PRISMA, 14(1), 85-94, June 2025
https://jurnal.unsur.ac.id/prisma
DOI:10.35194/jp.v14i1.4535

p-ISSN 2089 3604
e-ISSN 2614 4611

Students' Mathematical Reasoning Ability on Cuboid and Cube Story Problems Based on Learning Styles

Agnes Putri Ayu Wanlin[1,*], I Nengah Parta[2], Swasono Rahardjo[3]
[1,2,3,4] Universitas Negeri Malang, Malang, Indonesia
*Corresponding Author: agnes.putri.2203118@students.um.ac.id

Submitted: 07-08-2024	*Revised: 20-05-2025*	*Accepted: 26-05-2025*	*Published: 20-06-2025*

ABSTRACT

This study aims to determine the mathematical reasoning ability of grade VII students at SMP Negeri 2 Pakisaji in solving story problems about blocks and cubes in terms of learning styles. The type of research used is descriptive qualitative. The population of this study was grade VII students, with a sample of six grade VIIC students in the 2023/2024 academic year. Sample selection was based on visual, auditory, and kinesthetic learning styles as well as high and low levels of mathematical reasoning ability. Data were collected through mathematical reasoning tests and interviews. Data analysis techniques include data reduction, data presentation, and drawing conclusions. The results of the study showed that students with visual, auditory, and kinesthetic learning styles who had high mathematical reasoning abilities were able to present known and asked information, make guesses, carry out mathematical manipulations, draw conclusions, and check the correctness of answers. Meanwhile, students with low mathematical reasoning abilities had difficulty in meeting most of these indicators. The innovation of this research lies in the relationship between learning styles and students' mathematical reasoning abilities in solving block and cube story problems to support more effective learning strategies according to the characteristics of students' learning styles.

Keywords: cuboid and cube story problems; learning styles; mathematical reasoning

INTRODUCTION

Mathematics is a discipline that must be studied from primary through secondary education. The purpose of mathematics learning is to help students develop the ability to understand problems, create mathematical models, solve them, and interpret the results obtained (Farida et al., 2021; Nurjanah et al., 2022; Setyaningsih & Firmansyah, 2022). Mathematics instruction in schools is intended to enhance students' thinking abilities in solving mathematical problems (Septian et al., 2020; Septian & Maghfirah, 2021). This aligns with the goals of mathematics education as stated in Permendikbud Number 58 of 2014, which include communicating ideas and thoughts and constructing mathematical proofs using complete sentences, symbols, tables, diagrams, or other media to clarify issues (Alfionita & Hidayati, 2019).

The ability to reason mathematically is a crucial skill that students need to develop in the process of learning mathematics (Inayah et al., 2021; Nurjanah et al., 2022). With this ability, students can develop logical, analytical, systematic, critical, and creative thinking patterns (Linola et al., 2017). Students' mathematical reasoning abilities need to be developed so that students do not just follow procedures and imitate examples without truly understanding the material being taught. This is also in line with the opinion (Sumartini & Utami, 2023) that reasoning skills are important to develop because through reasoning students can think and explore mathematical ideas.

Considering the importance of mathematical reasoning, according to (Ario, 2016) A thorough examination of students' mathematical reasoning skills is necessary. This involves evaluating mastery of mathematical reasoning after instruction and identifying the different mistakes students make when responding to mathematical reasoning questions. The findings from this analysis will be utilized to develop learning strategies or methods aimed at addressing these errors. Thus, it is hoped that students' mathematical reasoning abilities can improve in the future and as conveyed by (Rohmah et al., 2020) students can understand the concept by developing solutions to a problem with the answers and abilities students have. On. Before conducting the analysis, the learning provided must be the type that encourages students to be more actively involved. Learning should position students as the primary participants in the educational process, rather than merely passive recipients of information from the teacher. Failing to do so can significantly contribute to students' weak reasoning abilities.

The limited mathematical reasoning abilities of students are undoubtedly influenced by several factors, one of which is their individual learning styles. According to Kurniawati (2021), every student has a unique learning style, and learning styles impact how students understand problem solving. Therefore, students' learning styles will produce various characteristics in solving problems. This is in line with the opinion of Wahyuni (2017), that the diversity of students' learning styles requires a selection of suitable teaching strategies so that the strengths of students' learning styles develop well, especially at the junior high school level, abstract students will face problems that are of a nature and require mathematical reasoning to solve them, especially in material regarding blocks and cubes.

Preliminary observations at SMP Negeri 2 Pakisaji indicated that students' mathematical reasoning abilities in solving word problems related to cuboids and cubes fell short of the expected indicators. The student's learning style factor was one of the causes. According to (Saputri et al., 2017), There are indicators used to assess students' mathematical reasoning abilities, these indicators include presenting information, asking questions, making guesses, carrying out mathematical manipulations, drawing conclusions, checking the correctness of answers and finding patterns or properties to make generalizations.

As for previous research, for example the first was conducted by (Salaswati & Adirakasiwi, 2022), The study found that students' mathematical reasoning abilities are categorized into three levels: high, medium, and low. Students with high mathematical reasoning skills almost meet all the established indicators. Students with moderate mathematical reasoning skills only fulfill a portion of the expected indicators, whereas those with low ability generally fail to meet the established criteria. The second study was conducted by (Kusumaningtyas et al., 2021), The study's results indicated that students with high mathematical ability tend to also exhibit high mathematical reasoning skills. In contrast, students with moderate mathematical ability generally show moderate mathematical reasoning, and those with low mathematical ability tend to have low mathematical reasoning skills. Students with high mathematical reasoning are capable of offering multiple solutions when solving problems.

The main difference between this study and previous studies lies in the focus and indicators used. This study concentrates on students' mathematical reasoning abilities in solving word problems involving cuboids and cubes, with consideration of their learning

styles. In contrast, previous research did not factor in students' learning styles. Moreover, while previous studies only included drawing conclusions as an indicator of completion, this study expands the scope by incorporating additional indicators such as verifying predetermined answer estimates and identifying patterns or characteristics of mathematical phenomena to form generalizations. This study will be conducted at SMP Negeri 2 Pakisaji with grade VII students in semester 2, using material about cuboid and cubes. In contrast, previous studies covered different materials, namely relations and functions in the first study, and quadrilaterals in the second study.

Based on observations at SMP Negeri 2 Pakisaji and interviews with grade VII mathematics teachers, it is evident that students' learning styles influence mathematical reasoning abilities in solving story problems related to cuboid and cubes. Therefore, the researcher intends to conduct a study to better understand the mathematical reasoning abilities of grade VII students at SMP Negeri 2 Pakisaji.

RESEARCH METHODS

This study employs a qualitative approach. A qualitative approach provides detailed explanations and discussions of problems that are not yet fully known and understood. This approach makes it easier to understand all aspects discussed in the study. This research will be conducted at SMP Negeri 2 Pakisaji, located on Jl. Darungan, Gelanggang Village, Pakisaji District, Malang Regency. The research subjects are seventh-grade students from the 2023/2024 academic year, and the study will take place during the even semester. SMP Negeri 2 Pakisaji was selected as the research site because observations and interviews with grade VII mathematics teachers revealed that students' learning styles impact mathematical reasoning abilities, particularly in solving story problems involving cuboid and cube. The purpose of this study is to investigate the mathematical reasoning skills of seventh-grade students at this school.

Since this research is qualitative, the subjects are chosen selectively based on the research objectives, which are to determine the mathematical reasoning abilities of seventh-grade students at SMP Negeri 2 Pakisaji in solving word problems about cuboids and cubes, considering their learning styles. A total of 30 students will be involved in this study.

In the process of collecting information and analyzing students' mathematical reasoning abilities, several students will be selected as representatives of each learning style and to represent various answers to the questions given. The selected students will be interview sources to further explore abilities in solving story problems about cuboid and cube. In this study, the indicators used to assess students' mathematical reasoning abilities include presenting information, asking questions, making guesses, carrying out mathematical manipulations, drawing conclusions, checking the correctness of answers, and finding patterns or properties to make generalizations.

RESULTS AND DISCUSSION

The analysis of the written test on mathematical reasoning abilities for class VIIC students at SMPN 02 Pakisaji reveals that the average score is below 55, indicating a low level of mathematical reasoning ability. Specifically, the average scores are 38.8 for visual learners, 40.9 for auditory learners, and 47.75 for kinesthetic learners. These findings are

consistent with Ardi Gustiadi's research, which also shows that the average score for students' mathematical reasoning ability is below 55, specifically 42.08, reflecting a low level of mathematical reasoning skills (Gustiadi et al., 2021). This shows the need for a learning process that is specifically designed to train students' mathematical reasoning abilities, with the aim of improving learning outcomes, especially in the material on cuboid and cube.

The learning process can assist students in addressing problems related to reasoning, particularly in enhancing mathematical reasoning abilities. Based on the analysis of written tests and interviews regarding students' mathematical reasoning skills from the perspective of learning styles, it is clear that different learning styles affect students' performance in this area. The challenges encountered are as follows:

1. Based on Figure 1 and Figure 2, students with a visual learning style with high mathematical reasoning abilities show that students can carry out the mathematical reasoning process including presenting known and asked information, making assumptions, carrying out mathematical manipulations, drawing conclusions, and checking the truth and accuracy of answers. The shortcomings of the students are that the students do not write the trait pattern to make generalizations on the answer sheet, but the students can provide answers during the interview process.

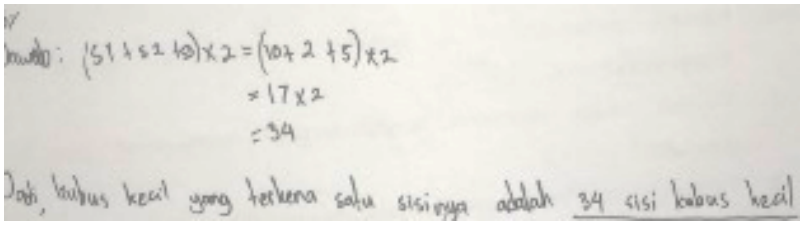

Figure 1. Student Work Results JJ Question Number 1

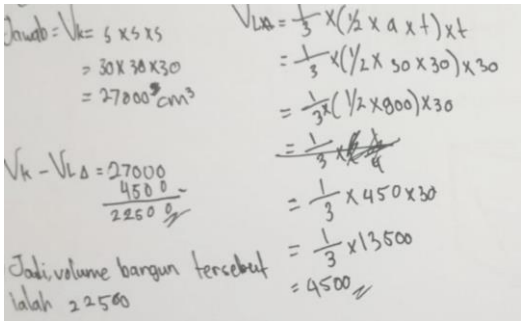

Figure 2. Student Work Results JJ Question Number 2

Meanwhile, Based on Figure 3 and Figure 4, Visual learning style students with low mathematical reasoning skills show that the students have not been able to carry out the mathematical reasoning process well. This can be seen in the students' answers in writing what is known and asked, there are errors that cause the next resolution process which includes submitting conjectures, carrying out mathematical manipulations, drawing conclusions, and checking the truth, accuracy of answers and writing trait patterns to make generalizations wrong.

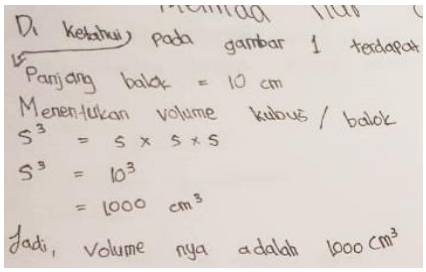

Figure 3. Student Work Results AD Question Number 1

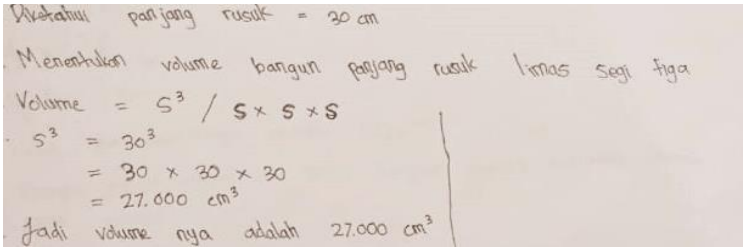

Figure 4. Student Work Results AD Question Number 2

This is in line with research conducted by (Irianti, 2020) that students with visual learning styles and high reasoning abilities are able to understand problems, plan problem solving, solve problems accurately, and recheck the answers obtained. In contrast, students with low reasoning abilities often have difficulty in understanding problems and planning solutions. The results of problem solving from students with low reasoning abilities are often inaccurate, and students usually do not recheck the answers that have been given. Therefore, it is important to strengthen conceptual understanding in the problem solving process, because it is in accordance with what was conveyed by (Annisa, 2022) that students' ability to understand mathematical concepts is influenced by mathematical reasoning factors, while the rest is influenced by other factors such as learning styles.

2. Based on Figure 5 and Figure 6, students with auditory learning styles with high mathematical reasoning abilities show that these students can carry out the mathematical reasoning process including presenting what is known and asked, making assumptions, carrying out mathematical manipulations, drawing conclusions, and checking the truth and accuracy of the answers. The shortcomings of these students are that students do not write down the trait patterns to make generalizations on the answer sheet, but students can provide answers during the interview process.

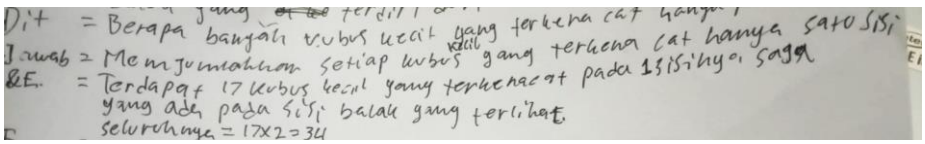

Figure 5. NR Student Work Results for Question Number 1

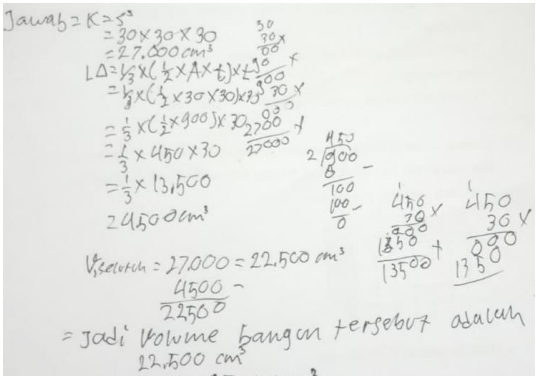

Figure 6. NR Student Work Results for Question Number 2

Meanwhile, Based on Figure 7 and Figure 8, Students with an auditory learning style with low mathematical reasoning skills show that the students have not been able to carry out the mathematical reasoning process well. This can be seen in the students' answers in writing what is known and asked, there are errors that cause the next resolution process which includes submitting conjectures, mathematical manipulation, drawing conclusions, and checking the truth and accuracy of the answers and writing the trait pattern to make generalizations wrong.

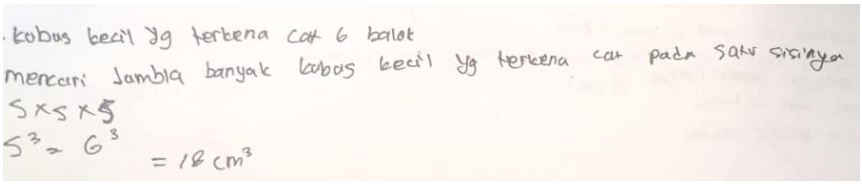

Figure 7. MN Student Work Results Question Number 1

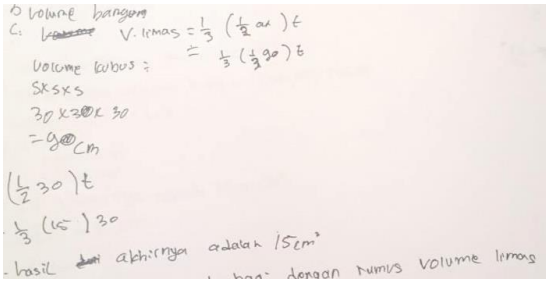

Figure 8. MN Student Work Results for Question Number 2

This is in line with research conducted by (Sayuri et al., 2020) Students with an auditory learning style have the ability to present mathematical statements in writing, using pictures or diagrams, and draw conclusions. However, these students are not yet fully able to compile evidence or provide appropriate reasons, draw conclusions from statements, and determine the correct pattern regarding the truth of the solution provided. Thus, in accordance with what has been conveyed by (Rahmatina et al., 2023) It is important to conduct interviews to obtain in-depth information about students' mathematical reasoning abilities, especially to explore information about students' conceptual understanding and the problem-solving processes students use.

3. Based on Figure 9 and Figure 10, Students with a kinesthetic learning style with high mathematical reasoning ability show that the student can carry out the mathematical

reasoning process including presenting what is known and asked, making assumptions, carrying out mathematical manipulations, and drawing conclusions. The shortcomings of the students are that the students do not check the truth and accuracy of the answers and write down the pattern of traits to make generalizations on the answer sheet, but the students can provide answers during the interview process.

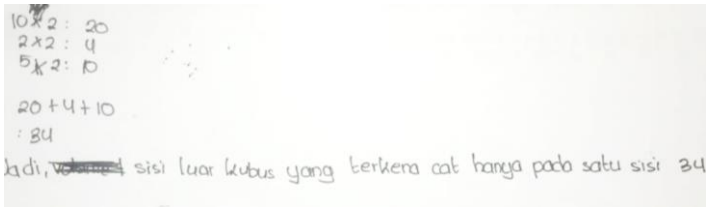

Figure 9. Student Work Results for RAP Question Number 1

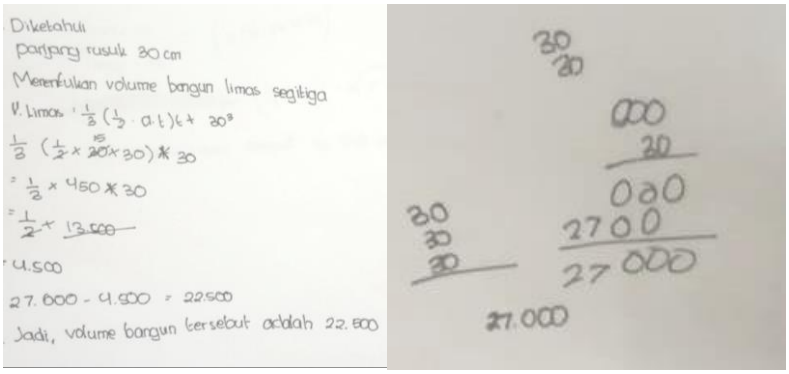

Figure 10. Student Work Results for RAP Question Number 2

Meanwhile, Based on Figure 11 and Figure 12, Students with a kinesthetic learning style with low mathematical reasoning skills show that the students have not been able to carry out the mathematical reasoning process well. This can be seen in the students' answers in writing down what is known and asked, there are errors that cause the next resolution process which includes submitting conjectures, mathematical manipulation, drawing conclusions, and checking the truth and accuracy of the answers and writing down nature patterns to make generalizations wrong.

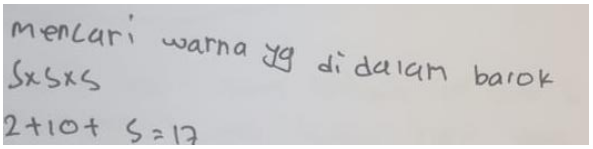

Figure 11. Results of IR Student Work on Question Number 1

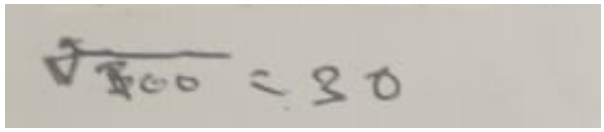

Figure 12. Results of IR Student Work on Question Number 2

This is in line with research conducted by (Safitri et al., 2023) The mathematical reasoning ability of students with kinesthetic learning styles only includes four indicators, namely submitting conjectures, presenting ideas, carrying out mathematical manipulations, and determining solution strategies. However, students with kinesthetic

learning styles have not been able to fulfill the indicators of drawing conclusions and checking the truth or validity of a statement. Therefore, as conveyed by (Araiku et al., 2019) There is a need to provide a conceptual understanding of solving mathematical reasoning problems continuously and with structured problem solving starting from determining what is known and asked, submitting conjectures, mathematical manipulation, drawing conclusions, rechecking and generalization so that students' mathematical reasoning abilities can improve.

CONCLUSION

The results of the study indicate that there is a close relationship between students' learning styles and students mathematical reasoning abilities. Students with high reasoning abilities, whether visual, auditory, or kinesthetic, are generally able to carry out mathematical reasoning stages such as presenting information, proposing conjectures, manipulating mathematics, concluding, and checking results. However, a common deficiency found is inconsistency in writing patterns or generalizations in writing, even though they can explain them verbally in interviews. In contrast, students with low reasoning abilities from all three learning styles tend to have difficulty from the early stages of understanding the problem, which has an impact on the entire subsequent reasoning process.

The implications of these findings indicate the need for learning strategies that are responsive to the diversity of learning styles, by integrating visual, verbal, and kinesthetic approaches in a balanced way in curriculum planning in order to encourage mathematical reasoning through various representations. Teachers need to pay attention to students' thinking processes, not just the final results, and encourage students to write down complete thinking steps and reflect on students answers. Further research is recommended to explore multiple learning styles and use more varied measuring instruments to capture the reasoning process holistically. These findings support a more inclusive and differentiated educational policy direction, by placing learning styles as an important component in curriculum development and learning evaluation.

REFERENCES

Alfionita, F., & Hidayati, N. (2019). Analisis Kemampuan Pemahaman Matematis Siswa SMP Pada Materi Bangun Ruang Sisi Datar. *Analisis Kemampuan Pemahaman Matematis Siswa*, 950–956.

Annisa, F. N. (2022). 6817-15890-2-Pb. *Pengaruh Penalaran Matematis Terhadap Kemampuan Pemahaman Konsep Matematika*, *2*(80), 125–133.

Araiku, J., Parta, I. N., & Rahardjo, S. (2019). Analysis of students' mathematical problem solving ability as the effect of constant ill-structured problem's employment. *Journal of Physics: Conference Series*, *1166*(1). https://doi.org/10.1088/1742-6596/1166/1/012020

Ario, M. (2016). Analisis Kemampuan Penalaran Matematis Siswa SMK Setelah Mengikuti Pembelajaran Berbasis Masalah. *Jurnal Ilmiah Edu Research*, *5*(2), 125–134.

Farida, R. N., Qohar, A., & Rahardjo, S. (2021). Analisis Kemampuan Literasi Matematis Siswa SMA Kelas X Dalam Menyelesaikan Soal Tipe Pisa Konten Change and Relationship. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *5*(3), 2802–2815. https://doi.org/10.31004/cendekia.v5i3.972

Gustiadi, A., Agustyaningrum, N., & Hanggara, Y. (2021). Analisis Kemampuan Penalaran Matematis Siswa dalam Menyelesaikan Soal Materi Dimensi Tiga. *Jurnal Absis: Jurnal Pendidikan Matematika Dan Matematika*, *4*(1), 337–348. https://doi.org/10.30606/absis.v4i1.894

Inayah, S., Septian, A., & Komala, E. (2021). Efektivitas Model Flipped Classroom Berbasis Problem Based Learning dalam Meningkatkan Kemampuan Berpikir Kritis. *Wacana Akademika: Majalah Ilmiah Kependidikan*, *5*(2), 138–144.

Irianti, N. P. (2020). Analisis Kemampuan Penalaran Siswa dalam Memecahkan Masalah Matematika Berdasarkan Langkah-langkah Polya. *MUST:Journal of Mathematics Education, Science and Technology*, *5*(1), 80–94.

Kusumaningtyas, N., Parta, I. N., & Susanto, H. (2021). Kemampuan Penalaran Matematis Siswa dalam Memecahkan Masalah Matematika pada Saat Pembelajaran Daring. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *6*(1), 107–119. https://doi.org/10.31004/cendekia.v6i1.1019

Linola, D. M., Marsitin, R., & Wulandari, T. C. (2017). Analisis Kemampuan Penalaran Matematis Peserta Didik dalam Menyelesaikan Soal Cerita di SMAN 6 Malang. *Pi: Mathematics Education Journal*, *1*(1), 27–33. https://doi.org/10.21067/pmej.v1i1.2003

Nurjanah, A., Nurcahyono, N. A., & Imswatama, A. (2022). Penerapan Model Problem Based Learning terhadap Kemampuan Pemecahan Masalah Matematis Ditinjau dari Gaya Belajar Siswa SMP. *Prisma*, *11*(2), 406–414. https://doi.org/10.35194/jp.v11i2.2420

Rahmatina, D., Nusantara, T., Parta, I. N., & Susanto, H. (2023). Students' Reasoning about Variability When Comparing Two Sets of Data from the Perspective of Commognitive. *International Journal of Instruction*, *16*(4), 1081–1098. https://doi.org/10.29333/iji.2023.16459a

Rohmah, W. N., Septian, A., & Inayah, S. (2020). Analisis Kemampuan Penalaran Matematis pada Materi Bangun Ruang Ditinjau dari Gaya Kognitif Siswa. *Prisma*, *9*(2), 179–191.

Safitri, I., Prayitno, S., Azmi, S., & Sarjana, K. (2023). Analisis Kemampuan Penalaran Matematis Pada Materi SPLDV Dinjau Dari Gaya Belajar Siswa. *ILmiah Pendidikan Dasar*, *08*(03), 5133–5147.

Salaswati, M., & Adirakasiwi, A. . (2022). Kemampuan Penalaran Matematis Siswa dalam Menyelesaikan Soal Materi Relasi dan Fungsi Meilinda. *Jurnal Didactical Mathematics*, *4(2)*(Oktober), 302–313.

Saputri, I., Susanti, E., & Aisyah, N. (2017). Kemampuan Penalaran Matematis Siswa Menggunakan Pendekatan Metaphorical Thinking pada Materi Perbandingan Kelas VIII di SMPN 1 Indralaya Utara. *Jurnal Elemen*, *3*(1), 15. https://doi.org/10.29408/jel.v3i1.302

Sayuri, M., Yuhana, Y., & Syamsuri, S. (2020). Analisis Kemampuan Penalaran Matematis Siswa SMP Ditinjau dari Gaya Belajar. *Wilangan: Jurnal Inovasi Dan …*, *1*(4), 403–414.

Septian, A., Darhim, & Prabawanto, S. (2020). Mathematical representation ability through geogebra-assisted project- based learning models. *Journal of Physics : Conference Series*, *1657*(1), 012019. https://doi.org/10.1088/1742-6596/1657/1/012019

Septian, A., & Maghfirah, D. (2021). Mathematical Literacy Skills using Google Classroom on Trigonometry. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *10*(4), 2515–2525. https://doi.org/10.24127/ajpm.v10i4.4263

Setyaningsih, V. P., & Firmansyah, D. (2022). Analisis Kemampuan Pemecahan Masalah Matematis Siswa SMP Pada Materi Persamaan Garis Lurus. *Prisma*, *11*(1), 10. https://doi.org/10.35194/jp.v11i1.2048

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