



Mathematical Logical Intelligence of Students with High Mathematical Communication Skills in System of Linear Equations in Three Variable

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Abstract: Mathematical logical intelligence greatly influences students' ability to solve mathematical problems, especially the ability to analyze logically in solving mathematical problems. This logical-mathematical intelligence is also closely related and has a positive impact on students' mathematical communication skills, both oral and written mathematical communication abilities. Based on the age development, MA students should be able to use logical thinking skills well. Through material students are tested and required to understand questions in the form of story questions to be able to solve the problem by first forming a mathematical model and then developing a plan to solve the problem. Thus, students indirectly get a stimulus to hone their reasoning and communication skills well. This study aims to analyze the mathematical logical intelligence of MA students with high mathematical communication skills on System of Linear Equations in Three Variable at MA Al-Islamiyah I Sumber Batu, Blumbungan, Larangan, Pamekasan. This type of research is qualitative descriptive research. The research instruments used were test questions and interview guidelines. The results showed that students who have high mathematical logical intelligence also have good competence for oral and written communication and are able to classify, compare, perform calculations correctly, reason deductively, make conclusions and check back according to the indicators in mathematical logical intelligence.

Keywords: Mathematical Logical Intelligence; Mathematical Communications Skills; System of Linear Equations in Three Variable

Kecerdasan Logis Matematis Siswa yang Memiliki Kemampuan Komunikasi Matematis Tinggi pada Sistem Persamaan Linier Tiga Variabel

Abstrak: Kecerdasan logis matematis sangat mempengaruhi kemampuan siswa dalam memecahkan masalah matematika, khususnya kemampuan menganalisis secara logis dalam menyelesaikan masalah matematika. Kecerdasan logis-matematis ini juga erat kaitannya dan berdampak positif terhadap kemampuan komunikasi matematis siswa, baik kemampuan komunikasi matematis lisan maupun tulisan. Berdasarkan perkembangan usianya, siswa MA harusnya sudah dapat menggunakan kemampuan berpikir logis dengan baik. Melalui materi Sistem Persamaan Linear Tiga Variabel siswa diuji dan dituntut memahami soal-soal berupa soal cerita untuk mampu menyelesaikan soal dengan terlebih dahulu membentuk model matematika kemudian menyusun rencana penyelesaian soal. Dengan demikian, siswa secara tidak langsung mendapat stimulus untuk mengasah kemampuan penalaran dan komunikasinya dengan baik. Penelitian ini bertujuan untuk menganalisis kecerdasan logis matematis siswa MA yang memiliki kemampuan komunikasi matematis tinggi pada materi Sistem Persamaan Linear Tiga Variabel di MA Al-Islamiyah I Sumber Batu, Blumbungan, Larangan, Pamekasan. Jenis penelitian ini adalah penelitian deskriptif kualitatif. Instrumen penelitian yang digunakan adalah soal tes dan

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pedoman wawancara. Hasil penelitian menunjukkan bahwa siswa yang memiliki kecerdasan logis matematis tinggi memiliki juga memiliki kompetensi yang baik untuk komunikasi lisan dan tulis serta mampu mengklasifikasikan, membandingkan, melakukan perhitungan dengan benar, bernalar deduktif, membuat kesimpulan dan memeriksa kembali sesuai dengan indikator dalam kecerdasan logis matematis.

Kata Kunci: Kecerdasan Logis Matematis ; Kemampuan Komunikasi Matematis; Sistem Persamaan Linear Tiga Variabel

PENDAHULUAN

Intelligence is basically part of a student's ability to exercise his intellect to solve mathematical problems both cognitively and other intelligences. Basically, every student has different intelligence, and it does not rule out the possibility of developing student intelligence if it is trained by providing intensive and interesting learning stimuli so that learning activities will be fun. An educational and psychology expert from Harvard University states that a person's brain stores nine types of intelligence which are often called multiple intelligences (Derakhshan & Faribi, 2015) which consists of linguistic intelligence, logical mathematical intelligence, kinesthetic intelligence, intrapersonal intelligence, interpersonal intelligence, visual spatial intelligence, musical intelligence, naturalist intelligence and existential intelligence. One of the intelligences related to solving mathematical problems is logical-mathematical intelligence. The difficulties experienced by students in solving mathematical problems are highly dependent on logical mathematical intelligence because students' logical mathematical intelligence greatly influences how students can solve mathematical problems (Siniguan, 2017).

Talking about logical-mathematical intelligence, someone who has logical-mathematical intelligence will involve the ability to analyze problems logically, find or create mathematical formulas or patterns and investigate problems scientifically in solving mathematical problems (Azinar et al., 2020). Meanwhile, Logical mathematical intelligence is an ability that includes the ability to add up mathematically, think logically, be able to think deductively and inductively as well as sharpness in making patterns and logical relationships (Amy, 1996). Students who have well-developed logical-mathematical intelligence have the characteristics of being able to solve problems, think about and arrange solutions in a logical sequence. The level of logical-mathematical intelligence is divided into 3, namely high-level logical-mathematical intelligence, moderate-level logical-mathematical intelligence, and low-level logical-mathematical intelligence (Arum et al., 2018). Based on previous research conducted students who have high mathematical logical intelligence tend to understand and solve math problems easier (Yayuk et al., 2020). Meanwhile, students who have moderate and low mathematical logical intelligence tend to experience difficulties in understanding and solving mathematical problems. Therefore, mathematical logical intelligence affects students' ability to solve mathematical problems.

This mathematical logical intelligence is closely related and has a positive impact on students' mathematical communication abilities. This was reinforced in his research by (Nisa et al., 2020) that there is a positive relationship between mathematical logical intelligence and students' mathematical communication abilities. Mathematical communication activities can

be in the form of conveying problem-solving ideas, strategies, and mathematical solutions in writing or orally (Lanya et al., 2020). So, mathematical communication ability is the ability of students to convey mathematical ideas both orally and in writing. Mathematical communication needs to be the focus of attention in learning mathematics because through communication students can organize and consolidate their mathematical thinking (NCTM, 2000), and students can explore mathematical ideas (NCTM, 2000).

According to (NCTM, 2000) indicators of mathematical communication skills in mathematics learning can be seen from: (1) the ability to express mathematical ideas through oral, written, and demonstrating them and depicting them visually; (2) The ability to understand, interpret, and evaluate mathematical ideas both orally and in other visual forms; (3) the ability to use terms, mathematical notations and structures to present ideas, describe relationships and model situations. Baroody and Coslick (1993) suggest that learning should be able to help students communicate mathematical ideas through five aspects of communication, namely representing, listening, reading, discussing, and writing.

In a previous study conducted by (Nisa et al., 2020) on class X IPA students at SMAN Jenggawah, whose research only focused on the relationship between logical-mathematical intelligence and students' mathematical communication skills, it turned out that there was a positive and significant relationship. Thus, it can be concluded that if students' logical intelligence is high, then students' mathematical communication skills are also high. on the contrary, if students' logical mathematical intelligence is low, students' mathematical communication skills are also low. Referring to this where the material used by (Nisa et al., 2020) is devoted to the subject of a system of three-variable linear equations, in this study researchers are also interested in using material for a system of three-variable linear equations as material in analyzing students' mathematical logical intelligence in terms of their mathematical communication abilities.

In her research, (Nisa et al., 2020) aimed to find out the relationship between mathematical logical intelligence and students' mathematical communication abilities in solving problems, and even then, it was only seen based on writing in the form of tests and questionnaires. Because this research only focuses on the relationship between logical-mathematical intelligence and students' mathematical communication skills based on writing in the form of tests and questionnaires, it is necessary to conduct research on students' logical-mathematical intelligence in terms of students' mathematical communication skills based on writing and orally, in the sense of reviewing logical-mathematical intelligence of students will be analysed and described based on tests and interviews. The students who were in the spotlight in this study were MA students, more specifically MA Al-Islamiah I. The main basis for taking MA students was because according to their age, MA students should have been able to apply their reasoning to think logically. Through this research students get a stimulus to hone their reasoning and communication skills well. Determination of the material in this study that takes System of Linear Equations in Three Variable because it material students will be tested and required to understand questions in the form of story questions to be able to

solve the problem by forming the mathematical model first then developing a plan to solve the problem.

Based on the description above, this research is to describe the mathematical logical intelligence of class X MA Al-Islamiyah I students who have high mathematical communication skills on System of Linear Equations in Three Variable. Thus, it is important to conduct this research with the title "Mathematical Logical Intelligence of Students with High Mathematical Communication Skills in System of Linear Equations in Three Variable."

METODE

The research used in this research is descriptive qualitative research. Descriptive research is intended to investigate the circumstances, conditions or other things that have been mentioned, the results of which are presented in the form of a research report (Helwig et al., 2011). The qualitative approach used in this study was chosen to analyse the mathematical logical intelligence of class X MA Al-Islamiyah I students who have high mathematical communication skills in System of Linear Equations in Three Variable. The selection of research subjects was obtained from the results of the mathematical communication ability tests given to students. So, from the results of these tests will be obtained students who meet the criteria to be used as research subjects. The following are the criteria for students who are the subject of research.

Table 1. Research Subject Criteria

Criteria	Indicator
Written Communication	• Students write down complete information. • Students model word problems • Students have solved the problem.
Spoken Communication	• Students express mathematical ideas orally. • Students understand, interpret, and evaluate mathematical ideas orally. • Students use terms, mathematical notations, and structures to present ideas, describe relationships and model situations.

Data collection procedures in this study are tests and interviews. The researchers gave a test to students of class X MA to find out students' mathematical communication skills in writing. Then, the researcher chose one student who met all indicators of written communication criteria. Furthermore, the researchers conducted interviews to explore students' mathematical communication skills verbally. After that, the subject was given a logical-mathematical intelligence test and interviewed regarding the answers to the logical-mathematical intelligence test that had been done by the students. There are five main components in logical-mathematical intelligence, namely: classification, comparing, mathematical arithmetic operations, inductive and deductive reasoning, forming hypotheses and checking hypotheses that have been made (Hakim & Yanuarsari, 2017). The following is a

indicators table of mathematical logical intelligence used in this study according to the components mentioned by (Hakim & Yanuarsari, 2017).

Table 2. Mathematical Logical Intelligence Indicator

No.	Characteristics of Mathematical Logical Intelligence	Indicator
1	Classification	- Students mention the information that is known in the problem correctly. - Students mention the information asked in the questions correctly.
2	Comparison	- Students link information known with their knowledge. - Students develop a problem-solving plan.
3	Mathematical arithmetic operations	Students carry out arithmetic operations correctly and precisely.
4	Inductive and deductive reasoning	- Students complete the problem by using several examples until the formulation is obtained. - Students analyse questions using models
5	Forming Hypotheses and Checking back	- Students provide conclusions from problems solving that have been done. - Students check the results obtained. - Students review the problem solving that has been done

The instrument in this study was the researchers themselves. While the supporting instruments used are subject determination instruments, namely mathematical communication ability tests, mathematical logical intelligence tests and interview guidelines.

In this study, to test the validity of the data, researchers used a data validation technique, namely time triangulation. Time triangulation is a data checking technique with a data collection method at different times and conditions. Time triangulation was carried out by comparing the 1st logical-mathematical intelligence test and interview with the 2nd logical-mathematical intelligence test and interview. While the data analysis techniques used in this study are data reduction, data presentation, and drawing conclusions.

RESULT AND DISCUSSIONS

1. Subject's Mathematical Communication Ability

Subjects with high mathematical communication skills can communicate their mathematical ideas both orally and in writing. The following is results shown by the subject on tests and interviews.

Handwritten mathematical work showing a system of linear equations in three variables (SLK) and its solution using the elimination method.

SLK: Evi = 2 Buku tulis, 3 Bolpoin, 1 Tipe-x = 20.000
 Shofi = 1 Buku tulis, 1 Bolpoin, 1 Tipe-x = 15.000
 Zahra = 1 Buku tulis, 3 Bolpoin, 1 Tipe-x = 25.000

Dit: Berapa 1 Buku tulis, 1 Bolpoin, 1 Tipe-x?

Jawab: $\begin{cases} 2x + 3y + z = 20.000 \\ x + y + z = 15.000 \\ x + 3y + z = 25.000 \end{cases}$

Eliminasi: $\begin{cases} 2x + 3y + z = 20.000 \\ x + y + z = 15.000 \\ x + 3y + z = 25.000 \end{cases}$

$\begin{matrix} 2x + 3y + z = 20.000 \\ - (x + y + z = 15.000) \\ \hline x + 2y = 5.000 \end{matrix}$

$\begin{matrix} x + 3y + z = 25.000 \\ - (x + y + z = 15.000) \\ \hline 2y = 10.000 \\ y = 5.000 \end{matrix}$

Substitusi: $\begin{cases} x + 2y = 5.000 \\ y = 5.000 \end{cases}$

$x + 2(5.000) = 5.000$
 $x + 10.000 = 5.000$
 $x = 5.000 - 10.000$
 $x = -5.000$

Substitusi: $\begin{cases} x + y + z = 15.000 \\ x = -5.000 \\ y = 5.000 \end{cases}$

$-5.000 + 5.000 + z = 15.000$
 $0 + z = 15.000$
 $z = 15.000$

Jika, Berapa 1 buku tulis ada Rp. 2000, 1 bolpoin Rp. 5000, dan 1 tipe-x ada Rp. 5000.

Figure 1. Mathematical communication ability test results

- Researcher** : Please explain your strategy in solving the problem!
- TS** : I read the questions first, then understood the questions, wrote down the known and asked information in the questions.
- Researcher** : Do you understand what the problem are about?
- TS** : Yes, I understand.
- Researcher** : Try to explain what is meant by the problem!
- TS** : So, the purpose of this problem is that after some information is known, there is one purpose, which is, to find out the purchase price of 1 notebook, 1 ballpoint pen, and 1 type-x
- Researcher** : Please explain your steps in solving the problem!
- TS** : First, I make examples; second, making the mathematical model according to the problem; third, using elimination and substitution methods; Fourth, drawing conclusions.
- Researcher** : Please explain why the mathematical model is like this!
- TS** : In making the mathematical model, I adjusted it to the information that was already known in the problem, in accordance with the purchases of notebooks, pens, and type-x that had been made by Evi, Shofi and Zahra
- Researcher** : What is your purpose in modelling it like this? Please explain!
- TS** : My purposes are, first, for each variable it shows the purchase of each item; secondly, knowing what is being asked in the problem, that's why I made a mathematical model first so that it's easier to do the next step.

Based on the results of the tests and interviews, the subject met the indicators of written mathematical communication ability, namely writing down information that was known and asked in the problem, making a mathematical model and solving the problem correctly. Then, the subject also meets the indicators of oral mathematical communication ability, this is indicated by the ability of students who meet the indicators of oral mathematical communication ability and can provide active responses and arguments when

communicating, and explaining strategies and steps in a structured manner, and also explaining the basics from his understanding when asked about the reason for the purpose of making his mathematical model. The results of this study are in line with the results of research by (Hakim & Yanuarsari, 2017) that students who have high mathematical communication skills can communicate in writing and orally.

2. Subject's Mathematical Logical Intelligence

The category of subjects who have high logical-mathematical intelligence is when students are able to fulfill 4 up to 5 indicators of logical-mathematical intelligence (Arum et al., 2018). In this study, the subject fulfilled 5 indicators of logical-mathematical intelligence. The following are the results shown by the subjects in tests and interviews in their logical-mathematical intelligence.

Diket: Ainun = 2 kg apel, 2 kg Anggur, 1 kg jeruk = 91.000
 Iis = 3 kg apel, 1 kg Anggur, 1 kg jeruk = 73.000
 Novi = 1 kg apel, 3 kg Anggur, 2 kg jeruk = 116.000
 Dit: Berapa kembalian jika membeli 2 kg apel, 1 kg Anggur, 3 kg jeruk dan membayar 100.000.00
 Jawab: 1) di misalkan: apel = x
 Anggur = y
 jeruk = z
 2) Model matematikanya:

$$\begin{cases} 2x + 2y + z = 91.000 & (1) \\ 3x + y + z = 73.000 & (2) \\ x + 3y + 2z = 116.000 & (3) \end{cases}$$

 3) Eliminasi:

$$\begin{aligned} (1) - (2) &: 2x + 2y + z = 91.000 \\ & - (3x + y + z = 73.000) \\ & \hline -x + y = 18.000 & (4) \\ (1) - (3) &: 2x + 2y + z = 91.000 \\ & - (x + 3y + 2z = 116.000) \\ & \hline x - y - z = -25.000 & (5) \\ (4) + (5) &: -x + y = 18.000 \\ & -x - y - z = -25.000 \\ & \hline 2y - z = -7.000 & (6) \\ (6) + (4) &: -x + y = 18.000 \\ & -x - y - z = -25.000 \\ & \hline 2y - z = -7.000 & (6) \\ (6) + (4) &: -x + y = 18.000 \\ & -x - y - z = -25.000 \\ & \hline 2y - z = -7.000 & (6) \end{aligned}$$

 4) Substitusi:

$$\begin{aligned} 2y - z &= -7.000 \\ z &= 2y + 7.000 \\ \text{Substitusi ke (1)} &: 2x + 2y + (2y + 7.000) = 91.000 \\ 2x + 4y + 7.000 &= 91.000 \\ 2x + 4y &= 84.000 \\ x + 2y &= 42.000 \\ x &= 42.000 - 2y \\ \text{Substitusi ke (2)} &: 3(42.000 - 2y) + y + z = 73.000 \\ 126.000 - 6y + y + z &= 73.000 \\ 126.000 - 5y + z &= 73.000 \\ -5y + z &= -53.000 \\ z &= 5y - 53.000 \\ \text{Substitusi ke (6)} &: 2y - (5y - 53.000) = -7.000 \\ 2y - 5y + 53.000 &= -7.000 \\ -3y &= -60.000 \\ y &= 20.000 \\ \text{Substitusi ke (4)} &: -x + y = 18.000 \\ -x + 20.000 &= 18.000 \\ -x &= -2.000 \\ x &= 2.000 \\ \text{Substitusi ke (6)} &: 2y - z = -7.000 \\ 2(20.000) - z &= -7.000 \\ 40.000 - z &= -7.000 \\ -z &= -47.000 \\ z &= 47.000 \end{aligned}$$

 5) Kesimpulan: jadi, jika ainun membeli 2 kg apel, 1 kg Anggur, 3 kg jeruk maka kembalian Rp 25.000.00

Figure 2. First Mathematical Logical Intelligence Test Results

Researcher : Try to retell the meaning of the problem!

TS : So, Ainun, Iis, and Novi, after coming home from tutoring, stopped at the fruit shop near the night market. In this problem, Ainun, Iis and Novi bought several fruits including apples, grapes, and oranges with a different number of purchases and total prices. And what stated in problem is How much the change will Ainun get if she wants to buy 2 kg of apples, 1 kg of grapes and 3 kg of oranges by handing over one hundred thousand?

Researcher : State the information you get from the problem.

TS : It is known that Ainun bought 2 kg of apples, 2 kg of grapes and 1 kg of oranges with the total price of IDR 91,000.00. Iis bought 3 kg of apples, 1 kg of grapes and 1 kg of oranges for Rp 73,000.00. Novi bought 1 kg of apples, 3 kg of grapes and 2 kg of oranges at a price of Rp. 116,000.00.

Researcher : What are being asked on the questions you have read?

TS : If Ainun wants to buy 2 kg of apples, 1 kg of grapes and 3 kg of oranges by handing over one hundred thousand, what is the amount of change?

Researcher : What concept will you use in solving the problem?

- TS : I solved this problem using the concept of a system of three-variable linear equations.
- Researcher : What are your steps in solving the problem? Please explain!
- TS : I read the problem first, then understand the problem, write down the known and asked information in the problem, make examples, make a mathematical model, solve it using elimination and substitution methods, and finally draw a conclusion.
- Researcher : Have you done the calculation correctly? Explain!
- TS : Yes, I have done the calculations correctly, starting from making the mathematical model, then calculating the method of elimination and substitution.
- Researcher : now please give an example of a problem that is almost the same as what you are doing!
- TS : For example, Mia buys 2 chocolates, 2 chocolate vegetables, and 1 corn ice cream with a total price of IDR 9,000.00. Siska bought 3 chocolates, 1 chocolate vegetable and 1 corn ice cream for a total price of Rp. 8000.00. Novi bought 1 chocolates, 3 chocolate vegetables and 2 corn ice cream. If Mia wants to buy 2 chocolates, 1 vegetable chocolate, and 3 corn ice cream by handing over twenty thousand, how much will she change?
- Researcher : What can you conclude from the problem?
- TS : So, if Ainun pays one hundred thousand rupiah to buy 2 kg of apples, 1 kg of grapes and 3 kg of oranges with the total price of seventy-five thousand rupiahs, then the amount of change is twenty-five thousand rupiahs.
- Researcher : Why do you conclude like that?
- TS : I made a conclusion like that according to the questions in the problem.
- Researcher : Please re-check the answers you got!
- TS : Yes, I have checked my answer again.
- Researcher : Are you sure about the answers you got?
- TS : Yes, I'm sure.

In the 1st logical intelligence test, the first indicator is classification, the subject can write down and explain the information that is known and what is asked in the problem. The second indicator is comparison, the subject can relate and explain by using his prior knowledge, especially on the concept of a system of three-variable linear equations. The third indicator is mathematical arithmetic operations, the subject can perform calculations correctly starting from making the mathematical model, the processes of elimination and substitution, and when giving conclusions. The fourth indicator is inductive and deductive reasoning, the subject can give examples of questions that are almost the same as those in the questions. The fifth indicator is making a hypothesis and checking again, the subject can provide conclusions correctly, can provide appropriate and logical reasons for giving conclusions that he has written, and the subject has re-checked his answers.

Dik: 2 kg cabu, 3 kg bawang putih = 162.000
 1 kg cabu, 2 kg bawang putih, 1 kg tomat = 110.000
 2 kg cabu, 1 kg bawang putih, 3 kg tomat = 151.000
 Dit: Berapa uang kembalian jika ibu Iva membayar Rp. 100.000 untuk membeli 1 kg cabu, 1 kg bawang putih, dan 1 kg tomat?

Jwb: Misalkan: Cabu = x
 Bawang putih = y
 Tomat = z

Model matematikanya:

$$\begin{cases}
 2x + 3y = 162.000 & (1) \\
 x + 2y + z = 110.000 & (2) \\
 2x + y + 3z = 151.000 & (3)
 \end{cases}$$

Eliminasi:

$$\begin{aligned}
 (1) - 2 \times (2) & \rightarrow 2x + 3y - 2x - 4y - 2z = 162.000 - 220.000 \\
 -y - 2z & = -58.000 & (4) \\
 (3) - 2 \times (2) & \rightarrow 2x + y + 3z - 2x - 4y - 2z = 151.000 - 220.000 \\
 -3y + z & = -69.000 & (5)
 \end{aligned}$$

Eliminasi:

$$\begin{aligned}
 (4) \times 3 & \rightarrow -3y - 6z = -174.000 \\
 -3y + z & = -69.000 & (5) \\
 \hline
 -7z & = -105.000 \\
 z & = 15.000
 \end{aligned}$$

Substitusi:

$$\begin{aligned}
 -y - 2z & = -58.000 & (4) \\
 -y - 2(15.000) & = -58.000 \\
 -y - 30.000 & = -58.000 \\
 -y & = -28.000 \\
 y & = 28.000
 \end{aligned}$$

Substitusi:

$$\begin{aligned}
 x + 2y + z & = 110.000 & (2) \\
 x + 2(28.000) + 15.000 & = 110.000 \\
 x + 56.000 + 15.000 & = 110.000 \\
 x + 71.000 & = 110.000 \\
 x & = 39.000
 \end{aligned}$$

Kesimpulan:

Ibu Iva harus membayar:

$$39.000 + 28.000 + 15.000 = 82.000$$

Maka kembalian ibu Iva:

$$100.000 - 82.000 = 18.000$$

Figure 3. Second Mathematical Logical Intelligence Test Results

- Researcher** : Please try to retell me what the problem is about!
TS : This problem explains several price details for each purchase of chilies, garlic, and tomatoes. In this question it is stated that the price of 2 kg of chilies and 3 kg of garlic is IDR 162,000.00. The price for 1 kg of chilies, 2 kg of garlic and 1 kg of tomatoes is IDR 110,000.00. The price for 2 kg of chilies, 1 kg of garlic and 3 kg of tomatoes is IDR 151,000.00. Then, the question is if Ms. Iva buys 1 kg of chilies, 1 kg of garlic and 1 kg of tomatoes by handing over one hundred thousand, how much will the amount of change be??
- Researcher** : State the information you know from the problem!
TS : From the question we knew, the price for 2 kg of chilies and 3 kg of garlic is IDR 162,000.00. Meanwhile, the price for 1 kg of chilies, 2 kg of garlic and 1 kg of tomatoes is IDR 110,000.00. The price for 2 kg of chilies, 1 kg of garlic and 3 kg of tomatoes is IDR 151,000.00.
- Researcher** : What are being asked in the questions you have read?
TS : If Ms. Iva buys 1 kg of chilies, 1 kg of garlic and 1 kg of tomatoes by handing over one hundred thousand, how much the amount of change will be??
- Researcher** : What concept will you use in solving the problem?
TS : I solved this problem using the concept of a system of three-variable linear equations.
- Researcher** : What are your steps in solving the problem? please explain!
TS : My steps in solving this problem are by reading the problem first, then understanding the problem, writing down the information that is known and what is being asked in the problem, making examples, making the mathematical model, solving it by using elimination and substitution methods, and finally make a conclusion.
- Researcher** : Have you done the calculation correctly? Explain!
TS : Yes, I'm sure I did the calculation correctly.

- Researcher* : Now please try to give an example of a problem that is almost the same as what you are doing!
- TS* : For example, the price for 2 kg of rice and 3 kg of sugar is IDR 112,000.00. The price for 1 kg of rice, 2 kg of sugar and 1 kg of eggs is IDR 84,000.00. The price for 2 kg of rice, 1 kg of sugar and 3 kg of eggs is Rp 147000.00. If Mrs. Yuli buys 1 kg of rice, 1 kg of sugar, and 1 kg of eggs by handing over a hundred thousand, how much the amount of change will be?
- Researcher* : What can you conclude from the problem?
- TS* : So, if Ms. Iva buys 1 kg of chilies, 1 kg of garlic and 1 kg of tomatoes by handing over one hundred thousand rupiah in cash where the total price to buy 1 kg of chilies, 1 kg of garlic and 1 kg of tomatoes is Rp. 82,000.00, then the change received by Mrs. Iva was IDR 18,000.00.
- Researcher* : How do you conclude like that?
- TS* : I concluded it in accordance with what is being asked in the problem.
- Researcher* : Please check the answers you have obtained!
- TS* : I have checked it.
- Researcher* : Are you sure about the answers you got?
- TS* : Yes, I am sure with my answer.

In the second logical intelligence test, the first indicator results, which is classification, the subject can write down and explain the information that is known and what is asked in the problem. The second indicator is comparison where the subject can relate and explain by using the prior knowledge he has, especially on the concept of a system of three-variable linear equations. The third indicator is mathematical arithmetic operations, the subject can perform calculations correctly starting from making the mathematical model, the processes of elimination and substitution, and when giving conclusions. The fourth indicator is inductive and deductive reasoning, the subject can give examples of questions that are almost the same as those in the questions. The fifth indicator is making a hypothesis and checking again, where the subject can provide conclusions correctly, can provide appropriate and logical reasons for giving conclusions that he has written, and the subject has re-checked his answers.

Based on the results of the tests and interviews it showed consistency from the results of the 1st and 2nd tests and interviews. So, this shows that the data obtained is said to be valid. In previous research conducted by (Nisa et al., 2020) showed that there was a positive and significant relationship between mathematical logical intelligence and students' mathematical communication skills in solving System of Linear Equations in Three Variable class XI IPA at Jenggawah State High School. The research results of (Nisa et al., 2020) support this research that there is indeed a relationship between students' logical mathematical intelligence and students' mathematical communication skills (Aini, et al, 2020; Zayyadi & Pratiwi, 2022). This is showed by the subject's exposure to mathematical communication ability tests and mathematical logical intelligence tests.

In this study, it was found that students who have high mathematical communication skills tend to have high mathematical logical intelligence. Demonstrated by the ability of students who are able to communicate in writing and orally. Then, students are able to fulfill the 5 indicators of logical-mathematical intelligence, namely being able to classify, compare, do calculations correctly, do inductive and deductive reasoning, and be able to make conclusions and re-check. Mathematical logical intelligence affects a person's abilities and skills in solving mathematical problems (Ab et al., 2019). It is shown by the results of his research that students with high logical-mathematical intelligence have a more systematic, logical problem-solving profile, and can explain completely. In line with this, (Ulfah et al., 2020) revealed that in mathematical logical intelligence there are steps or phases in solving problems, where the steps in solving the problem are systematic and logical steps. Starting from the stage of understanding the problem, planning a solution, carrying out the plan, and re-checking (Zayyadi, et al, 2019). Mathematical logical intelligence is a combination of systematic calculation levels and reasoning (Suwarno et al., 2020). It is closely related to logical-mathematical intelligence with mathematics and reasoning (Zayyadi & Kurniati, 2020). Good students' reasoning abilities will tend to be easier to develop their mathematical communication skills both in writing and orally (Setiyani et al., 2020).

SIMPULAN

Based on the results, it can be concluded that students' mathematical logical intelligence has high mathematical communication abilities in the material of a three-variable system of linear equations indicating that the subject has high mathematical communication skills, where his written and oral communication is classified as very good, indicated by the subject's ability to respond and active argument when communicating and able to explain strategies and steps in a structured manner and can explain the basis of their understanding. Subjects who have high mathematical communication skills also have high mathematical logical intelligence which is classified as capable of fulfilling the 5 indicators of logical mathematical intelligence, namely being able to classify, compare, perform calculations correctly, perform inductive and deductive reasoning, and be able to draw conclusions and re-checking.

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