

Analysis of Students' Mathematical Reasoning Ability Using the Realistic Mathematics Education (RME) Approach Assisted by Scratch

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ABSTRACT

This study was motivated by students' low reasoning ability, which stem from a monotonous learning process that results in a lack of thinking activities, causing students to be passive or disengaged, as well as a lack of engaging and interactive learning media. Reasoning is an essential skill because it is one of the primary focuses of the Indonesian education curriculum. Reasoning involves the logical thinking process of gathering facts, analyzing them, and drawing conclusions. Based on this background, this study aims to describe students' mathematical reasoning ability using the RME approach supported by Scratch. The RME approach emphasizes the use of real-world contexts; in this case, the researcher uses the context of grilled kemplang, which is closely related to the subjects' daily lives. The novelty of this study lies in the application of RME supported by Scratch using the context of grilled kemplang. This is a qualitative descriptive study with 34 seventh-grade students as the research subjects; then, using purposive sampling, 3 students were selected as representatives of the categories of students' mathematical reasoning abilities. Data were collected through observation, written tests to be analyzed based on scoring guidelines, and interviews to be transcribed and subsequently described. The results of the study indicate that after instruction using the RME approach with Scratch as a learning medium, students' mathematical reasoning ability fell into the moderate category. Thus, instructional activities using the RME approach are effective in improving students' mathematical reasoning ability and their active engagement in the learning process.

Keywords: *Mathematical reasoning, Realistic Mathematics Education (RME), Scratch*

Analisis Kemampuan Penalaran Matematis Siswa Dengan Realistic Mathematics Education (RME) Berbantuan Scratch

ABSTRAK

Penelitian ini dilatarbelakangi oleh rendahnya kemampuan penalaran siswa yang disebabkan oleh proses pembelajaran yang monoton sehingga kurangnya aktivitas berpikir yang membuat siswa bersifat pasif atau kurang terlibat serta kurangnya media

pembelajaran yang menarik dan interaktif. Penalaran penting dimiliki karena merupakan salah satu perhatian utama dalam kurikulum pendidikan di Indonesia. Penalaran itu adalah kegiatan berpikir secara logis untuk mengumpulkan fakta, menganalisis serta membuat kesimpulan. Berdasarkan latar belakang tersebut, penelitian ini bertujuan untuk mendeskripsikan kemampuan penalaran matematis siswa dengan pendekatan RME berbantuan scratch. Pendekatan RME menekankan pada penggunaan konteks nyata dalam hal ini peneliti menggunakan konteks kemplang panggung yang dekat dengan kehidupan sehari-hari subjek. Kebaruan penelitian ini terletak pada penerapan RME berbantuan scratch menggunakan konteks kemplang panggung. Jenis penelitian ini adalah deskriptif kualitatif dengan subjek penelitian adalah siswa kelas VII berjumlah 34 siswa kemudian dengan teknik purposive sampling diambil 3 siswa sebagai perwakilan kategori kemampuan penalaran matematis siswa. Data dikumpulkan melalui observasi, tes tertulis yang akan dianalisis berdasarkan pedoman penskoran dan wawancara yang akan ditranskripsikan untuk kemudian dideskripsikan. Hasil penelitian menunjukkan bahwa setelah dilakukannya pembelajaran dengan pendekatan RME dengan media pembelajaran scratch kemampuan penalaran matematis siswa berada pada kategori sedang. Dengan demikian kegiatan pembelajaran dengan pendekatan RME efektif untuk meningkatkan kemampuan penalaran matematis dan keterlibatan aktif siswa dalam proses belajar.

Kata kunci: *Penalaran matematis, Realistic Mathematics Education (RME), Scratch*

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1. Introduction

Mathematics plays a crucial role as the foundation of education and a vehicle for the developing of the knowledge. Mathematics learning not only trains scientific and logical thinking ability, but also is key to improving the quality of human resources. Therefore, mathematics is often referred to as the Queen of Sciences by Carl Friedrich Gauss ([Pahlevi et al., 2021](#)). Improving reasoning is one of the main goals of mathematics education ([Setiawan et al., 2022](#)). Students who have mathematical reasoning ability will be able to think critically, logically, systematically, and creatively, especially in drawing conclusions from facts or data ([Kosasih et al., 2023](#)).

Reasoning ability are one of the most important ability in mathematics because they help students understand concepts, analyze relationships between concepts, and draw conclusions based on the information they have obtained ([Putri et al., 2024](#); [Rohman & Shodikin, 2025](#)). The importance of reasoning ability is also reflected in the Indonesian education curriculum, where reasoning is listed as one of the learning objectives for mathematics in Ministry of Education Regulation No. 22 of 2006. Mastery of reasoning ability can enhance students' mathematical proficiency ([Oktaviana & Aini, 2021](#); [Shodikin, 2023](#)), as mathematics and reasoning are closely intertwined: mathematics is understood through the reasoning process, and reasoning ability develop through mathematical learning activities ([Arida & Ikhsan, 2023](#)). Reasoning is the process of analyzing and using a method to draw conclusions and infer new

information from the information provided ([Wibowo, 2022](#)). Therefore, it is concluded that reasoning is a thinking activity to collect facts, analyze, and make conclusions.

Although these reasoning ability are crucial, various studies indicate that they remain underdeveloped among Indonesian students, as noted in [Julaeha & Kadarisma \(2020\)](#). According to the results of the 2022 PISA mathematics test, the majority of students scored below the average of 472, with an average score of 366, indicating weak mathematical reasoning ability ([Ariati & Juandi, 2022](#)). Indonesia ranks 44th out of 49 countries, with an average score of 397, according to the results of the 2015 TIMSS international study ([Qudsiah et al., 2023](#)). This low level of reasoning ability is evident in the topic of ratios, as noted by Putra, who observed that students have not yet met the reasoning indicators for the topic of ratios, specifically in the subtopics of direct and inverse ratios ([Putra et al., 2020](#)). Furthermore, [Rosyidah et al. \(2021\)](#) argued that poor mathematical reasoning ability were caused by inaccuracy and difficulty in identifying the steps to solve problems, while [Wau et al. \(2022\)](#) argued that students' lack of desire to learn mathematics, which made them easily forget the material taught, was the cause of their low reasoning ability.

One way to improve reasoning skills is by using the RME approach. According to [Fendrik \(2021\)](#) research, mathematical reasoning skills developed through the RME approach are superior to those acquired through conventional learning. RME is an excellent approach for teachers to enhance mathematical reasoning skills ([Subroto et al., 2025](#)). Additionally, [Siswono et al. \(2019\)](#) found that the implementation of cooperative learning models such as Numbered Head Together (NHT) and Think Pair Share (TPS) combined with the RME approach had a significant impact on the mathematical reasoning abilities of seventh-grade junior high school students. Research by [Amelia et al \(2025\)](#) also demonstrated an improvement in students' mathematical reasoning skills on SPLDV material through the implementation of RME and recommended the use of worksheets appropriate to the learning stages to support students' reasoning processes. In addition to using appropriate teaching approaches, the use of technology through digital learning media can also support the mathematics learning process. RME approach is widely acknowledged as one of the greatest methods to teach mathematics since it focuses on teaching students high order thinking skills including building their own knowledge, problem-solving, and critical and creative thinking ([Oktavia et al., 2025](#)). The development of RME-based digital media continues to be pursued to create more interactive and meaningful learning experiences ([Nisa et al., 2025](#), [Ramidha et al., 2025](#)). Students' lack of motivation to learn, which is one of the causes of poor reasoning skills, can be addressed by using interactive learning media that engage students' interest in learning, such as Scratch. Scratch was chosen as a learning medium because it features an easy-to-use block-based programming system and is capable of presenting mathematical concepts visually and interactively ([Metahelumual & Maharbid, 2026](#)). This aligns with the characteristics of RME, which emphasizes active student engagement, the use of models, and interactivity in learning. Through learning activities, Scratch provides students with the opportunity to make conjectures and try out problem-solving strategies, thereby supporting their reasoning skills. Research findings by [Pradja & Saputra \(2023\)](#) indicate that Scratch-based game-based learning media can enhance students' mathematical reasoning skills. Digital learning media such as Scratch enable students to improve their reasoning skills through visual and contextual exploration. RME-based digital learning media are effective and have a positive impact on learning ([Pratiwi et al., 2023](#)). Previous studies have shown that both the RME approach and Scratch-based learning materials have the potential to support students' mathematical skills. Earlier research indicates that the implementation of RME using Scratch can improve students' mathematical skills and is recommended for use in mathematics instruction ([Aida, 2025](#)).

Based on a review of previous studies, there are still problems in mathematical reasoning abilities, and previous studies have shown the existence of RME effectiveness in the increase of mathematical reasoning, but not many have combined this approach with interactive media such as Scratch, especially in comparison material. Therefore, the researcher was interested in conducting research that focused on the mathematical reasoning abilities of seventh-grade students using an RME approach based on digital teaching media. This research aims to describe mathematical reasoning abilities in students on the subject of equivalent and inverse ratios through the RME approach assisted by digital media, namely Scratch. The implementation of this research is expected to provide an overview of students' ability to reason mathematically while encouraging teachers to use interactive learning media that can increase student activity.

2. Research Method

The researcher used descriptive qualitative research in this study, which describes something or describes a phenomenon in detail using data and facts. The researcher chose a qualitative descriptive approach because this study focuses on describing in-depth about students' mathematical reasoning abilities while participating in RME learning assisted by Scratch media. This study was conducted at a public junior high school in Indralaya during the 2025/2026 academic year, with the research subjects comprising all 34 seventh-grade students. All students participated in the learning process using the RME approach supported by Scratch and were administered a mathematical reasoning test to assess their mathematical reasoning abilities. Subsequently, based on the results of grouping mathematical reasoning abilities, three students representing the high, medium, and low ability categories were selected as interview subjects using purposive sampling. The selection of interview subjects was based on test results and the consideration that the subjects could provide in-depth information regarding their mathematical reasoning processes. Before the learning took place, the researcher conducted preliminary observations and interviews with the mathematics teacher, which indicated that students were still experiencing difficulties with mathematical reasoning. Therefore, RME-based instruction using Scratch was implemented in this study. The research was conducted over three meetings. For the first and second meetings, the process of learning using the RME approach assisted by digital teaching media, namely Scratch, was carried out on the material of equivalent ratios in the first meeting and the material of inverse ratios in the second meeting. Meanwhile, for the third meeting, a test of mathematical reasoning ability was conducted on the material that had been learned in the previous two meetings. All of the instructional materials to be used in this study have been validated in accordance with the characteristics of RME and are therefore suitable for use in instructional activities.

The first meeting began with opening the lesson by saying greetings, asking how everyone was doing, praying, checking student attendance, and getting the students ready to learn. This learning activity was conducted using the group discussion method, and each student accessed the Scratch learning link that the researcher had prepared. The Scratch learning link contained a contextual problem regarding equivalent comparisons, with steps for solving the problem tailored to reasoning ability indicators.

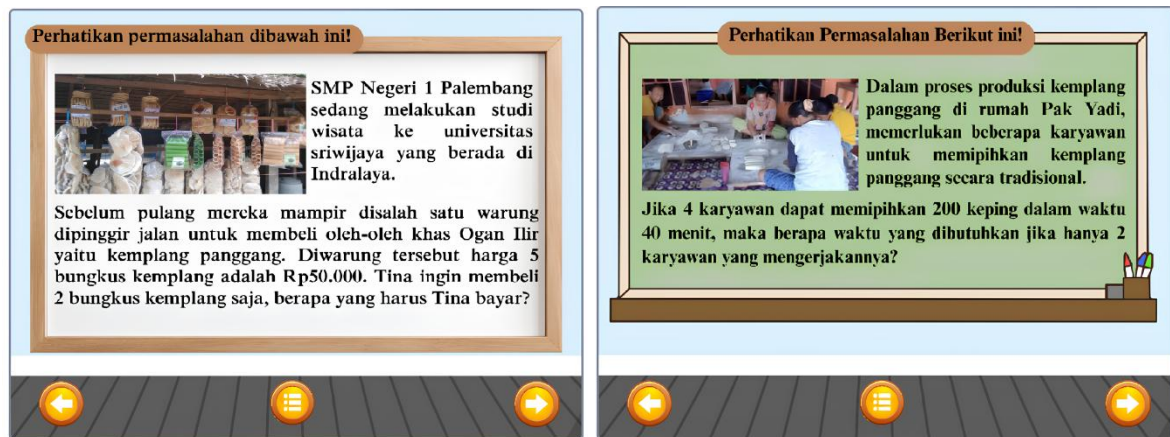


Figure 1. Contextual Problems in Scratch for Sessions 1 and 2

The problems presented in the lesson were designed in accordance with the characteristics of the RME approach, namely the use of context. The context used was grilled kemplang, a traditional food closely associated with the daily lives of students in Ogan Ilir. This context was chosen so that students could understand that mathematical concepts can be found and applied in real-life situations. Through these contextual problems, students are encouraged to understand the problem situation, identify known and unknown information, and connect their daily experiences with the concept of comparison they are learning. Additionally, the lesson demonstrates the characteristic use of models, where students transform contextual problems into mathematical representations by comparing two quantities and creating a table of values to facilitate determining the ratio.

Next, students developed and used their own strategies to solve problems in Scratch, reflecting the principle of guided reinvention in Realistic Mathematics Education (RME). In this approach, students are encouraged to articulate, explain, and develop their mathematical strategies, while the teacher facilitates the process without taking over students' mathematical reasoning ([Solomon et al., 2021](#)). Scratch-assisted mathematics learning can improve students' problem-solving skills while taking their curiosity into account ([Sumarno & Winarti, 2025](#)). The researcher did not immediately provide students with a solution formula; instead, they were encouraged to discover the concept of comparison through trial and error and by discussing with their groupmates. The characteristic of interactivity is also evident during the learning process, specifically through interactions among students as they discuss and compare strategies during group discussions. Interactions occur between students and the researcher through question-and-answer sessions using the Scratch platform, where they explore alternative strategies and receive guidance on using the Scratch interface. Additionally, students engage with the Scratch platform itself throughout the learning process. When students discussed their solutions, they exchanged opinions, agreed with or criticized their peers, and asked questions when they encountered difficulties. Furthermore, the use of Scratch facilitated interactive learning through visual displays, supporting audio, animations, and activities that encouraged students to participate actively. The final characteristic is interconnection; in this lesson, students not only understand the concept of comparison in the context of grilled kemplang, but are also guided to connect this concept with other mathematical topics they have already studied such as fractions, percentages, and probability as directed by the researcher during the conclusion and reflection phase. After the core learning process was completed, the researcher concluded the learning activity by guiding the students toward a conclusion, then clarifying the conclusions provided by the students, offering a prayer, and saying goodbye.

The second meeting was conducted in the same manner as the first meeting, but the material used in the second meeting was a continuation of the previous material, namely inverse ratios.

So, in the first and second meetings, steps were taken in accordance with the characteristics of RME, namely using context, using their own strategies as a result of mathematical work, interactivity, and intertwining. Then, for the third meeting, a test of students' mathematical reasoning abilities was conducted on 34 students. After the test was completed, 3 students from the 34 students were selected as research subjects using purposive sampling techniques. The selected subjects were representatives of high, medium, and low reasoning ability levels, who were then interviewed. The categorization of mathematical reasoning ability was based on research ([Suhandri et al., 2017](#)).

Table 1. Categories of Reasoning Ability

Categories	Achievements in Reasoning Skills
High	value $\geq \bar{x} + \sigma$
Medium	$\bar{x} - \sigma \leq \text{value} \leq \bar{x} + \sigma$
Low	value $\leq \bar{x} - \sigma$

Explanation:

Value = Reasoning Ability Achievement

$\bar{x}$ = average student score

σ = Standard Deviation

This study used a test instrument consisting of four open-ended questions that addressed contextual problems involving equivalent and inverse values, with a focus on indicators of mathematical reasoning ability. This instrument was developed based on four indicators of mathematical reasoning from [Nurlinda et al. \(2024\)](#), namely (1) making assumptions, (2) performing calculations based on specific rules or formulas, (3) providing evidence of the correctness of the solution, and (4) drawing conclusions. Question 1 measures the first indicator, question 2 measures the second indicator, question 3 measures the third indicator, and question 4 measures the fourth indicator. This instrument was validated through expert assessment by two mathematics education lecturers and one junior high school teacher. In addition to the written test, this study also used an observation instrument to assess the implementation of learning using the RME approach supported by Scratch. The observation sheet was designed based on the characteristics of RME, namely the use of context, the use of models, the contribution or use of students' own strategies, and interactivity; thus, based on the observation sheet, it can be confirmed that the learning process took place in accordance with the characteristics of RME. Data were collected through observations, tests, and interviews. Observations were used to monitor students' activities during the implementation of the RME approach using Scratch, particularly their engagement in learning. Tests were administered to evaluate students' mathematical reasoning ability after the lesson. Meanwhile, semi-structured interviews were conducted with three selected students to gain in-depth insights into their processes and strategies for solving contextual problems. In this context, the Miles and Huberman model ([Purwanto, 2023](#)) was used to analyze the data through the following activities: (1) data reduction, which is the process of selecting and simplifying data obtained from observations, tests, and interviews; (2) data presentation, which involves presenting data in the form of tables, interview excerpts, and narrative descriptions to facilitate the derivation of meaning; and (3) drawing conclusions, which involves summarizing the analysis results to describe students' mathematical reasoning abilities.

3. Result

Based on the findings of observing learning activities using the RME approach during two sessions, the teaching and learning process using the RME approach assisted by Scratch went well. The observation was conducted by an observer during two sessions, focusing on the

activities of teachers and students during the learning process. Teachers carried out each step of the learning process consistently, starting from presenting real contexts, guiding students to rediscover concepts, to facilitating reflection on learning outcomes. The learning activities were active and participatory. Based on the results of the observations, instruction that incorporates RME characteristics provides opportunities for students to actively engage in the learning process, such as through discussion, sharing ideas, and using their own problem-solving strategies. This engagement is an integral part of the learning process that supports students in developing their mathematical reasoning ability. The use of Scratch helps students understand problems more clearly through interactive learning activities. Through digital worksheets supported by Scratch, students can gradually engage with contextual problems, read the provided information, and complete each step of the activity according to the available instructions. Furthermore, the use of Scratch provides a more active learning experience because students not only receive information from the researcher but are also directly involved in exploring problems, writing down answers, and receiving guidance throughout the learning process. Through these activities, students can connect the contextual situations within the problems to the mathematical concepts they have learned, thereby helping them develop problem-solving strategies and engage in mathematical reasoning. Based on the observation results, some students were able to understand and reason contextually about mathematical problems, although their levels of achievement varied. Thus, the implementation of RME supported by Scratch can support the development of students' mathematical reasoning ability in a gradual and meaningful way.

According to the results of the test that students took on mathematical reasoning ability in the material on equivalent and inverse ratios, the following data was obtained.

Table 2. Percentage Achievement of Each Mathematical Reasoning Ability Indicator

Indicator	Percentage
Submit a hypothesis	66,91%
Perform calculations based on specific rules/formulas	87,50%
Provide evidence to prove the solution is correct	38,24%
Draw conclusions from the statements	63,24%

Table 3. Frequency of Mathematical Reasoning Ability Levels

Value Range	Category	Frequency	Percentage
nilai ≥ 84.36	High	5	14,70%
$42.85 \leq \text{nilai} \leq 84.36$	Medium	22	64,70%
nilai ≤ 42.85	Low	7	20,58%
	Total	34	
	Average	63,60	

Preliminary observations conducted in collaboration with the mathematics teacher indicated that students' abilities prior to instruction using the Scratch-assisted RME approach were still relatively low; however, after participating in instruction using the Scratch-assisted RME approach and taking a written exam, the majority of students fell into the "moderate" category. This suggests that the Scratch-assisted RME approach is effective in improving basic mathematical reasoning ability but is not yet optimal for developing higher-order reasoning ability, such as providing proof. These findings are clarified by the results of categorizing students' mathematical reasoning abilities, which show the classification of this ability in each category. There were five in the category of high reasoning ability with a percentage of 14.70% in the interval greater than 84.36. There were twenty-two in the category of moderate reasoning ability with a percentage of 64.70% in the interval less than or equal to 42.85 to greater than or equal to 84.36. Meanwhile, there are seven in the category of low reasoning ability, with a

percentage of 20.58% in the interval less than 42.85. Based on the results of the grouping of mathematical reasoning abilities, it has been explained that the responses for each category will be represented by one student with high, moderate, and low abilities. The selection of these subjects was conducted using purposive sampling, taking into account the results of the mathematical reasoning ability test and the representativeness of the response characteristics in each category.



Figure 2. Learning activities

3.1 Students with High Mathematical Reasoning Ability

The following are the answers to question number 1 of the mathematical reasoning test with the indicator of making assumptions. The results of the high-scoring students' answers are as follows.

Karena orang nya ber kuantitas dari 6 → 3
jadi tidak se cepat 6 orang

1. tidak di ketahui jenis: perbandingan berbalik nilai: Kesimpulan: Semakin sedikit orang nya - semakin lama waktu nya.
di tanya: berapa waktu jika 6 orang
untuk membuat 70 buah kue kemudian dan
berapa waktu jika 3 orang membuat 140
buah kue yang di berikan

Jumlah orang	waktu
6	30
3	X

$$\frac{a_1}{a_2} = \frac{b_2}{b_1} \Rightarrow \frac{6}{3} = \frac{X}{30} =$$

$$6 \times 30 = 180 \Rightarrow \frac{180}{3} = X$$

$$X = 60$$

2. di ketahui jenis: perbandingan senilai: Kesimpulan: Semakin banyak tambah nya - semakin banyak kuantitas nya.
di tanya: berapa waktu jika 2 orang
untuk membuat 14 buah kue kemudian dan
berapa waktu jika 14 orang membuat 28
buah kue yang di berikan

kuantitas	tambah
2	14
X	42

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} \Rightarrow \frac{2}{X} = \frac{14}{42} =$$

$$2 \times 42 = 84 \Rightarrow \frac{84}{14} = X$$

$$X = 6$$

3. di ketahui jenis: perbandingan senilai: Kesimpulan: Semakin sedikit kuantitas nya - semakin sedikit yang di berikan.
di tanya: berapa waktu jika 12 orang
untuk membuat 6 buah kue kemudian dan
berapa waktu jika 6 orang membuat 12
buah kue yang di berikan

Jumlah di buat kuantitas	berapa
12	6
6	X

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} \Rightarrow \frac{12}{6} = \frac{6}{X} =$$

$$12 \times 6 = 72 \Rightarrow \frac{72}{12} = X$$

$$X = 6$$

4. lebih lama di ketahui jenis: perbandingan berbalik nilai: Kesimpulan: Semakin sedikit orang nya - semakin banyak/lama waktunya.
di tanya: berapa waktu jika 3 orang
untuk membuat 60 buah kue kemudian dan
berapa waktu jika 2 orang membuat 90 buah
kue yang di berikan

Jumlah orang	waktu
3	60
2	X

$$\frac{a_1}{a_2} = \frac{b_2}{b_1} \Rightarrow \frac{3}{2} = \frac{X}{60} =$$

$$3 \times 60 = 180 \Rightarrow \frac{180}{2} = X$$

$$2 \times X = 2X$$

$$X = 90 \text{ menit / 1,5 jam}$$

Figure 3. High-Category Students' Answers

Figure 1 shows the answers of a student with the initials AFR, who represents the high category of mathematical reasoning ability. On the indicator of making assumptions observed in question number 1, subject AFR was able to make accurate assumptions. This can be seen from their statement saying “no” accompanied by a logical reason that the number of people

decreased from six to three. The answer was also accompanied by a solution process and conclusion, showing that the subject had a comprehensive understanding of the problem. Although the subject of AFR did not mention the information known and also asked directly, they presented it in the form of a table. This is in agreement with [Pradana and Murtiyasa \(2020\)](#) that students with high mathematical reasoning abilities already understand the problem, as can be seen from the fact that students write down what is known and identify the problem. Then, in question number 2, AFR demonstrated good ability in performing calculations based on certain rules/formulas. The subject was to write down the information known, choose the right solution, and draw conclusions according to the calculation results. Based on the interview results, AFR was able to explain the steps of the solution he had taken in a coherent manner, even demonstrating the ability to find a solution strategy using his own method. This reflects the characteristics of RME, namely that students use their own strategies in mathematical calculations.

R : "Where did you get the result of 6?"

AFR: "According to my own formula, if 2 steamers can hold 14 baskets, then 1 steamer can hold how many baskets? This is equal to 14 baskets divided by 2 steamers, which equals 7. This means that 1 steamer can hold 7 baskets, and 7 multiplied by whatever gives a result of 42 gives us 6."

Furthermore, in the AFR response of question number 3, it can be seen the subject has met the indicator of providing evidence of the rightness of solution where the subject is able to solve the problem correctly and accompanied by logical evidence of the solution, namely dividing the number of kemplang by the number of teachers who received it. This ability also appears in the interview results, where the subject explains that the distribution of the number of kemplang was equal, namely 3 packs of kemplang. This finding is in line with the research by [Darmayanti et al. \(2022\)](#) that subjects with high reasoning abilities are able to provide evidence or reasons for their statements. The fourth indicator was measured through question number 4, where the AFR answer showed the ability to draw accurate conclusions. The AFR subject was able to explain the relationship between the number of employees and the time needed for baking, which reflects an understanding of the concept of inverse comparison and demonstrates the ability to think logically in relating two interrelated quantities. Based on this explanation, students with high mathematical reasoning abilities have met all the indicators observed. This demonstrates the students' ability to analyze the problems presented. This reflects the basic principles of RME, such as guided reinvention and didactical phenomenology, whereby through realistic and interactive activities, students can understand problems and develop their mathematical thinking process gradually from real contexts to symbolic representations.

3.2 Students with Moderate Reasoning Ability

Based on Figure 2, which shows the answers of the student with the initials AT, who represents the category of moderate mathematical reasoning ability. On the indicator of making assumptions, subject AT was able to make assumptions about the problems given, even though the reasons underlying these assumptions were only explained after he had performed the calculations. This indicates that the subject has a good understanding of the context of the problem, as evident from their ability to accurately mention the information that is known and asked. Furthermore, on the indicator of performing calculations using specific rules/formulas, subject AT was able to answer correctly and fulfill the indicator. The subject wrote down the information obtained from the question and then used the equivalent ratio formula to find the number of steamers for 42 baskets.

1. Dik : 6 karyawan (30 Mnt) (30 bungkus) → SENIN
3 karyawan → SELASA

Dit : Apakah 3 orang tsb bisa mengemas kemplang dlm waktu 30 mnt ? jelaskan

Tidak bisa

karyawan	Waktu
6	30
3	x

$$\frac{a_1}{a_2} \times \frac{b_1}{b_2} = \frac{6}{3} \times \frac{x}{30}$$

$$a_1 \times b_1 = a_2 \times b_2 \quad = 3x = 6 \times 30$$

(Rumus Perbandingan berbalik nilai)

$$x = \frac{6 \times 30}{3} = \frac{180}{3} = 60$$

Kesimpulan : Semakin banyak karyawan maka semakin sedikit waktu yang diperlukan. Begitu juga sebaliknya.

Jawab : Tidak, karena 3 karyawan tidak mampu mengemas kemplang dalam waktu 30 menit, mereka membutuhkan waktu yang lebih banyak (60 menit)

2. Dik : 2 kukusan (14 Tampah)

Dit : berapa kukusan yg diperlukan untuk 42 kemplang (tampah)

Kukusan	tampah
2	14
y	42

$$\frac{a_1}{a_2} \times \frac{b_1}{b_2} = \frac{2}{y} \times \frac{14}{42} = 2 \times 42 = 14y$$

$$a_1 \times b_1 = a_2 \times b_2 \quad y = \frac{2 \times 42}{14} = \frac{84}{14} = 6$$

(Rumus perbandingan senilai)

Kesimpulan : Semakin banyak kukusan maka semakin banyak pula tampah yg diperlukan.

Jawab : jika ingin mengukus 42 tampah yg berisi kemplang panggang, kita membutuhkan 6 kukusan.

3. Dik : K. Dita (18 bungkus) → Diborong dan dibagi rata dgn 6 guru (Bu Mayang)
K. Mawar (12 bungkus) → Diborong dan dibagi rata juga .. (Bu Anita)

Dit : Kepada berapa org Bu Anita hrs membagi rata seperti bu Mayang ?

kemplang	guru
18	6
12	j

$$\frac{a_1}{a_2} \times \frac{b_1}{b_2} = \frac{18}{12} \times \frac{6}{j} = 18j = 12 \times 6$$

$$a_1 \times b_1 = a_2 \times b_2 \quad j = \frac{12 \times 6}{18} = \frac{72}{18} = 4$$

(Perbandingan senilai)

Kesimpulan : semakin dikit kemplang maka semakin dikit juga guru yg bisa dibagikan

Jawab : 12 kemplang dapat dibagi rata dengan 4 guru, 1 guru mendapat 3 kemplang

4. Dik : 3 Karyawan (160 keping) 60 Mnt

Dit : 2 karyawan berapa menit ?

Karyawan	Waktu
3	60
2	z

Rumus perbandingan berbalik nilai

$$\frac{a_1}{a_2} \times \frac{b_1}{b_2} = \frac{3}{2} \times \frac{z}{60}$$

$$a_1 \times b_1 = a_2 \times b_2 \quad = 3 \times 60 = 2z$$

$$z = \frac{3 \times 60}{2} = \frac{180}{2} = 90$$

Kesimpulan : Semakin sedikit karyawan maka semakin banyak waktu yang diperlukan. Dan semakin banyak karyawan maka semakin sedikit waktu yang dibutuhkan.

Jawab : Waktu yang dibutuhkan 2 karyawan tersebut adalah 90 menit. Proses pemanggangan menjadi lebih lama karena karyawan yang berkurang, membuat proses pemanggangan membutuhkan waktu yang lebih banyak.

Figure 4. Responses from Students in the Intermediate Category

According to the interview results, AT was also able to explain the steps to solve the problem correctly and in accordance with what he wrote. On the indicator of providing evidence of the solution's correctness, AT was able to provide a solution using the equivalent ratio formula but did not include evidence of the solution, so AT was unable to meet the indicator of providing evidence of the solution's correctness. This was also supported by the interview results.

R : "Here you wrote that one teacher gets 3 kemplang, why?"

AR : "I don't know."

This shows that even though the subjects understood the calculation procedure, their ability to reason deeply and construct mathematical proofs was still not optimally developed. It is in accordance with the findings in the research by [Sumartini & Utami \(2023\)](#) that some students are not yet able to give evidence of the solution's correctness because they do not know the right method to construct evidence and are unfamiliar with working on contextual problems. Meanwhile, in indicators of drawing conclusions from statements, AT compiled statements in solving the problems given and the information known and asked questions until drawing conclusions about the relationship of the number of employees with the time needed to bake if the number of employees decreased. Based on these results, students with moderate reasoning abilities have met the three reasoning ability indicators, namely making assumptions, performing calculations, and drawing conclusions. This achievement shows that the RME stages enable students to interpret contextual problems gradually. This has been proven to improve the ability to make assumptions and draw conclusions in students with moderate abilities because students practice connecting real experiences with mathematical symbols.

3.3 Students with Low Reasoning Ability

1. BISA / TIDAK BISA : TIDAK BISA

KARYAWAN	WAKTU
6 ORANG	30 MENIT
3 ORANG	X

KESIMPULANNYA ADALAH
 JIKA ORANGNYA BERTAMBAH MAKA WAKTUNYA MENJADI
 SEDIKIT, TAPI JIKA ORANGNYA SEDIKIT MENGURANG MAKA
 WAKTUNYA MENJADI BANYAK

$\frac{6}{3} = \frac{60}{30}$ $6 \times 30 = 3 \times 60$
 $= 60$ MENIT

2.

TAMPAH	KUKUSAN
14 TAMPAH	2 KUKUSAN
42 TAMPAH	X

KESIMPULANNYA ADALAH
 14 MENJAWAB 6 KARENA 2 DI KUKUS 6
 SAMA DENGAN 42 KARENA 14 ITU 2 KUKUSAN JADI KUKUSAN 42
 TAMPAH SAMA DENGAN $2 \times 3 = 6$ KUKUSAN

$14 + 14 = 28$
 $14 + 28 = 42$ $2 + 2 = 6$ KUKUSAN

3.

ISU	KEMPLANG	JUMLAH GURU
BU MAYANG	18 BUNGKUS	6 GURU
BU ANITA	12 BUNGKUS	X

KESIMPULANNYA ADALAH
 JIKA 18 BUNGKUS DI BAGI KAN SAMA
 RATA ADALAH 6 GURU, TAPI JIKA 12
 BUNGKUS MAU DI BAGI SAMA RATA
 MAKA HASILNYA 2 GURU

$\frac{18}{12} = \frac{6}{2}$ $18 \times 2 = 12 \times 2$
 $= 2$ GURU

4. $\frac{3}{2} = \frac{30}{60}$ $3 \times 60 = 2 \times 90$
 $= 90$ MENIT

KESIMPULANNYA ADALAH
 JIKA ORANG 3 BISA MEMBUAT KEMPLANG PANGGAP
 DENGAN WAKTU 60 MENIT TAPI TIDAK BERKURANG
 1 ORANG JADI SISA 2 DAN WAKTU 60 MENIT JIKA DI
 KURANG 1 ORANG SAMA DENGAN 70 MENIT KARENA KAN
 ORANG DI TAMBAH WAKTU PAKAN MENGURANG TAPI JIKA
 ORANGNYA KURANG MAKA JUMLAH WAKTUNYA NAIK

Figure 5. Student Responses in the Low Category

Based on the answer given by the student with the initials NA in Figure 3, it can be seen that in question number 1, the subject NA was only able to provide an initial guess without giving any reasons or arguments as to why he estimated that answer. The interview results also showed that the subject was still confused when asked to explain the reasons for his guess and was unable to explain the calculation results he had written down.

R : "What's your initial guess?"

NA : "I can't."

R : "Why?"

NA : "Just guessing."

In answering question number 2, subject NA performed calculations but did not use the equivalent ratio formula; instead, he used his own logic. Although he could mention the information that was identified and asked during the interview, he did not explicitly write this information on his answer sheet. Furthermore, for question number 3, NA was only able to provide a solution but did not write down the evidence for the solution he provided. The solution provided was also inaccurate, and results from the interview showed that subject NA was still hesitant in explaining his thought process. Meanwhile, for question number 4, the subject was able to provide a conclusion, but the conclusion was based on a statement that was incorrect, so the conclusion was also inaccurate. Based on these findings, low-level mathematical reasoning students can only fulfill one indicator, which is performing calculations according to certain rules/formulas. It is in line with the research by [Wau et al. \(2022\)](#), which states that students with low abilities are often unable to draw conclusions from statements due to a lack of understanding of the question and carelessness in answering, resulting in incorrect statements. Based on the results of the tests and interviews, students in the moderate and low categories also demonstrated difficulty in providing evidence for their solutions and drawing conclusions appropriate to the problems. These difficulties indicate that the students have not yet been able to connect the information in contextual problems with the relevant mathematical concepts.

Based on analysis results regarding the mathematical reasoning abilities in contextual problems involving equivalent and inverse values, we will now discuss the descriptions for each indicator of high, medium, and low mathematical reasoning abilities.

3.4 Indicator of Making Assumptions

The data obtained after conducting written tests and interviews showed that subjects with high mathematical reasoning abilities and subjects with moderate mathematical reasoning abilities were able to make assumptions, although subjects with moderate abilities were unable to provide reasons for their assumptions at the outset. Subjects of high and moderate mathematical reasoning ability were able to write down or mention and describe the information obtained from the questions and were able to organize the process of solving problems. Meanwhile, subjects with low mathematical reasoning abilities could not write down the information obtained from the questions, but they made guesses without providing reasons. Subjects with low mathematical reasoning abilities cannot state the reasons why they make such assumptions; they are merely guessing. This is in line with research ([Permatasari & Marlina, 2022](#)) which states that in order to make assumptions, students must be able to write down what is known and asked in the questions given so that they can understand the problems to be solved. The students' ability to make assumptions reflects the application of the principles of reality and activity proposed by [Van den Heuvel-Panhuizen \(2000\)](#), as students are encouraged to interpret contextual situations and make assumptions based on the problem.

3.5 Indicator of Performing Calculations Based on Specific Rules/Formulas

Based on the analysis data presented earlier, subjects with high, medium, and low level of mathematical reasoning were able to perform mathematical calculations to solve the problems given. However, subjects with low level of reasoning did not use the equivalent ratio formula but based their calculations on logic alone, yet the results obtained were correct. Subjects with low reasoning abilities have not written down information that is known and asked in the problems, but they can mention it during interviews. It is stated in the study ([Imam et al., 2018](#)) that students actually understood the information in the questions, but they did not understand how to use the formulas that would be used in the solution process.

3.6 Indicator of Providing Evidence of the Correctness of Solutions

The analysis data shows that subjects with high mathematical reasoning abilities can provide evidence or reasons for the solutions they give. They write down the solutions to the problems given and then provide methods or strategies that prove their solutions. However, subjects with moderate and low reasoning abilities are not yet able to write down evidence or reasons for the solutions they give. Subjects with moderate reasoning abilities are able to write down the solution correctly but do not write down the reasoning, while subjects with low mathematical reasoning abilities write down the solution but the solution is not entirely correct. This is supported by research ([Nurhalin & Effendi, 2022](#)) that students with moderate abilities are only able to formulate solutions or statements, while students with low abilities are unable to write down statements or solutions accurately and do not include evidence or reasons.

3.7 Indicator of Drawing Conclusions from Statements

The data from the analysis of the subjects' answers showed that subjects with high and moderate mathematical reasoning abilities were able to draw conclusions from the statements or solutions they provided. However, one of the subjects with moderate reasoning abilities did not answer question number 4, so they were not counted as meeting the indicator of drawing conclusions from statements. This is in line with research by ([Rosyidah et al., 2021](#)) as students with moderate mathematical reasoning abilities were able to meet the indicator of drawing conclusions. Meanwhile, subjects with low reasoning abilities could only provide statements/solutions that were still inaccurate and were unable to draw accurate conclusions. One of the subjects with low abilities wrote an inaccurate statement, so their conclusion was also inaccurate. This is also supported by research by [Rosyidah et al. \(2021\)](#) and ([Asdarina & Ridha, 2020](#)) that subjects with low reasoning abilities are not yet able to draw conclusions accurately.

4. Conclusion

The students' responses indicate that their mathematical reasoning ability regarding the "making assumptions" indicator stood at 66.91%, while for the "performing calculations using specific rules or formulas" indicator, the highest percentage reached 87.50%. Furthermore, the indicator for providing evidence of the correctness of the solution was met by 38.24%, which was the least frequently met indicator, while the indicator for drawing conclusions from statements was met by 63.24%. Overall, the results indicate that there are 5 students with high-level reasoning ability (14.70%), 22 students with moderate-level reasoning ability (64.70%), and 7 students with low-level reasoning ability (20.58%). Interview results indicate that students in the high category were able to meet all mathematical reasoning indicators; students

in the moderate category met three indicators but still struggled with the indicator of providing evidence for the validity of a solution; whereas students in the low category were only able to meet the indicator of performing calculations based on specific rules or formulas. Thus, the test and interview results indicate differences in the characteristics of mathematical reasoning abilities across each category of students following RME instruction supported by Scratch. This indicates that the mathematical reasoning abilities of seventh-grade students at SMP N 1 Indralaya fall into the moderate category following instruction using the RME approach supported by Scratch. The results of this study indicate that the use of RME supported by Scratch can promote the development of students' mathematical reasoning ability.

Overall, the results of the test analysis and interviews indicate differences in mathematical reasoning ability across student categories. Students with high reasoning ability were able to meet all indicators of mathematical reasoning, whereas students with moderate and low reasoning ability still experienced difficulties, particularly with the indicators of providing evidence for the validity of solutions and drawing conclusions. These findings align with the research by [Wau et al. \(2022\)](#), which states that students with low abilities tend to struggle with drawing conclusions because they have not fully understood the problem and are less careful in providing answers. Based on the test results and interviews, students with moderate and low abilities also showed difficulty in justifying the problem-solving strategies they used and in connecting information in contextual problems with appropriate mathematical concepts. These conditions indicate that students' reasoning processes in establishing connections between contextual situations and mathematical concepts have not yet developed optimally. The findings of this study provide a more in-depth understanding of the characteristics of students' mathematical reasoning abilities after participating in instruction using the Realistic Mathematics Education (RME) approach supported by Scratch. Unlike previous studies, which generally focused on the impact of implementing the RME approach or using Scratch on improving specific mathematical skills, this study emphasizes the analysis of students' mathematical reasoning processes and characteristics based on high, moderate, and low ability categories through an examination of test results and interviews. Thus, this study provides information regarding the variations in students' abilities and the difficulties they experience across each indicator of mathematical reasoning, thereby serving as a basis for teachers to design learning activities that better align with students' characteristics and needs.

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6. References

- Aida, A. N. (2025). Systematic literature review: Students' mathematical problem solving ability in view of self-efficacy in the PjBL model with RME approach assisted by Scratch. *Prosiding Seminar Nasional Mahasiswa Matematika UNNES*, 276–286. <https://proceedings.unnes.ac.id/psnmmu/article/view/4271>
- Amelia, S. R., Hidayat, W., & Maya, R. (2025). Meningkatkan kemampuan penalaran matematis siswa melalui pendekatan Realistic Mathematics Education. *JPMI (Jurnal Pembelajaran Matematika Inovatif)*, 10(4), 499–506. <https://doi.org/10.22460/jpmi.v8i4.28763>
- Ariati, C., & Juandi, D. (2022). Kemampuan penalaran matematis: Systematic literature review. *LEMMA: Letters of Mathematics Education*, 8(2), 61–75.

- <https://doi.org/10.22202/jl.2022.v8i2.5745>
- Arida, S. F., & Ikhsan, M. F. (2023). Analisis kemampuan penalaran matematis siswa kelas V sekolah dasar di Desa Sukolilo Pati terhadap pengerjaan soal berbasis pembuktian. *Enggang: Jurnal Pendidikan, Bahasa, Sastra, Seni, dan Budaya*, 3(2), 124–131. <https://doi.org/10.37304/enggang.v3i2.8947>
- Asdarina & Ridha. (2020). Analisis kemampuan penalaran matematis siswa dalam menyelesaikan soal setara PISA konten geometri. *Jurnal Numeracy*, 7(1), 35–48. <https://doi.org/10.46244/numeracy.v7i2.1167>
- Darmayanti, R., Sugianto, R., Muhammad, Y., & da Silva Santiago, P. V. (2022). Analysis of students' adaptive reasoning ability in solving HOTS problems arithmetic sequences and series in terms of learning style. *Numerical: Jurnal Matematika dan Pendidikan Matematika*, 6(1), 73–90. <https://doi.org/10.25217/numerical.v6i1.2340>
- Fendrik, M. (2021). Pengaruh pendekatan Realistic Mathematics Education terhadap kemampuan matematis. *Jurnal Numeracy*, 8(2), 102–112. <https://doi.org/10.46244/numeracy.v8i2.1611>
- Imam, A. M., & Nursangaji, A. (2018). Kemampuan penalaran matematis siswa kelas VIII SMP Negeri 01 Selakau. *Jurnal Pendidikan dan Pembelajaran Khatulistiwa*, 7(1), 1–13. <https://doi.org/10.26418/jppk.v7i1.23643>
- Julaeha, S., & Kadarisma, G. (2020). Analisis kemampuan penalaran matematis siswa SMP pada materi fungsi kuadrat. *JPMI: Jurnal Pembelajaran Matematika Inovatif*, 3(6), 663–670. <https://doi.org/10.22460/jpmi.v3i6.663-670>
- Kosasih, U., Shekhawati, N. N., Aqilah, N., Sulastri, Y. L., Prasetyo, E., & Mulia, S. (2023). Penerapan model problem posing untuk meningkatkan kemampuan penalaran matematis peserta didik SMP. *UJMES (Uninus Journal of Mathematics Education and Science)*, 8(2), 118–127. <https://doi.org/10.30999/ujmes.v8i2.2605>
- Metahelumual, M. M. E., & Maharbid, D. A. (2026). Analisis implementasi media pembelajaran matematika berbasis game edukasi Scratch dalam mengintegrasikan aktivitas deep learning di sekolah dasar. *Pendas: Jurnal Ilmiah Pendidikan Dasar*, 17(1), 6–17. <https://doi.org/10.23969/jp.v11i01.43360>
- Nisa, A. R., Aziz, A., & Purnomo, E. A. (2025). MathWhiz: Media pembelajaran digital dengan pendekatan Realistic Mathematics Education (RME) pada materi SPLDV kelas VIII. *Jurnal Ilmiah Profesi Pendidikan*, 10(2), 1940–1947. <https://doi.org/10.29303/jipp.v10i2.3379>
- Nurhalin, Y., & Effendi, K. N. S. (2022). Kemampuan penalaran matematis siswa SMP pada materi sistem persamaan linear dua variabel. *Jurnal Educatio FKIP UNMA*, 8(1), 180–192. <https://doi.org/10.31949/educatio.v8i1.1957>
- Nurlinda, E., Azis, Z., & Nasution, M. D. (2024). Students' mathematical reasoning ability and self-efficacy viewed from the application of problem-based learning and contextual teaching and learning models assisted. *Journal of Mathematics Education and Application (JMEA)*, 3(2), 54–61. <https://doi.org/10.30596/jmea.v3i2.20329>
- Oktavia, S. P., Shodikin, A., & Ekawati, R. (2025). Developing Students' Worksheet of Cuboid and Cube Volume with Realistic Mathematics Education (RME). *Journal of the Indonesian Mathematics Education Society*, 3(1), 33–43. <https://doi.org/10.26740/jimes.v3n1.p33-43>
- Oktaviana, V., & Aini, I. N. (2021). Deskripsi kemampuan penalaran matematis siswa smp kelas VIII. *JPMI (Jurnal Pembelajaran Matematika Inovatif)*, 4(3), 587-600. <https://journal.ikipsiliwangi.ac.id/index.php/jpmi/article/view/7035>
- Pahlevi, A. R., Samijo, & Darsono. (2021). Profil berpikir kritis siswa menyelesaikan masalah open-ended materi program linear berdasarkan langkah Polya. *SINKESJAR*, 106–120.

- <https://proceeding.unpkediri.ac.id/index.php/seinkesjar/article/view/1224>
- Permatasari, L., & Marlina, R. (2022). Kemampuan penalaran matematis siswa kelas VII SMP pada materi himpunan. *Jurnal Educatio FKIP UNMA*, 8(2), 505–511. <https://doi.org/10.31949/educatio.v8i2.1998>
- Pradana, D. A. Y., & Murtiyasa, B. (2020). Kemampuan siswa menyelesaikan masalah berbentuk soal cerita sistem persamaan linear ditinjau dari kemampuan penalaran. *Pythagoras: Jurnal Pendidikan Matematika*, 15(2), 151–164. <https://doi.org/10.21831/pg.v15i2.35419>
- Pradja, B. P., & Saputra, N. N. (2023). Usage of Scratch in making game-based mathematics learning media to improve students' mathematical skills. *Prima: Jurnal Pendidikan Matematika*, 7(2), 131–142. <https://doi.org/10.31000/prima.v7i2.8613>
- Pratiwi, S., Sukmaningthias, N., & Sari, N. (2023). The influence of RME-based teaching media assisted by the Pixton application on students' interest in learning mathematics. *JTMT: Jurnal Tadris Matematika*, 4(2), 149–157. <https://doi.org/10.47435/jtmt.v4i02.1964>
- Purwanto, E. (2023). Analisis kesalahan coding pemrograman di Microsoft Visual Basic for Applications pada mahasiswa Program Studi Pendidikan Matematika. *ELIPS: Jurnal Pendidikan Matematika*, 4(1), 93–102. <https://doi.org/10.47650/elips.v4i1.693>
- Putra, A., Tensa, Y., & Erita, S. (2020). Analisis penalaran proporsional siswa dengan gaya belajar auditori dalam menyelesaikan soal perbandingan. *Journal on Education*, 2(4), 323–330. <https://doi.org/10.31004/joe.v2i4.326>
- Putri, K. D., Ekawati, R., & Shodikin, A. (2024). Students' Reasoning in Mathematics Learning: How to Solve Problem of Ethnomathematics Based on Personality. *Journal of the Indonesian Mathematics Education Society*, 2(2), 70–79. <https://doi.org/10.26740/jimes.v2n2.p70-79>
- Qudsiah, J. R., Fahrurrozi, & Hayati, N. (2023). Pengembangan instrumen tes kategori higher order thinking skills (HOTS) pada mata pelajaran matematika kelas XI SMA. *NOTASI: Jurnal Pendidikan Matematika*, 1(1), 10–23. <https://doi.org/10.70115/notasi.v1i1.48>
- Ramidha, N. F., Shodikin, A., & Abdullah, A. H. (2025). The Effect of Dynamic Geometry Software-Based Interactive Media with the RME Approach in Improving Critical Thinking on the Rotation Topic. *Jurnal Pendidikan Progresif*, 15(3), 1640–1652. <https://doi.org/10.23960/jpp.v15i3.pp1640-1652>
- Rohman, A., & Shodikin, A. (2025). The Characteristics of Analogical Reasoning of Senior High School Students in Solving Geometry Problems. *Phenomenon : Jurnal Pendidikan MIPA*, 15(1), 95–110. <https://doi.org/10.21580/phen.2025.15.1.27277>
- Rosyidah, A. S., Hidayanto, E., & Muksar, M. (2021). Kemampuan penalaran matematis siswa SMP dalam menyelesaikan soal HOTS geometri. *JIPM (Jurnal Ilmiah Pendidikan Matematika)*, 10(2), 268. <https://doi.org/10.25273/jipm.v10i2.8819>
- Rosyidah, U., Setyawati, A., & Qomariyah, S. (2021). Analisis kemampuan penalaran dan kemampuan pemahaman konsep matematis mahasiswa pendidikan matematika pada mata kuliah aljabar dasar. *SJME (Supremum Journal of Mathematics Education)*, 5(1), 63–71. <https://doi.org/10.35706/sjme.v5i1.4488>
- Setiawan, W., Hatip, A., Muhajir, M., Ghazali, A., & Fathimatuazzahro, I. (2022). Pengembangan modul pembelajaran matematika pada materi geometri dan pengukuran berbasis profil Pelajar Pancasila. *Supermat: Jurnal Pendidikan Matematika*, 6(2), 187–202. <https://doi.org/10.33627/sm.v6i2.949>
- Shodikin, A., Murniasih, T. R., Faizah, S., & Ekawati, D. W. (2023). Students' Analogical Reasoning in Solving Geometry Problems Viewed from Visualizer's and Verbalizer's Cognitive Style. *Jurnal Pedagogi Dan Pembelajaran*, 6(3), 330–338. <https://doi.org/10.23887/jp2.v6i3.60960>

- Siswono, T. Y. E., Hartono, S., Kohar, A. W., Karim, K., & Lastiningsih, N. (2019). How do Prospective Teachers Manage Students' Learning of Mathematics?. *TEM Journal*, 8(2), 677-685. <http://doi.org/10.18421/TEM82-49>
- Solomon, Y., Hough, S., & Gough, S. (2021). The role of appropriation in guided reinvention: establishing and preserving devolved authority with low-attaining students: Solomon Y. et al. *Educational Studies in mathematics*, 106(2), 171-188. <https://doi.org/10.1007/s10649-020-09998-5>
- Subroto, P. W., Raharjo, S., Tyas, S. A., & Firdaus, N. (2025). Pengaruh model pembelajaran RME terhadap kemampuan penalaran matematis. *JJM: Jurnal Jendela Matematika*, 3(1), 60–65. <https://doi.org/10.57008/jjm.v3i01.1209>
- Suhandri, Nufus, H., & Nurdin, E. (2017). Profil kemampuan koneksi matematis mahasiswa dalam menyelesaikan masalah matematika berdasarkan level kemampuan akademik. *Jurnal Analisa*, 3(2), 115–129. <https://doi.org/10.15575/ja.v3i2.2012>
- Sumarno, W. S., & Winarti, E. R. (2025). Scratch-Assisted Issue, Discussion, Establish, and Apply (IDEA) Learning Model to Improve Students' Problem-Solving Skills Evaluated from Their Curiosity. *Journal of the Indonesian Mathematics Education Society*, 3(1), 1–11. <https://doi.org/10.26740/jimes.v3n1.p1-11>
- Sumartini, T. S., & Utami, I. E. (2023). Analisis kemampuan penalaran matematis siswa pada materi relasi dan fungsi. *Prisma*, 12(2), 333. <https://doi.org/10.35194/jp.v12i2.3062>
- Van den Heuvel-Panhuizen, M. (2000). Mathematics education in the Netherlands: A guided tour. *Freudenthal Institute CD-rom for ICME9*, 5-9. <https://www.researchgate.net/profile/Marja-Van-Den-Heuvel-Panhuizen/publication/251769977>
- Wau, H. A., Harefa, D., & Sarumaha, R. (2022). Analisis kemampuan penalaran matematis pada materi barisan dan deret siswa kelas XI SMK Negeri 1 Toma tahun pembelajaran 2020/2021. *Afore: Jurnal Pendidikan Matematika*, 1(1), 41–49. <https://doi.org/10.57094/afore.v1i1.435>
- Wibowo, A. (2022). *Ketrampilan penalaran deduktif (Deductive reasoning skills)* (J. T. Santoso, Ed.). Yayasan Prima Agus Teknik bekerja sama dengan Universitas Sains & Teknologi Komputer. <https://penerbit.stekom.ac.id/index.php/yayasanpat/article/view/316>