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Ukas Alif Fuadi, Dimas Anditha Cahyo Sujiwo, Aswar Anas

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1Ukas Alif Fuadi, 2Dimas Anditha Cahyo Sujiwo, 3Aswar Anas
Mathematics Education Study Program, Teacher Training and Education Faculty, Universitas PGRI Argopuro Jember
Email: ukasalif6@gmail.com

Abstract: *Quality education in the SDGs aims to improve high-level thinking and problem-solving capabilities at all levels of education. Nevertheless at SMP Baitul Arqom, students has difficulties in solving mathematical problems, especially in social arithmetic. The aim of this research is to determine the ability of 8th grade students at SMP Baitul Arqom in solving social arithmetic problems in terms of impulsive and reflective cognitive styles. This research approach is descriptive, which describes the level of students' problem solving abilities based on impulsive and reflective cognitive styles. Then this research is a qualitative type, because the findings that will be explored in this research do not require procedural statistical analysis. This research was carried out at SMP Baitul Arqom Balung. Data sources include arithmetic test questions, MFFT, and interviews. The research subjects were class VIII students at SMP Baitul Arqom. Based on the results of the MFFT test and social arithmetic problem solving for 8th grade students at SMP Baitul Arqom, it shows that there were 9 impulsive students, 11 reflective students, and 4 students who were neither categorized as impulsive nor reflective. There is a clear difference between impulsive and reflective students. Impulsive students, IS1 and IS2, tended to be quick in responding but often inaccurate, indicating the need for practice in slowing down the decision-making process to increase accuracy. Meanwhile, reflective students, RS1 and RS2, were very accurate but slow, indicating the need for practice in speeding up the thinking process without sacrificing quality.*
Keyword: cognitive styles, reflective, impulsive, problem solve, social arithmetic

INTRODUCTION

Quality education is upheld in the Sustainable Development Goals (SDGs). Based on Kementerian PPN/Bappenas, (2022), one of 17 goals in the Sustainable Development Goals is the capability of human resources who are able to think at a high level at all levels of education. Meanwhile, high-level thinking abilities are also supported by faster and more efficient problem-solving abilities (Panglipur & Putra, 2018). Meanwhile, according to research by Fitri (2017), the ability of students to understand mathematical concepts is still low, which means that it is not in accordance with the purpose of mathematics learning.

Based on the results of observations in the 8th grade of SMP Baitul Arqom, students had difficulties solving social arithmetic problems. Low scores in social arithmetic are caused by students not being active during mathematics learning. There are only 1 or 2 students who put forward ideas and ask the teacher about misunderstandings. Students are able to answer sample questions. However, when the teacher gave another example of a question that was a bit deceptive, the students felt difficulty and were unable to answer it. This indicates that students cannot think and understand the real concept of social arithmetic, so they only follow the sample questions. Meanwhile, problem solving does not only depend on the final answer but also on how students can complete the thinking process to solve arithmetic problems. According to Azhil et al. (2017), students do not possess problem-solving abilities directly but need to be studied and trained, especially through studying mathematics.

In addition to the low understanding of students in social arithmetic, teachers are not able to understand the various characteristics of students when solving problems. There are students who are able to solve problems for quite a long time, but there are also students who are able to solve problems very quickly. There are types of students who are able to

solve problems for quite a long time, but there are also types of students who are able to solve problems very quickly. Thus, it refers to cognitive style, and cognitive style influences student problem solving. Susan and Collinson (Hayuningrat & Listiawan, 2018) state that in general, strategies or ways of solving problems are more influenced by cognitive style.

One of the cognitive styles is the reflective and impulsive cognitive style. Reflective and impulsive cognitive styles are cognitive styles that indicate the duration of thinking, so the ideas used to solve problems depend on the cognitive style of the students (Fadiana, 2016). Based on the problems of students, there are differences in students' characters that influence the way they process and receive learning. In solving problems, the methods used by each student are definitely different, which will affect their speed in solving problems. Therefore, this research will examine the influence of reflective and impulsive cognitive styles on the problem-solving abilities of 8th grade students at SMP Baitul Arqom to help teachers find out about the cognitive styles of students.

METHOD

This research approach is descriptive, which describes the level of problem-solving abilities of students based on impulsive and reflective cognitive styles. Then the type of this research is qualitative, because the findings that will be explored in this analysis do not require procedural statistics but rather aim to reveal students' level of understanding by collecting data in a natural setting (Fadli, 2021).

The subject of this research are 24 students of 8th grade at SMP Baitul Arqom, Balung, which held by May until June 2024. The data sources needed in this research are primary and secondary data. The assessment tool used to identify students' impulsive and reflective cognitive styles is adapted from the Matching Familiar Figure Test (MFFT) which was originally taken from Jerome Kagan's research in 1965. Validity test on MFFT, arithmetic question test, and interview sheet on 3 validators from Universitas PGRI Argopuro Jember. Students with a reflective cognitive style are able to complete assessments in a period of time above the average for all students and with more correct answers. Meanwhile, students with an impulsive cognitive style are those who are able to answer the fastest (below the average time for all students) but have few correct answers. The determination of students with impulsive and reflective cognitive styles is based on the following table:

Table 1. The Determination of Impulsive and Reflective Styles

Time Allocation (t)	Cognitive Error (f)	Cognitive Types
Time (f) ≤ 7' 28"	Error (f) ≥ 7 questions	Impulsive Student
Time (f) > 7' 28"	Error (f) < 7 questions	Reflective Student

Interviews are needed to reveal information that has not been identified during observations and to further explore students' critical thinking processes in solving mathematical problems. The interview method chosen was an unstructured interview, which means the researcher did not adhere to a well-structured interview guide for collecting data. The interview guide used only includes an outline of the problems that will be raised. The questions are adapted to the student's situation and condition. If students have difficulty answering, they are given options or assistance so that it can help them in providing a response.

RESULT AND DISCUSSION

The study involved 24 students as respondents, but only 4 students, including 2 reflexive students and 2 impulsive students, saw the results of the mathematical understanding test and were subsequently interviewed for triangulation of the data. The tree that will be discussed early in this study is the results of the MFFT test to classify the cognitive style of students.

The MFFT test results are the basis for determining the cognitive style of a student whose parameters refer to the completion time (*t*) and the number of wrong student answers that are usually marked by frequency (*f*). The results of the reflexive and impulsive students' cognitive style tests showed that in the study there were 9 students who had impulsive styles, 11 students had reflective styles and 4 other students did not fall into either impulsive or reflective categories. After students are classified into two categories of impulsive and reflective cognitive styles, the next analysis is student problem-solving ability on social arithmetic material.

Table 2. Grouping Of Students' Cognitive Styles and Problem-Solving Abilities

Cognitive Styles	Qty	Averages Score	Problem Solving Ability Levels	Qty	Percentage (%)
Reflective	11	70,45	Advanced	5	45,4%
			Medium	5	45,4%
			Low	1	9,2%
Impulsive	9	45,67	Medium	3	33,3%
			Low	6	66,7%

Based on the analysis of the MFFT test data, the average impulse student score was 70.45 with high, medium, and low problem-solving rates. While impulsive students only have a moderate problem-solving rate, and are low with an average score of 45.67. Through the comparison of these scores it can be concluded that the ability to solve mathematical problems reflective students better than impulsive students (Kurniawati et al., 2022). In order to improve the efficiency of speech, impulsive students are labeled with IS1 and IS2, while reflective students are marked with RS1 and RS2. As for the percentage level of ability to solve mathematical problems of students at each stage of problem solving according to Polya is presented in Table 3:

Table 3. Percentage Level of Mathematical Problem Solving Ability of Students on Social Arithmetic Material for Each Stage of Problem-Solving

No	Stages of Problem Solving	Qualification of Problem Solving Ability			
		Reflective		Impulsive	
		Quantity	Percentage	Quantity	Percentage
1	Understanding Problem	10	90,9%	7	77,7%
2	Make a plan	9	81,8%	7	77,7%
3	Solve the plan	9	81,8%	5	55,5%
4	Re-examines	6	54,5%	1	11,1%

In order to efficiency, impulsive students are marked with IS1 and IS2, while reflective students are marked with RS1 and RS2.

Impulsive Student
The figure 1 below is a sample of test results for students' problem solving abilities which are triangulated with the results of interviews with impulsive cognitive style subjects (IS1 students). The following are the results of data analysis on the problem-solving abilities of subjects with an impulsive cognitive style on social arithmetic material.
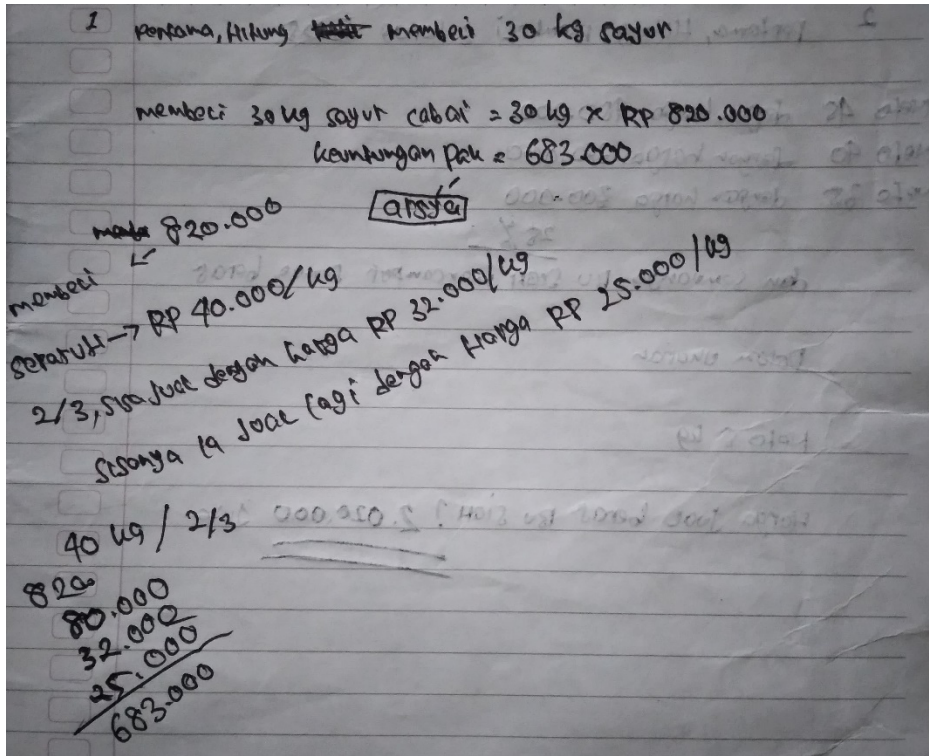
Figure 1. Answer Sheet Sample of Problem Solving Skill Test Of IS1 Student

Problem solving ability in the indicator of understanding the problem, IS1 students only write down what is known about the problem, but it is not complete and uses short word descriptions as if they don't understand the problem at all. The subject considers that writing down what is known and what is asked is not that important and troublesome. However, during the interview he admitted that writing down what he knew and asked about the problem could make it easier to solve the problem, but he considered it unimportant and troublesome.

In the indicator of making a plan, the subject has a solution plan but it is not appropriate because he is too quick in making decisions without thinking deeply about solving the problem. In the interview session, the subject mentioned material which he thought was related to the question but the material mentioned by the subject was not relevant to the question being asked. In completing the plan, the subject carried out the solution using an unclear procedure. The subject did not write down in detail the steps he took to complete it. There are several steps that are not written down so that the subject can solve the problem quickly with the wrong solution.

The indicator re-examines problem-solving abilities, the subject does not write conclusions and does not re-examine the work and results of the answers. Therefore no conclusions are written.

IS1 shows a tendency to make decisions very quickly. In the MFFT test questions and social arithmetic problem solving, IS1 provided answers in a short time. However, analysis of the answers shows that this speed comes at the expense of accuracy, with error rates being quite high. This is caused by carelessness and hasty behavior of students with an impulsive cognitive style in working on questions (Aminah et al., 2023). When interviewed, IS1 explained that even though he had a poor understanding of the questions, IS1 was still confident in answering the questions. According to Naryaningsih et al. (2022), impulsive students tend to answer quickly without paying attention to important aspects in solving mathematics problems. In line with research results Erviandita et al. (2023), that impulsive

students tend to make conceptual errors that have an impact on the procedures for working on mathematics problems.
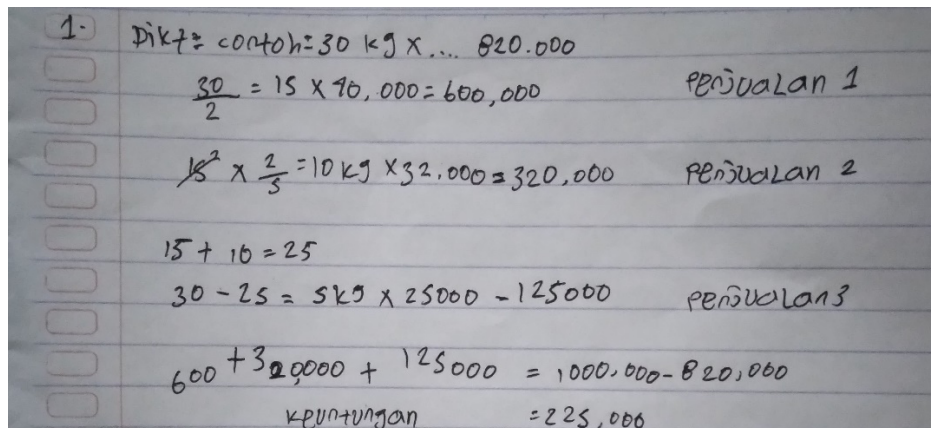

Figure 2. Answer Sheet Sample of Problem Solving Skill Test of IS2 Student

The results of these answers were then triangulated with the results of interviews with impulsive cognitive style subjects (IS2 students). The following are the results of data analysis on the problem-solving abilities of subjects with an impulsive cognitive style on social arithmetic material.

Problem solving ability in the indicator of understanding the problem, IS1 students only write down what is known about the problem, but it is not complete and uses short word descriptions as if they do not understand the problem. The subject thinks that writing down what is known briefly and not writing down what is asked can shorten the completion time. During the interview he admitted that by only writing what he knew, he could work quickly without writing anything else that was not important.

In make a plan indicator, the subject has a solution plan that leads to the correct answer but the answer written is not appropriate because he is too quick in making decisions without thinking deeply about solving the problem. In the interview session, subject stated the material correctly which he thought was related to the question but was too quick in solving the question so there were inappropriate answers.

In completing the plan, the subject carried out the completion plan with the correct procedures but the calculations were wrong. The subject did not write down in detail the steps he took to solve it and there were steps that were not written correctly so that the subject could work on the problem quickly with the wrong solution.

The indicator re-examines problem-solving abilities, the subject does not write conclusions and does not re-examine the work process and answer results. Therefore no conclusions are written. IS2 also displays impulsive behavior similar to IS1, namely being able to solve problems faster than other students. However, the difference lies in IS2's attention pattern which tends to be more easily distracted, causing some tasks not to be completed properly. According to Awaliya & Masriyah (2022) and Appulembang (2015), students with an impulsive cognitive style are actually only able to focus on one thing they are thinking about. Therefore, if the subject has a personality that is easily distracted, then the ability to complete the things being done will decrease and the impact will be poor completion. In the mathematics test, IS2 made a mistake because he did not read the questions carefully. Both impulsive students (IS1 and IS2) indicated that their speed in responding was not always in line with accuracy. In line with Ramadanti et al. (2022) which states that impulsive students tend not to think about the right strategy during the process of working on questions.

Table 4. Category of Impulsive Students Sample

No	Students	Score	Category	Conclusion
1	IS1	22	Low	Low
2	IS2	45	Low	

Based on Table 4, it shows that IS1, IS2 students obtained scores of 22 and 45, which are in the low criteria. So in this study, IS1 and IS2 students' ability to solve mathematical problems in social arithmetic material was at low criteria.

Reflective Students

Based on the results of answers test on Figure 3, they were then triangulated with the results of interviews with reflective cognitive style subjects (RS1 students). The following are the results of data analysis on the problem-solving abilities of reflective cognitive style subjects on social arithmetic material.
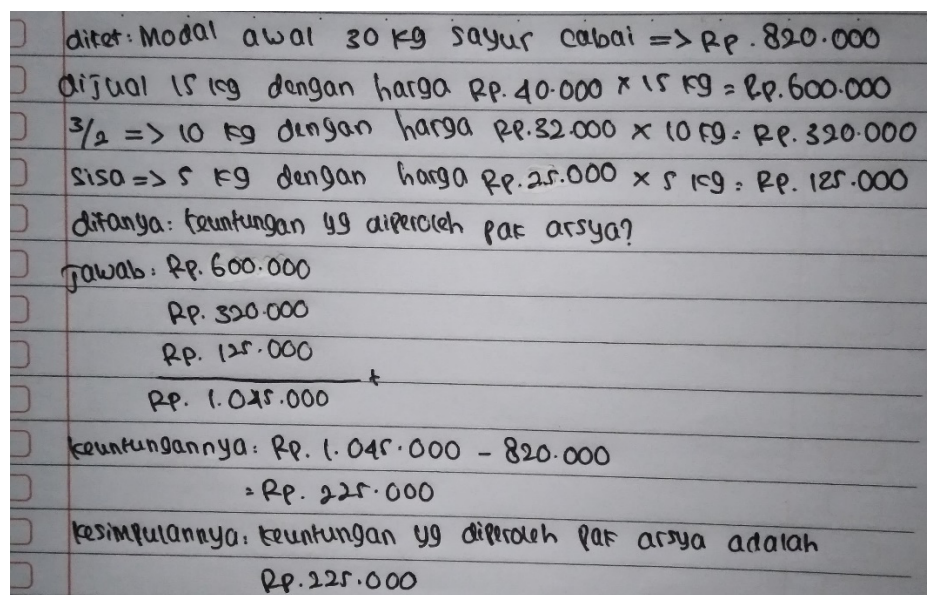

Figure 3. Answer Sheet Sample of Problem Solving Skill Test of RS1 Student

Problem solving ability is an indicator of understanding the problem, RS1 students are able to understand and write down what is known about the problem completely and accurately. During the interview he admitted that writing down what he knew and asked about the questions could make it easier to solve problems, but he needed time to understand the problems in the test questions.

In the indicator of making a plan, the subject is able to carry out solutions with a plan and the correct answer. In making a decision, the subject thinks deeply to develop a plan before solving the problem. During the interview, the subject mentions material related to the question, it is relevant to the question being asked.

In completing the plan, the subject carries out the completion plan and the answer used is correct. The subject wrote in detail the completion steps taken. However, solving the questions requires quite a long time so that you can complete the answers correctly and completely. The indicator re-examines problem-solving abilities, the subject is able to write conclusions and re-examine the work and results of answers correctly.

Besides, RS1 shows a very careful approach in every problem. In the interview session, RS1 stated that he was careful in working on the questions because RS1 tried to answer the questions systematically and in accordance with the material that had been taught. This shows that RS1 has a strategy in working on questions. In line with Muniri & Yulistiyah (2022), that students with a reflective cognitive style have plans and references

when solving the problems given. RS1 takes longer to solve math problems, but the results are accurate with minimal error rates. RS1's thoroughness is clearly visible in tasks that require in-depth analysis, which can be seen from the questions being carefully examined before making a final decision. Even though the duration of answering is longer, students are able to answer questions more accurately than impulsive students (Herianto & Hamid, 2020).
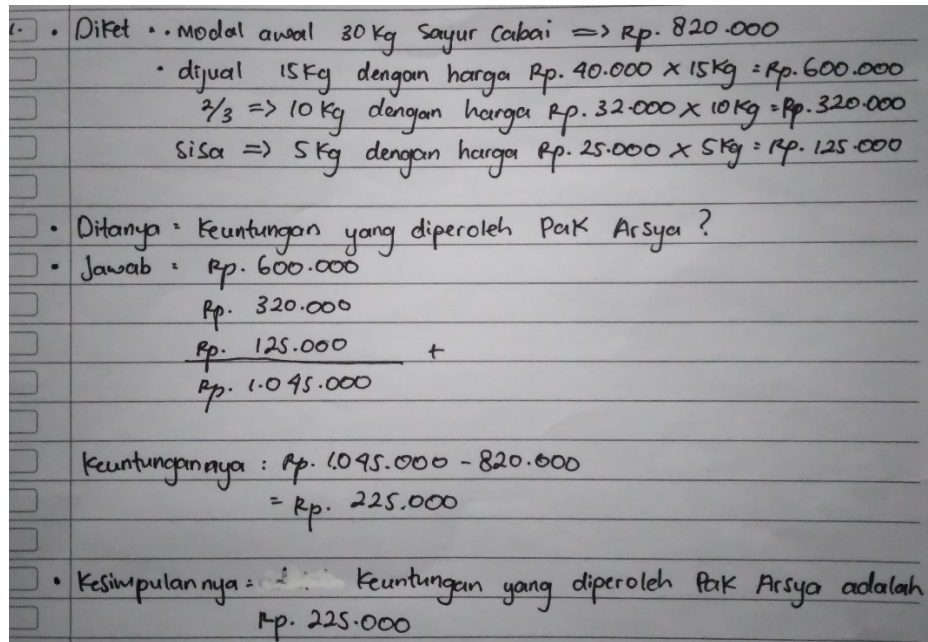

Figure 4. Answer Sheet Sample of Problem Solving Skill Test of RS2 Student

The results of these answers were then triangulated with the results of interviews with reflective cognitive style subjects (RS2 students). The following are the results of data analysis on the problem-solving abilities of reflective cognitive style subjects on social arithmetic material. Problem solving ability is an indicator of understanding the problem, RS2 students are able to understand and write down what is known about the problem completely and precisely. During the interview he admitted that writing down what he knew and asking about the problem could make it easier to solve the problem but it took quite a long time to understand the problem.

In the planning indicator, the subject completes the solution with the plan and the correct answer. In preparing a plan, the subject thinks deeply before solving the problem. During the interview the subject mentions material that is appropriate to the question being asked. In completing the plan, the subject carries out the completion plan correctly and the answers used are correct. The subject wrote in detail the completion steps taken. However, to write down the solution correctly and completely it takes a long time.

The indicator re-examines problem-solving abilities, the subject is able to write conclusions and re-check the solution and answer results correctly. RS2 also demonstrated a reflective cognitive style by taking time to consider each alternative before making a decision. In reading-based tasks, RS2 analyzes texts carefully and provides complete and detailed answers. Besides that, RS2 was more intense in checking the answers to the questions. In line with the research results Idris, et al. (2022), reflective students have good answer accuracy because they double-check the results of working on questions. Reflective students are better at analyzing questions and are more thorough in their work, this is because reflective students are able to answer questions in an orderly and logical manner (Rohmah et al., 2020). Despite sometimes being late in completing assignments within the allotted time, RS2 demonstrates deep understanding and strong critical thinking skills.

Table 5. Category of Impulsive Students Sample

No	Students	Score	Category	Conclusion
1	RS1	80	Advanced	Advanced
2	RS2	85	Advanced	

Based on Table 5, it shows that RS1, RS2 students obtained scores of 80 and 85, which are included in the high criteria. So in this study, RS1 and RS2 students' ability to solve mathematical problems in social arithmetic material was at high criteria.

CONCLUSION

Based on the results of the MFFT test and social arithmetic problem solving in 8th grade high school students, Baitul Arqom showed that there were 2 impulsive students, 18 reflective students, and 4 students who were not categorized as impulsive or reflective. There is a clear difference between impulsive and reflective students. Impulsive students, IS1 and IS2, tend to respond quickly but not accurately, indicating the need for practice in slowing down the decision-making process to improve accuracy. There is a clear difference between impulsive and reflective students. Impulsive students, IS1 and IS2, tend to respond quickly but not accurately, indicating the need for practice in slowing down the decision-making process to improve accuracy.

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REFERENCES
Aminah, Suwarno, & Adinda, A. (2023). ANALISIS BERDASARKAN TAHAPAN KASTOLAN: BAGAIMANA KESALAHAN SISWA REFLEKTIF DAN IMPULSIF DALAM MENYELESAIKAN SOAL EKSPONEN ? *ARITMATIKA*, 4(2), 106–116.

Appulembang, O. D. (2015). *PROFIL PEMECAHAN MASALAH ALJABAR BERPANDU PADA TAKSONOMI SOLO DITINJAU DARI GAYA KOGNITIF KONSEPTUAL TEMPO SISWA SMA NEGERI 1 MAKALE TANA TORAJA* [Thesis]. Universitas Negeri Makassar.

Awaliya, V. I., & Masriyah. (2022). PROSES BERPIKIR KRITIS SISWA SMA DALAM MEMECAHKAN MASALAH MATEMATIKA DITINJAU DARI GAYA KOGNITIF REFLEKTIF DAN IMPULSIF. *Jurnal Ilmiah Pendidikan Matematika*, 11(1), 70–79.

Azhil, I. M., Ernawati, A., Lutfianto, M., & Pendidikan Matematika STKIP Al Hikmah Surabaya Jl Kebonsari Elveka Surabaya, J. V. (2017). Profil Pemecahan Masalah Matematika Siswa Ditinjau dari Gaya Kognitif Reflektif dan Impulsif. In *JRPM* (Vol. 2, Issue 1). http://jrpm.uinsby.ac.id

Erviandita, S., Pramasdyahsari, A. S., & Wulandari, D. (2023). ANALISIS KESALAHAN SISWA DALAM MENYELESAIKAN SOAL-SOAL EKSPONEN BERDASARKAN TEORI KASTOLAN DITINJAU DARI GAYA KOGNITIF REFLEKTIF DAN IMPULSIF. *ALGORITMA: Journal of Mathematics Education*, 5(1), 1–12. https://doi.org/10.15408/ajme.v5i1.31685

Fadiana, jizatin. (2016). Perbedaan Kemampuan Menyelesaikan Soal Cerita antara Siswa Bergaya Kognitif Reflektif dan Impulsif. In *Journal of Research and Advances in Mathematics Education ISSN* (Vol. 1, Issue 1). http://journals.ums.ac.id/index.php/jramathedu

Fadli, M. R. (2021). Memahami desain metode penelitian kualitatif. *Humanika: Kajian Ilmiah Mata Kuliah Umum*, 21(1), 33–54. https://doi.org/10.21831/hum.v21i1

Hayuningrat, S., & Listiawan, T. (2018). Proses Berpikir Siswa dengan Gaya Kognitif Reflektif dalam Memecahkan Masalah Matematika Generalisasi Pola. *Jurnal Elemen*, *4*(2), 183. https://doi.org/10.29408/jel.v4i2.752

Herianto, & Hamid, N. (2020). ANALISIS PROSES BERPIKIR KREATIF DALAM PEMECAHAN MASALAH GEOMETRI BERDASARKAN GAYA KOGNITIF REFLEKTIF DAN IMPULSIF SISWA. *Pedadogy*, *5*(2), 38–49.

Idris, M., Kodirun, & Wibawa, G. N. A. (2022). Analisis Kemampuan Pemecahan Masalah Matematis Siswa Impulsif-Reflektif Menurut Gender (Analysis of Impulsive-Reflective Students' Mathematical Problem Solving Ability According to Gender). *Jurnal Pembelajaran Berpikir Matematika*, *7*(2), 150–160.

Kementerian PPN/Bappenas. (2022). *PEDOMAN TEKNIS PENYUSUNAN RENCANA AKSI TUJUAN PEMBANGUNAN BERKELANJUTAN (TPB)/ SUSTAINABLE DEVELOPMENT GOALS (SDGs)*.

Kurniawati, N., Prayitno, S., Hayati, L., & Subarinah, S. (2022). Analisis Kemampuan Pemecahan Masalah Aritmatika Sosial Ditinjau dari Gaya Kognitif Impulsif dan Reflektif Siswa MTs. *Griya Journal of Mathematics Education and Application*, *2*(2), 493–503. https://mathjournal.unram.ac.id/index.php/Griya/index

Muniri, & Yulistiyah, E. (2022). Representasi Matematis Siswa dalam Menyelesaikan Masalah Sistem Persamaan Linear Ditinjau dari Gaya Kognitif Reflektif-Implusif. *Plus Minus: Jurnal Pendidikan Matematika*, *2*(2), 201–210.

Naryaningsih, P. D., Siswono, T. Y. E., & Wintarti, A. (2022). Literasi Matematis Siswa Reflektif dan Siswa Impulsif dalam Menyelesaikan MasalahKontekstual Berorientasi PISA. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *6*(3), 2685–2697. https://doi.org/10.31004/cendekia.v6i3.1408

Panglipur, I. R., & Putra, E. D. (2018). ANALISIS PEMAHAMAN KONSEP DASAR GEOMETRI DENGAN PEMBELAJARAN METODE PENEMUAN TERBIMBING PADA MATA KULIAH GEOMETRI. *LAPLACE: Jurnal Pendidikan Matematika*, *1*(1), 33–40.

Ramadanti, A. V., Syahri, A. A., & Kristiawati. (2022). Deskripsi Keterampilan Metakognitif Dalam Memecahkan Masalah Matematika Ditinjau Dari Gaya Kognitif Konseptual Tempo. *Paradikma*, *15*(1), 32–44.

Rohmah, W. N., Septian, A., Inayah, S., & Suryakancana, U. (2020). Analisis Kemampuan Penalaran Matematis pada Materi Bangun Ruang Ditinjau dari Gaya Kognitif Siswa SMP. *Prisma*, *9*(2), 179–191. https://jurnal.unsur.ac.id/prisma