

Kemampuan Numerasi Siswa Bergaya Kognitif Reflektif dan Impulsif dalam Memecahkan Masalah SPLDV

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Abstrak

Kemampuan numerasi merupakan kemampuan yang penting dimiliki oleh siswa. Penelitian ini bertujuan untuk menganalisis kemampuan numerasi peserta didik pada materi sistem persamaan linier dua variabel (SPLDV) ditinjau dari gaya kognitif reflektif dan impulsif, sehingga pendekatan penelitian yang digunakan adalah kualitatif dengan jenis penelitian yaitu deskriptif. Subjek dalam penelitian ini merupakan empat siswa yang terbagi menjadi dua siswa reflektif dan dua siswa impulsif. Teknik pengumpulan data yang digunakan adalah *Matching Familiar Figure Test* (MFFT), tes kemampuan numerasi, wawancara, dan dokumentasi. Hasil penelitian menunjukkan subjek dengan gaya kognitif reflektif mampu memenuhi 4 indikator numerasi (memahami masalah, merancang penyelesaian masalah, menjalankan strategi, dan memeriksa kembali), subjek membutuhkan waktu yang lama untuk menyelesaikan soal, namun memiliki kehati-hatian lebih dalam mengambil keputusan, sehingga jawaban yang diberikan memiliki kecenderungan salah yang relatif kecil. Sedangkan subjek dengan gaya kognitif impulsif dapat menjawab semua soal namun hanya memenuhi 2 indikator numerasi (memahami masalah dan merancang penyelesaian masalah), membutuhkan waktu yang cepat dalam menyelesaikan soal, sehingga jawaban yang diberikan memiliki kecenderungan salah yang relatif besar.

Kata Kunci: gaya kognitif impulsif, gaya kognitif reflektif, kemampuan numerasi, SPLDV

Numeracy Abilities of Reflective and Impulsive Cognitive Style Students in Solving SPLDV Problems

Abstract

Numerical ability is an important ability for students to have. This study aims to analyze students' numeracy abilities in the matter of a two-variable linear education system (SPLDV) in terms of reflective and impulsive cognitive styles, so that the research approach used is qualitative with a descriptive type of research. This study's subjects were four students divided into two reflective students and two impulsive students. The data collection technique used is the Matching Familiar Figure Test (MFFT), a numeracy skills test, interviews, and documentation. The results showed that subjects with a reflective cognitive style were able to fulfill 4 numeric indicators (understanding problems, designing problem solutions, implementing strategies, and re-examining). given has a relatively small tendency to be wrong. Whereas subjects with an impulsive cognitive style can answer all questions but only fulfill 2 numeration indicators (understanding problems and designing problem solutions), and require a fast time to solve questions, so the answers given have a relatively large tendency to be wrong.

Keywords: *impulsive cognitive style; numeracy abilities; reflective cognitive style; SPLDV*

INTRODUCTION

Mathematics is referred to as a universal science that plays an important role in various disciplines (Galante, 2014). There are at least four roles of mathematics, including: 1) mathematics plays a role in life, 2) mathematics as part of cultural heritage, 3) mathematics for work, and 4) mathematics as a study of science for the scientific community (NCTM, 2000). Based on these four roles, mathematics for life is something that can be felt by all individuals, whether consciously or not. Much information such as advertisements, signs, and announcements is presented in numerical form. Thus, students need to be able to have the ability to read the information so that they can make the right decisions.

One of the abilities that can apply to this is numeracy. This numeracy ability includes skills in using numbers or symbols related to basic mathematics that can be used to solve everyday life problems (GLN, 2017). Numeration means an ability that translates quantitative information into all aspects of life including knowledge, skills, and behavior (Kemendikbudristek, 2021). So it can be said that numeracy is how one uses basic knowledge of mathematics in everyday life (Ojose, 2011). This shows that numeracy ability is different from mathematical competence, both are based on the same knowledge, but what distinguishes it is how to empower the knowledge that has been obtained.

Numerical abilities are seen more as the knowledge students need as a form of skills and behavior to place mathematics in various situations (OECD, 2019). Students are required to apply the knowledge they have acquired to solve mathematical problems both in school and in the real world. So an important numeracy ability for students, but it does not have a good effect on the quality of students' numeracy in Indonesia (Nasoha, Araiku, Pratiwi, & Yusup, 2022). It can be seen from the 2018 PISA, that Indonesia ranks 75th out of 80 countries with a score of 379 out of a maximum score of 500 (Kemdikbud, 2019). Low results may be caused by students who are used to solving questions with a routine type of solution. Meanwhile, the numeracy abilities measured by PISA on students are not only based on the material in textbooks, but rather on unstructured problems in everyday life such as work, social, and personal.

There are three aspects of numeration, including numeration relations, arithmetic operations, and counting (Purpura, 2009). Then over time, numeration is divided into four aspects, which consist of relationships and changes, space and shape, quantity, as well as uncertainty and data in which it is related to algebraic material, numbers, and geometry (Delima et al., 2022). One of the algebraic materials studied in class VIII is a system of two-variable linear equations, where many students still experience difficulties in communicating problems in written mathematical form, this is in line with research conducted by Kurniawan & Munandar (2022). This happens because understanding algebraic problems requires skills in making patterns and generalizing them (Andriani, 2015).

The application of basic mathematics contained in algebraic material requires a deeper analysis of thinking to solve it (Fakhriyana, Mardiyana, & Aryuna, 2018) This thinking analysis is closely related to students' cognitive styles which are of course different (Yuliyani & Setyaningsih, 2022). As Patta, Muin, & Mujahidah (2021) said, one of the factors that can influence students in solving math problems is cognitive style. Cognitive style is a bridge between personality and one's intelligence (Sternberg & Grigorenko, 1997). So that the cognitive style is very influential on students in processing the information obtained so that it can be realized to be a determinant of behavior. As said by Mailili (2018) students use different ways of processing, using, and processing information to solve problems. Thus, because the processing of student data is different, there is a tempo in solving problems accurately, so the cognitive style used in this study is included in the conceptual tempo category, namely reflective and impulsive.

METHOD

This study aims to analyze students' numeracy abilities in algebra material in terms of reflective and impulsive cognitive styles so that the research approach used is qualitative with a descriptive type of research. This is in line with what was stated by Rahmat (2009) that qualitative research is more directed toward analysis with an inductive approach that is descriptive. where there are two main objectives of qualitative research, namely to 1) describe and explain; 2) describe and reveal; (Bachri, 2010).

The research subjects were four Grade VIII students at SMP Negeri 32 Tangerang with two students having a reflective cognitive style and two students having an impulsive cognitive style. The supporting instruments in this study consisted of MFFT (*Matching Familiar Figure Test*) to determine reflective and impulsive subjects, student numeracy tests, and interviews.

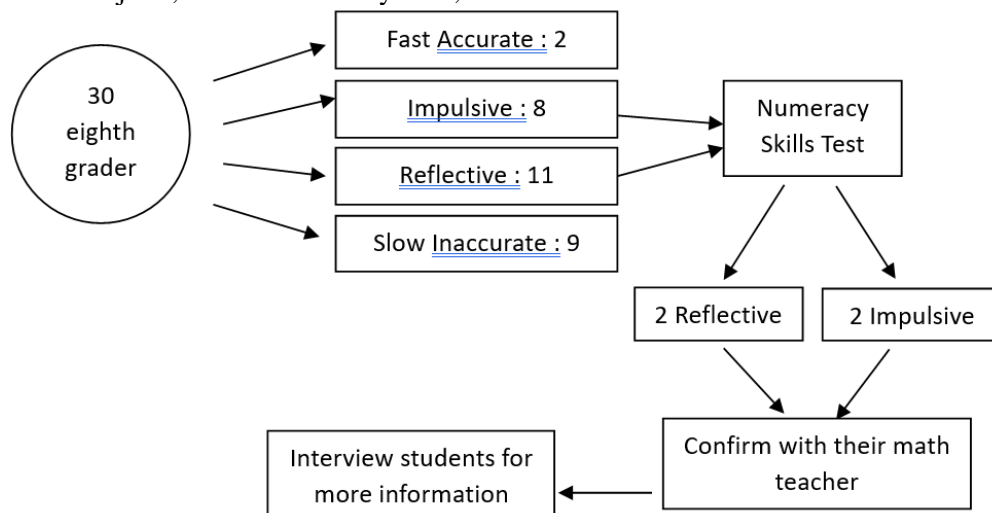


Figure 1. Subject Selection Chart in the Study

Data collection techniques used in this study were observation, MFFT tests, and numeracy skills tests, as well as interviews. The MFFT test will later be used to divide students into four groups, namely reflective, impulsive, fast-accurate, and slow-inaccurate (Warli, 2010). The MFFT test consists of 13 illustrated questions, each of which consists of one standard image and five similar images, but only one image is the same as the standard image. Next, a numeracy ability test was given to reflective and impulsive students. The numeracy ability test used in this study was a description type consisting of three questions as follows;

1. Seorang konstruksi bangunan akan membuat kolam renang berbentuk persegi panjang dengan perhitungan lebarnya 5 m lebih pendek dari panjangnya. Jika keliling kolam tersebut adalah 58 m. Maka luas permukaan tanah yang diperlukan kontraktor tersebut untuk membuat kolam renang adalah?
2. Pak Sardi dan Pak Anto merupakan adik dan kakak, jika dua tahun yang lalu perbandingan umur mereka adalah 4:3 dan dua tahun yang akan datang perbandingan umur keduanya adalah 5:4, maka selisih umur Pak Sardi dan pak Anto saat ini adalah?
3. Nana, Nina, dan Nunu akan membeli baju dan celana yang sama di toko “INTAN”, Nana membeli 2 celana dan 3 baju dengan harga Rp. 300.000, sedangkan Nina harus membayar Rp. 400.000 untuk harga 3 celana dan 4 baju. Jika Nunu akan membeli 1 lusin celana dan 2 lusin baju berapakah yang harus dibayar oleh Nunu?

Furthermore, interviews were conducted with the four subjects consisting of 2 reflective subjects and 2 impulsive subjects. Then do data analysis with data reduction, data presentation, and conclusion. Technical analysis of data is done by reducing data, presenting data, and drawing conclusions. This study uses data reduction as shown in table 1.

Based on Table 1 it can be seen that in completing numeracy skills a systematic step is needed. This is because numeracy skills fulfill several aspects such as communication, mathematization, representation, reasoning, and argumentation, as well as the ability to choose strategies for solving problems (OECD, 2019).

Table 1. *Numeracy Ability Indicators* (Sari & Wijaya, 2017)

No.	Aspect	Indicator	Response to Questions	Code
1.	Communication	Understanding the problem	Unable to analyze known information.	IN 1.1
			Able to analyze information but there are still errors.	IN 1.2
			Able to analyze information correctly.	IN 1.3
2.		Design problem solving	Unable to write down the mathematical form of the problem.	IN 2.1
			Able to write the mathematical form of the problem but there are still errors.	IN 2.2
			Able to write the mathematical form of the problem correctly.	IN 2.3
3.	Mathematization	Execute strategies for solving problems	Not being able to choose and use strategies to solve problems	IN 3.1
			Able to choose and use strategies in solving problems but not yet correct	IN 3.2
			Able to choose and use strategies in solving problems correctly.	IN 3.3
4	Representation	Re-examination	Not able to use the results of analysis to predict and make decisions.	IN 4.1
			Able to use analysis results to predict and make decisions but are not precise.	IN 4.2
			Able to use analysis results to predict and make decisions.	IN 4.3

The technique of checking the validity of the data is by using the triangulation method based on a numeracy ability test and subsequent interviews are checked to see whether the data obtained is valid or not.

RESULT

Result of the matching Familiar Figure Test (MFFT) which was attended by 30 class VIII students of SMP Negeri 32 Tangerang, there were 10 students slow-inaccurate, 11 were reflective students, 1 was fast-accurate, and 8 were impulsive students. Then a numeracy test was conducted for 11 reflective students and 8 impulsive students. Until the subject is found as in the following table.

Table 2. *Subject with Reflective and Impulsive Cognitive Style*

No.	Subject	Subject Type	MFFT Result	
			Time	Frequency
1.	ACM	Reflective Cognitive Style	69,461	10
2.	NNM	Reflective Cognitive Style	37,20	11
3.	MIH	Impulsive Cognitive Style	23,584	5
4.	MHN	Impulsive Cognitive Style	29,492	6

Based on Tables 2, it is found that reflective subjects are ACM with an average time of 69.461 and a frequency of 10 correct answers and NNM subjects with a processing time of 37.2 and a frequency of 11 correct answers. Meanwhile, for impulsive subjects, there are MIH with an average time of 23.584 and a frequency of 5 correct answers and MHN with an average time of 29,492 and a frequency of 6 correct answers.

Reflective Student Numerical Ability

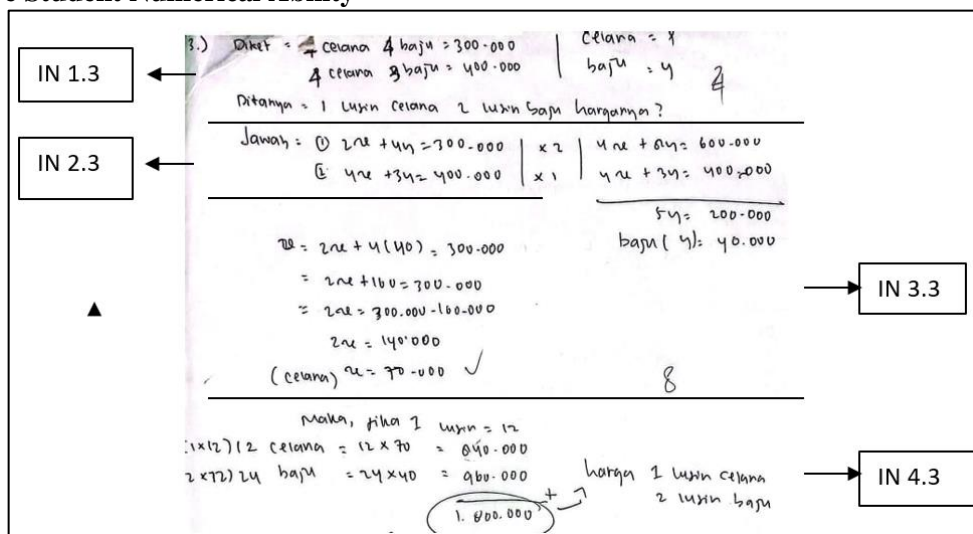


Figure 2. ACM's Answer to Question Number 2

Based on Figure 2, it can be seen that ACM can solve the problem well, where ACM can understand the information found in the problem by using simpler language so that it fulfills IN 1.3. In 2.3, ACM creates a mathematical form using the example variables it has defined. Then in IN 3.3 ACM chose to use elimination and substitution solutions and did it well step by step. Furthermore, IN 4.3 can interpret the results of the analysis to be able to make decisions in the matter. Based on the results of the interviews, ACM was able to properly describe step by step the results of the numeration test work it had done. Meanwhile, the NNM subject had good work results like the ACM subject, except that in IN 3.3, the subject chose to use only substitution as a solution. During the interview, NNM said he only remembered how to eliminate. Following are the results of NNM's answers to question number 3.

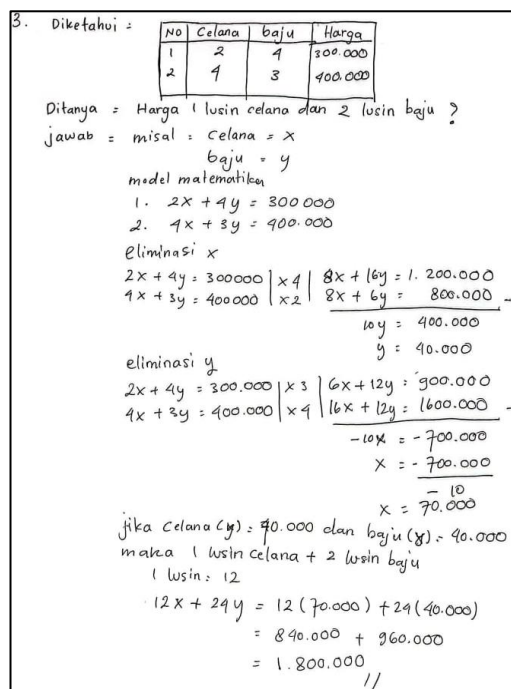


Figure 3. NNM's Answer to Question Number 3

Based on Figure 3, NNM provides a variety of answers that are different from those given by ACM. The results of the interviews revealed that NNM analyzed information into tables to make it easier

for them to make a mathematical form of the problem. Based on the results of the analysis of ACM and NNM answers, it is known that both of them can fulfill the four indicators.

Impulsive Student Numeral Ability

The results of the analysis of the numeracy abilities of subjects with an impulsive cognitive style found two subjects, namely MIH and MHN. The results of the analysis of numeracy skills show that MIH has been able to write down information well even though it still uses word repetition in the questions, but it has fulfilled IN 1.3. The following is MIH's answer to question number 2.

2. Diketahui = 4:3 umur pak sardi dan pak Anto 2 tahun yg lalu
 = 5:4 umur pak sardi dan pak Anto 2 tahun yang akan datang
 Ditanya = selisih umur mereka
 jawab = misal = pak sardi = x
 pak Anto = y

Figure 4. MIH's Answer to Question Number 2

Based on Figure 4, MIH has been able to analyze the problems contained in the questions but has not been able to solve the problems. This was also experienced by MHN in solving question number 2. The results of interviews with MIH found that the subject was unable to carry out the procedure to be able to solve the problem. In addition, MIH also did not understand the SPLDV concept well so it could not choose a strategy to solve the problem.

3. relama = x
 Baju = y
 $y = 40.000$
 $2x + 4(40.000) = 300.000$
 $2x + 160.000 = 300.000$
 $2x = 300.000 - 160.000$
 $2x = 140.000$
 $x = \frac{140.000}{2}$
 $x = 70.000$

Figure 5. MHN's Answer to Question Number 3

Based on Figure 5, MHN has been able to understand the problem given but has not been able to write clearly about the process of solving the problem. MHN has not been able to carry out the strategy properly and has not been able to re-examine the problems given so it has not fulfilled the results of the answers requested. It was also known in the interview process that MHN understood the problems given and was capable of giving the mathematical form of these problems. MHN just hasn't been able to conclude what problems are being asked in the question.

DISCUSSION

Reflective and impulsive cognitive styles can be measured using speed in doing the test, according to Warli (2010), Matching Familiar Figure Test (MFFT) is a test that can be used to measure impulsive and reflective cognitive styles. Reflective students are determined based on the slow processing time of the MFFT ($t > 7,28$ minutes) with a frequency of wrong answers less than or equal to 7 questions ($f \leq 7$ questions). While the selection of impulsive students did MFFT quickly ($t < 7,28$ minutes) with more than seven wrong answers ($f \geq 7$ questions) (Pramastasari, 2017).

After classifying students into reflective and impulsive, they were given a numeracy ability test. So that there were 4 subjects represented by 2 students with reflective cognitive style and 2 students with impulsive cognitive style. The research findings discuss the numeracy skills possessed by each cognitive style ability group. The results of data analysis on numeracy skills found that students with a reflective cognitive style were able to fulfill the four indicators of numeracy ability, namely understanding problems, designing problem solutions, implementing strategies in solving problems, and conducting re-examination. The results of the answers given by the two reflective students were also very structured and thorough. ACM and NNM subjects have their own strategies for solving problems, this is in accordance with the main characteristics of reflective students, namely always trying repeatedly when solving math problems (Aprilia, Sunardi, & Trapsilasiwi, 2017). So, it can be said that both of them have good numeracy skills. ACM and NNM also use the time to complete the questions properly and carry out the numeracy ability test carefully, so as to minimize errors in giving answers. This is in line with Warli's statement (2013) that cognitive style has a tendency to answer problems slowly, but has more accuracy so that the answers given tend to be correct.

The results of data analysis on the numeracy abilities of students with the impulsive cognitive style show that MIH and MHN subjects were only able to fulfill the two indicators of numeracy ability, namely understanding problems and designing problem solutions. MIH subjects were able to fulfill both indicators well. However, on the indicator of designing problem-solving, the MHN subject was only able to convey it during the interview process. When responding to interviews, both subjects responded quickly to the questions asked without considering the statements put forward. Rushed and inaccurate work also caused MIH and MHN to be unable to find answers correctly and correctly in solving problems. This is in line with the fact that impulsive students have characteristics that are fast in answering problems, but are not careful so that the answers given tend to be wrong (Warli, 2013).

CONCLUSION

Based on research conducted by researchers on four subjects at SMP Negeri 32 Tangerang, the conclusions obtained from the analysis of numeracy abilities in terms of reflective and impulsive cognitive styles in the SPLDV material is that reflective subjects were able to fulfill the four indicators of numeracy ability, namely being able to analyze the given problem where the subject was able to rewrite the information in the problem using their respective perspectives, transforming the information into a mathematical form where the subject was able to form a mathematical model to make it easier to determine the solution strategy (designing a solution problem). In determining the completion strategy, the reflective subject was very careful so it took a long time to solve the problem. Reflective subjects are also able to provide interpretations of the results of the analysis to make decisions on a given problem. With the carefulness and thoroughness of the reflective subject in solving the questions, he tends to answer the questions correctly. Impulsive subjects were only able to fulfill two indicators of numeracy ability, namely understanding the problem and designing a solution to the problem (making a mathematical model from the information already obtained). Answering questions tends to be fast, so many answers are broken in the middle of the road if they can't be completed. A result of answering questions quickly so that there is less accuracy in them which causes impulsive subjects to tend to answer questions correctly less than reflective subjects.

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