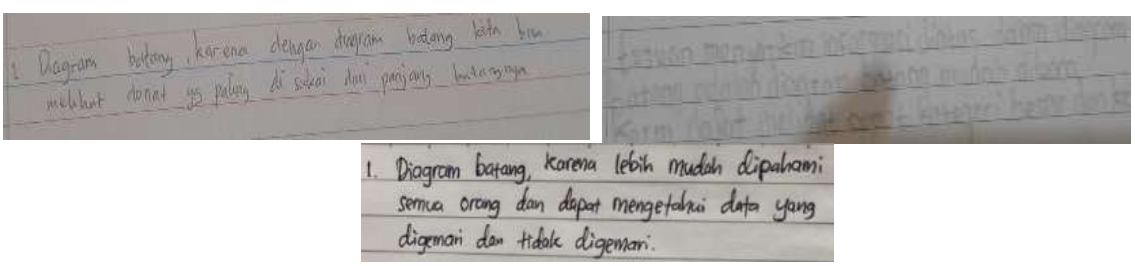


Figure 2. Some Student Answers Formulate Indicator

In Figure 2, it can be seen that the students were able to determine the appropriate diagram based on the problem presented. In addition, the students were able to explain why they represented the problem using a bar chart. This indicates that the students had understood the problem and represented it with a suitable diagram.

The second indicator of mathematical literacy is the ability to apply mathematical concepts, facts, procedures, and reasoning to solve mathematical problems. This involves performing calculations as well as analyzing information presented in mathematical representations such as graphs and diagrams (*employ*). The following is an excerpt of a mathematical literacy problem addressing the second indicator.

Figure 3. Excerpt from Employ Indicator Posttest Questions

In this problem, students are required to use the concept of ratio within a pie chart, the given facts in the problem, the appropriate calculation procedures, and mathematical reasoning in order to solve the problem (employ). The following are excerpts of several students' answers from the experimental class to this problem.

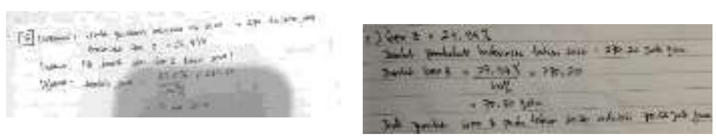


Figure 4. Some Student Answers for Employment Indicators

Based on the students' work shown in Figure 4, it can be seen that they have already applied the correct concepts, facts, procedures, and reasoning to solve the given problem. The students understood what was known and what was asked in the problem. Consequently, they were able to carry out the correct calculations to solve it. These results are related to the principles of Realistic Mathematics Education (RME), which trains students to solve problems and discuss them. Through discussion activities, students are able to construct their understanding, which they can then apply to problem solving. In addition, RME is characterized by the principle of intertwining, where students are able to connect concept they have previously learned. Before being able to solve the contextual problem above, students need to master basic arithmetic skills, such as calculating percentages and interpreting data.

The third indicator of mathematical literacy is interpreting solutions in relation to the context of a problem. This involves applying mathematical reasoning to evaluate whether the obtained mathematical solution is reasonable and meaningful within the given context. In the implementation of learning through the RME approach, students are not only trained to present the appropriate diagram based on the problem provided, but also to interpret the diagram they have created during the discussion process. Students are given guiding statements that encourage them to translate, interpret, and make sense of the diagrams they have constructed. This process helps students develop their ability to interpret mathematical results within real-world contexts.

Learning through the RME approach also has the characteristic of *interactivity*, which is implemented in the step of discussing contextual problems. In this stage, students actively discuss problem-solving strategies with their peers. They also practice evaluating the solutions they have obtained through presentation activities (*student's contribution*). These activities stimulate whole-class discussion, enabling students to validate and strengthen the understanding they have developed during the learning process. This aligns with the view of Sumirattana et al., (2017), who emphasize the use of interaction and communication to help students verify and further develop mathematical ideas, thereby enhancing their mathematical literacy skills. The following is an excerpt of a problem representing the third indicator.


Perhatikan Tabel di bawah ini!

Material Organik	Waktu Dekomposisi
Kulit Pisang	[illegible] minggu
Kulit Jeruk	[illegible] bulan
Kantong kertas	[illegible] minggu
Sisa apel	[illegible] bulan
Kertas tisu	[illegible] minggu

Doni membaca tabel dan diagram di atas. Ia menyatakan bahwa data pada tabel seharusnya bisa digambarkan menjadi satu diagram batang saja. Pernyataan tersebut dikoreksi oleh gurunya. Berikan alasan mengapa guru mengoreksi pernyataan yang dibuat oleh Doni!

Figure 5. Excerpt from the Interpret Indicator Posttest Question

Some of the answers of students in the experimental class for the questions in Figure 5 are presented in Figure 6.

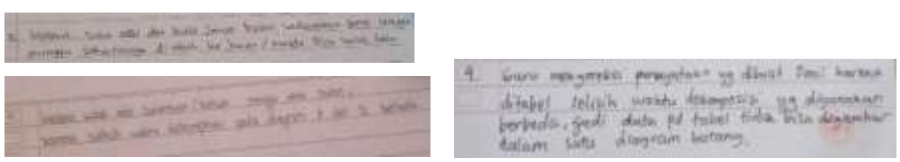


Figure 6. Some of the Answers of Students Interpret Indicators

In Figure 6, it can be seen that students were able to evaluate the given statements based on the presented data. The students demonstrated a good understanding of the problem, enabling them to determine whether the table could be represented in a single bar chart.

The influence of RME on students' mathematical literacy skills is consistent with the findings of Fauzana et al., (2020), who reported that the RME approach can enhance students' mathematical literacy. This improvement is closely related to the characteristics and stages of the RME approach. RME begins with the use of contexts that can be imagined by students, thereby helping them to understand the mathematical concepts being studied. In this study, the teaching of data and diagrams through the RME approach began with contexts that were relatable to students, such as student council elections, grocery purchases, the number of homecoming travelers, plastic waste emergencies, and other familiar issues.

Similar results were also obtained in the study by Maulyda (2023), which showed that the improvement of students' mathematical literacy skills through the RME approach was greater than that achieved through the scientific approach. The use of RME in teaching supports students in representing problems into appropriate mathematical models, thereby enabling them to arrive at correct solutions (Wigati et al., 2020).

3. The Effect of the Realistic Mathematics Education (RME) Approach Combined with Metacognitive Strategies on Students' Adversity Quotient

Based on the results of the two independent sample t-test, teaching data and diagram material using the Realistic Mathematics Education (RME) approach combined with metacognitive strategies had a significant effect on improving students' Adversity Quotient (AQ), with outcomes superior to those of the scientific approach. AQ refers to an individual's ability to face challenges and difficulties, which is categorized into quitters (low), campers (moderate), and climbers (high). In this study, all students in the experimental class reached the climber category.

The integration of RME with metacognitive strategies places students in real-world problem contexts, encouraging self-control, responsibility (origin/ownership), cooperation, reflection, and endurance when facing challenges. Through exploratory activities and group discussions, students not only developed a deeper understanding of mathematical concepts but also cultivated a resilient, persistent attitude. Thus, this approach proved effective in enhancing AQ, offering long-term benefits not only in the learning process but also in students' everyday lives. These findings are consistent with previous studies, which have demonstrated that RME significantly improves students' AQ (Anindita et al., 2021; Nisa & Elvis, 2020).

Research Limitations

The scope of this study was restricted to the mathematics topic of data and diagrams, which means the results may not necessarily represent learning outcomes in other subject areas. Furthermore, the use of metacognitive strategies at the evaluation phase was not fully optimized, as it focused primarily on assessing students' final learning achievements rather than encompassing a broader range of evaluative practices.

Conclusion

Based on the results of data analysis and the discussion presented, the following conclusions can be drawn:

1. The application of learning using the *Realistic Mathematics Education* (RME) approach combined with metacognitive strategies has a significant effect on students' mathematical literacy and adversity quotient.

2. The use of the RME approach with metacognitive strategies significantly influences students' mathematical literacy.

3. The use of the RME approach with metacognitive strategies significantly influences students' adversity quotient.

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