



MATHEMATICAL COMMUNICATION ABILITY OF CLASS X MIPA 1 MAN DONGGALA STUDENTS

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ABSTRACT

This type of research is a descriptive qualitative approach. The subjects in this research are class X MIPA 1 MAN Donggala students, consisting of 4 people, each two male students and two female students, who have FI cognitive style and FD cognitive style. Written assignments and interviews obtained data on students' communication skills. The results of the research show that the mathematical communication skills of students who have a Field-dependent cognitive style are less capable than men because they cannot achieve all the indicators. The student subject has a Field Dependent female cognitive style, which is quite capable because it achieves one. The student subject has a Field Independent male cognitive style, which is quite capable because it achieves two indicators. The student subject has a Field Independent female cognitive style that is capable of achieving all three indicators. The conclusion obtained from this research is that students' mathematical communication abilities are generally said to be poor. The majority of students have not met several indicators of the three indicators of students' mathematical communication abilities. This condition can be seen with only one student achieving all three indicators.

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1. INTRODUCTION

Mathematics is an abstract science so studying mathematics requires the ability to reason. Mathematics is also a subject that must be studied at every level of education at school. Novri et al., (2018) said mathematics is one of the most important subjects in the world of

education, because mathematics lessons can help students think logically, rationally, critically and broadly, this is in line with the goals of national education, namely: preparing students to be able to face changes in the world which is always changing, acts on the basis of logical, rational, critical thinking, and so that students are able to use mathematics in everyday life and in studying various sciences. Mathematics is also used as a language, which requires communication to convey mathematical ideas or ideas such as symbols, letters and others.

In daily activities, a person cannot be separated from communication. Communication can take place between individuals, groups, social groups and so on, communication is the delivery of messages verbally and in writing between people. Basic communication skills in general include oral and written abilities. Oral abilities are in terms of pronunciation, understanding, listening, while written abilities are practice writing letter symbols, reading symbols, practice using words or punctuation, and so on. Lamonta et al., (2016) states that mathematical communication is a student's ability to convey something they know through dialogue events or what occurs in the classroom environment, so that message transfer occurs. The transferred message can contain mathematics material that students are studying, for example concepts, formulas, or strategies for solving a problem. These messages are the result of mathematical communication which is important in the process of organizing thoughts, developing patterns, connecting ideas with other ideas so that they can improve students' understanding of mathematical concepts.

Communication is a very important component in the mathematics learning process. The abstract characteristics of mathematics result in many students simply swallowing all the material without trying to understand what information it contains. Most students apply the method of memorizing formulas to learn mathematics, even though the basis of learning mathematics is not memorization but as stated in the fourth point of mathematics learning objectives listed in National Education Minister Regulation number 22 of 2006 is for students to be able to communicate ideas using symbols, tables, diagrams or other media. to clarify a situation or problem. Thus, it is clear that mathematical communication is an important ability that needs to be developed in every student.

According to Pratiwi et al., (2013) said that one of the things that influences students' mathematical communication skills in solving problems is cognitive style. Cognitive style influences mathematical communication abilities both in presenting written ideas and communicating ideas verbally, so researchers will examine mathematical communication abilities in terms of cognitive style. Cognitive style is a person's style or characteristics in receiving, storing, processing, making decisions, presenting information and responding to a task or various types of environmental situations. The position of cognitive style in the learning process cannot be ignored. This is in line with this view Wicaksana & Rachman, (2018) saying that cognitive style is one of the student characteristics that is included in the learning conditions variable, in addition to other student characteristics such as motivation, attitude, talent, interest, thinking ability, etc.

Imanita et al., (2021) say that There are many variations in cognitive styles that are of interest to educators and they differentiate cognitive styles based on dimensions: (a) differences in psychological aspects, which consist of field dependent (FD) and field independent (FI), (b) time to understand concepts, which consist of impulsive styles. and reflective style. According to him, implementation in learning really determines learning so researchers want to review the cognitive styles of FI and FD. A student who has the FI cognitive style looks at things analytically or sets boundaries in analyzing patterns, is able to distinguish objects around him and tends not to be easily influenced by the environment, while the FD cognitive style looks at things globally, not able to distinguish objects around

them and tend to be more easily influenced by the environment.

Based on the results of interviews conducted by researchers with one of the mathematics teachers on Monday, 22 August 2022 at MAN Donggala, information was obtained that there were still many students who had difficulty working on questions, namely changing verbal language into mathematical models and writing mathematical symbols. There are still many students in the class who are less enthusiastic in expressing his mathematical ideas when the student is asked to explain the answer he has worked on, the student is still hesitant in answering, it can be said The student understands the material that has been taught given if students can express or communicate their mathematical ideas verbally and in writing well. It is very important for students to have mathematical communication skills orally and in writing so that teachers can find out students' understanding. So this is the basis for researchers to profile students' mathematical communication abilities. SPLTV material was chosen in order to explore students' mathematical communication skills because many problems related to everyday life can be worked on with SPLTV material expressed in mathematical communication.

The low mathematical abilities of students in Indonesia can also be seen based on the results of the Program for International Students study Assessment (PISA) 2018 which was released on Tuesday, December 3 2019. Based on the results of this study, Indonesia's 2018 PISA ranking decreased when compared to the 2015 PISA results. This 2018 study assessed 600,000 15 year old children from 79 countries every three years. The study compared math, reading, and science performance from each child (Tohir, 2019). Based on the results of interviews conducted by researchers at MAN Donggala, students' mathematical abilities are also low. It can be seen from the exam results that many students scored below the completion standard. Based on the problems experienced by students, teachers must be aware of the different types of students for each individual. Identifying student types in terms of cognitive style will help teachers provide appropriate treatment for students' mathematical communication ability problems.

Based on a preliminary study conducted by Pane (2018), regarding the analysis of students' mathematical communication skills in data presentation material in class VII MTs Islamiyah Medan. The conclusion obtained from this research is that students' mathematical communication abilities are generally said to be poor, this is because the majority of students have not met several indicators of the five indicators of students' mathematical communication abilities, whereas research conducted by Ridwanah, RM, & Masriyah, M. (2021) shows that field dependent and field independent cognitive styles can influence students' written communication in problem solving. Therefore, it is important for teachers and students to know written mathematical communication in order to improve abilities and understanding in problem solving. Based on the background that has been described, it is necessary to carry out research to determine the description of students' mathematical abilities for cognitive learning styles, so that they can form appropriate actions to optimize mathematical communication abilities. Based on the background of the researcher, he was interested in conducting research with the title "Ability Student Mathematical Communication Class X MIPA in Completing SPLTV Viewed from Cognitive Style"

2. METHOD

This type of research is descriptive research with the approach used, namely a qualitative approach. This research was carried out at MAN Donggala which is located on the Trans Sulawesi road, Surumana, South Banawa District, Donggala Regency, Palu City, Central Sulawesi Province. This research was carried out in the even

semester of the 2022/2023 academic year.

The subjects in this research were class Subject selection is done by providing *Instrument Group Embedded Figure Test* namely finding a simple shape hidden in a complicated image with 18 questions. After that, FD and FI cognitive styles were classified based on the GEFT score. The correct answer will be given a score of 1 and the wrong answer will be given a score of 0. The subjects taken are students who have FD and FI cognitive styles with the following classification:

1. Students with a score ≤ 9 include students with the FD cognitive style
2. Students with a score > 9 include students with the FI cognitive style

For the classification of cognitive styles, 2 subjects with FD cognitive style were taken, namely students who had the lowest scores, with 1 female subject with FD cognitive style and 1 male subject with FD cognitive style and 2 subjects with FI cognitive style, namely students who had The highest score was 1 female subject with FI cognitive style and 1 male subject with FI cognitive style so 4 subjects were selected.

For students' mathematical communication skills, the material used is a system of three variable equations (SPLTV). This research instrument uses written assignments and in-depth interviews with research subjects. The indicators used are Mathematical communication skills adapted from several opinions, then there are 3 indicators of students' mathematical communication abilities in this research, namely:

1. Students' ability to express everyday events in the form of language or mathematical sentences. In this research, students can use symbols when writing down all the information, questions are contained in questions that are made in the form of mathematical models when solving problems.
2. Ability to understand, interpret and evaluate mathematical ideas both orally, in writing and in other visual forms.

In this research students can understand, explain and write from a mathematical problem with mathematical steps so as to obtain a solution or answer to the problem mathematically and be able to calculate the problem properly and correctly.

Students' ability to summarize answers verbally and in writing. In this research, students can write conclusions from the SPLTV solutions provided using their own language.

3. RESULTS AND DISCUSSION

3.1. Results

Research subjects were obtained by grouping students based on cognitive style and gender, namely Field Dependent cognitive style and Field Independent cognitive style, gender, namely male and female. Results of cognitive style grouping of 22 students.

Table 1. Cognitive Style Test Results

Cognitive style	Gender	Amount
<i>Dependent Fields</i>	Man	2
<i>Dependent Fields</i>	Woman	6
<i>Field Independent</i>	Man	4
<i>Field Independent</i>	Woman	10

Data was obtained that as many as 2 students had a male Field Dependent cognitive style, as many as 6 students had a female Field Dependent cognitive Style, as many as 4

students had a Female Field Dependent Cognitive Style. Field Independent cognitive style is male, and as many as 10 students have Field Independent cognitive style female gender, then 4 subjects are selected from the cognitive style, male and female gender, in the selection to discuss with the field of study teacher. In Table 2 the subjects are presented cognitive styles of male Field Dependent, female Field Dependent, male Field Independent, and female Field Independent.

Table 2. Research Subjects

Subject Name Initials	Subject Code	Score
AN	FDL	9
IN	FDP	9
AB	FIL	15
NA	FIP	16

Following exposure student data has a male Field Dependent cognitive style

Figure 1 FDL Subject's Answers to Indicator 1

Based on the explanation of the answers and interview results, FDL was unable to write down all the known information using symbols formed in a mathematical model. FDL made a mistake in writing the separation (figure 1), then FDL was unable to reveal the use of colons in the separation. FDL was also unable to express how to write the written symbols and FDL did not write down what was asked in the problem but he was able to express the question in the problem by looking at the question mark at the end of the sentence but he forgot to write it.

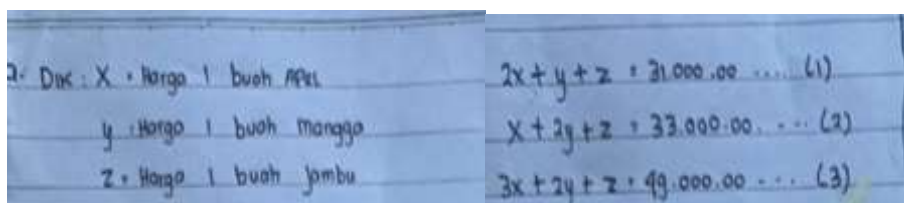
Figure 2 FDL Subject's Answers to Indicator II

Based on the explanation of the answers and interview results, FDL was wrong in solving the problem, even though the arithmetic operations used were correct, but FDL was wrong in calculating the results of the answer, FDL was unable to explain the answer to the solution of the steps according to the answer he had written and was unable to express the reasons. using arithmetic operations. FDL was unable to mention and explain

the method used to solve the problem, then when explaining the steps to solve it, FDL realized that the solution answer he had worked on was wrong in calculating the answer in the elimination step so that the calculation results were not correct.

Based on the presentation of FDL's answers and interview results, the description was that FDL did not write down the conclusions of his answers, and FDL could not verbally express the conclusions of the answers he obtained because FDL no longer knew the next step in solving the problem so FDL could not write down the answer conclusions.

The following is a presentation of data on students who have a Female Field Dependent cognitive style:



2. Dik: x = Harga 1 buah Apel
 y = Harga 1 buah Mangga
 z = Harga 1 buah Jambu

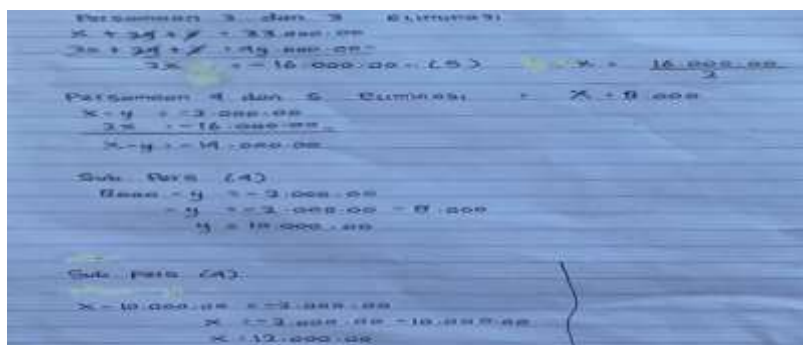
$$2x + y + z = 31.000,00 \dots (1)$$

$$x + 2y + z = 33.000,00 \dots (2)$$

$$3x + 2y + z = 49.000,00 \dots (3)$$

Figure 3. FDP Subject Answers to Indicator I

Based on the explanation of the answers and interview results, FDP wrote down and conveyed all known information using symbols formed in a mathematical model by first analyzing the problem (Figure 3). Then FDP can reveal the use of colons in the example x is the price of an apple. FDP is unable to express how to express the written symbols and FDP does not write down what is asked in the question but FDP can express the question in the problem by looking at the question mark at the end of the sentence but FDP forgets to write it.



Persamaan 1 dan 2 Eliminasi:

$$x + 2y + z = 33.000,00$$

$$- (2x + y + z = 31.000,00)$$

$$3x = -16.000,00 \dots (4)$$

$$x = 16.000,00$$

Persamaan 1 dan 3 Eliminasi:

$$x + 2y + z = 33.000,00$$

$$- (3x + 2y + z = 49.000,00)$$

$$x - y = 16.000,00$$

Sub. Pers. (4):

$$16.000,00 - y = 33.000,00 - 31.000,00$$

$$-y = 33.000,00 - 31.000,00 - 16.000,00$$

$$y = 18.000,00$$

Sub. Pers. (4):

$$x = 16.000,00 - 18.000,00 = -2.000,00$$

$$x = -2.000,00 - 18.000,00$$

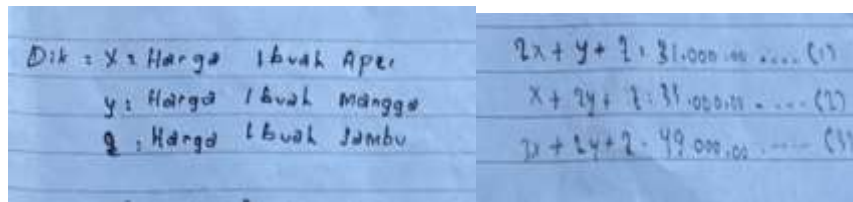
$$x = -20.000,00$$

Figure 4. Answers of FDP Subjects in Indicator II

Based on the explanation of the answers and interview results, FDP was wrong in solving the problem even though he had used the elimination and substitution method correctly (Figure 4), but in the step of solving the substitution equation 4, FDP was wrong in determining the value of x , he looked for the answer to the value of x twice, he should have looking for the z value, then FDP was able to explain again the solution to the steps according to the answers he had written, then FDP realized his mistake by looking for the x value twice so that FDP could not solve the problem. FDP was also only able to mention the method used to solve the problem but was unable to explain because FDP had forgotten how to do it.

Based on the explanation of the answers and the results of the interview, a description was obtained that FDP did not write down the conclusions of his answers, and FDP could not verbally express the conclusions of the answers obtained because FDP made a mistake in solving the questions so he did not get a conclusion.

The following is a presentation of data on students who have a male Field Independent cognitive style:

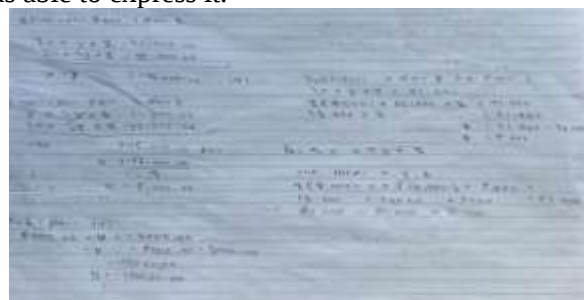


$$\begin{aligned} \text{Dik} &= x = \text{Harga 1 buah Apel} \\ y &= \text{Harga 1 buah Mangga} \\ z &= \text{Harga 1 buah Jambu} \end{aligned}$$

$$\begin{aligned} 2x + y + z &= 31.000,00 \dots (1) \\ x + 2y + z &= 31.000,00 \dots (2) \\ 3x + 2y + z &= 49.000,00 \dots (3) \end{aligned}$$

Figure 5. FIL Subject's Answers to Indicator I

Based on the explanation of the answers and interview results, FIL wrote down all the known information using symbols formed in a mathematical model by making examples first. FIL was able to express how to express the written symbols, but FIL did not write down what was asked in the question, but FIL was able to express it.



$$\begin{aligned} \text{Dik} &= x = \text{Harga 1 buah Apel} \\ y &= \text{Harga 1 buah Mangga} \\ z &= \text{Harga 1 buah Jambu} \end{aligned}$$

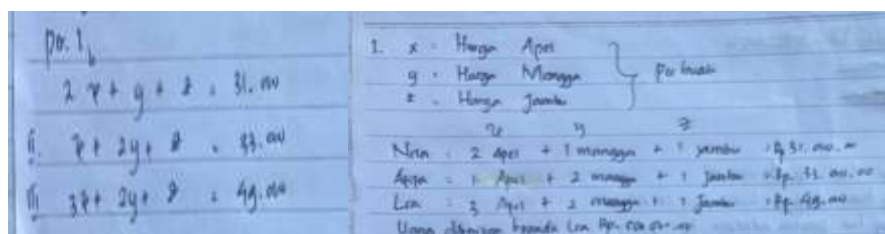
$$\begin{aligned} 2x + y + z &= 31.000,00 \dots (1) \\ x + 2y + z &= 31.000,00 \dots (2) \\ 3x + 2y + z &= 49.000,00 \dots (3) \end{aligned}$$

Figure.6. FIL Subject's Answers to Indicator II

Based on the presentation of answers and interview results, FIL can solve problems correctly by using the elimination and substitution method, FIL is also able to explain the answers to solve the steps according to the answers he has written, FIL is able to mention and explain the methods used to solve the problem. according to his understanding. FIL is also able to evaluate the solution answers that have been worked out to ensure that the answers that have been worked out are correct.

Based on the presentation of FIL's answers and interview results, a description was obtained that FIL could express the conclusions of his answers verbally, but FIL did not write the conclusions of his answers using his own language because FIL forgot to write them down.

The following is a presentation of data on students who have a female Field Independent cognitive style:



$$\begin{aligned} \text{Dik} &= x = \text{Harga 1 buah Apel} \\ y &= \text{Harga 1 buah Mangga} \\ z &= \text{Harga 1 buah Jambu} \end{aligned}$$

$$\begin{aligned} \text{I. } 2x + y + z &= 31.000 \\ \text{II. } x + 2y + z &= 31.000 \\ \text{III. } 3x + 2y + z &= 49.000 \end{aligned}$$

Figure 7. FIP Subject Answers to Indicator I

Based on the explanation of the answers and interview results, FIP wrote down all the known information using symbols in the form of a mathematical model by making examples first. FIP was able to express how to express the written symbols, but FIP did not write down what was asked in the question, but he was able to express it.

Handwritten mathematical work for Indicator II. It shows two systems of linear equations in three variables (SLK) being solved using the elimination method. The first system is:

$$\begin{cases} 2x + 3y + z = 40.000 \\ x + 2y + 2z = 30.000 \\ 3x + 4y + z = 50.000 \end{cases}$$

The second system is:

$$\begin{cases} 2x + 3y + z = 40.000 \\ x + 2y + 2z = 30.000 \\ 3x + 4y + z = 50.000 \end{cases}$$

The work shows the elimination of x from the first two equations, resulting in:

$$-y - z = -10.000 \quad (*)$$

Then, the elimination of x from the first and third equations, resulting in:

$$-y - z = -10.000 \quad (**)$$

Subtracting equation (*) from equation (**), we get:

$$0 = 0$$

Then, the elimination of y from the first and second equations, resulting in:

$$x + z = 20.000 \quad (***)$$

Substituting $x = 20.000 - z$ into equation (*), we get:

$$-(20.000 - z) - z = -10.000$$

$$-20.000 + z - z = -10.000$$

$$-20.000 = -10.000$$

Then, the elimination of y from the second and third equations, resulting in:

$$x + z = 20.000 \quad (***)$$

Substituting $x = 20.000 - z$ into equation (***), we get:

$$20.000 - z + z = 20.000$$

$$20.000 = 20.000$$

Finally, the elimination of z from equation (***), we get:

$$x = 20.000$$

Substituting $x = 20.000$ into equation (*), we get:

$$-y - z = -10.000$$

$$y + z = 10.000$$

Substituting $x = 20.000$ into equation (***), we get:

$$20.000 + z = 20.000$$

$$z = 0$$

Substituting $z = 0$ into equation $y + z = 10.000$, we get:

$$y = 10.000$$

So, the solution is $x = 20.000$, $y = 10.000$, and $z = 0$.

Figure 8. FIP Subject Answers to Indicator II

Based on the explanation of the answers and interview results, FIP was able to solve the problem correctly using the elimination and substitution method. FIP was also able to explain the answer to the solution of the steps according to the answer he had written. FIP is able to mention and explain the methods used to solve problems. FIP is also able to evaluate the solution answers he has worked on to ensure that the answers he has worked on are correct.

Handwritten mathematical work for Indicator III. It shows a word problem about the price of a book and a pen. The problem is:

1. Harga buku : Rp. 8.000
2. Harga pena : Rp. 3.000
3. Jumlah harga buku yang harus dibayar : Rp. 51.000,00
4. Jumlah harga pena yang harus dibayar : Rp. 5.000,00

The solution is:

$$\begin{aligned} \text{Jumlah harga buku yang harus dibayar} &= 51.000,00 \\ \text{Jumlah harga pena yang harus dibayar} &= 5.000,00 \\ \text{Jumlah harga buku yang harus dibayar} &= 51.000,00 \\ \text{Jumlah harga pena yang harus dibayar} &= 5.000,00 \end{aligned}$$

Figure 9. FIP Subject Answers to Indicator III

Based on the presentation of FIP's answers and interview results, a description was obtained that FIP could express conclusions from the answers verbally that he obtained, and FIP could write conclusions from his answers completely using his own language (figure 9).

3.2. Discussion

a. Profile of mathematical communication abilities of FDL subjects

In indicator I mathematical communication skills, FDL is not able to write all known information using symbols formed in a mathematical model because it is wrongwrite an example. FDL is also unable to express how to write the written symbols and FDL does not write down what is asked in the problem but he is able to express the question in the problem but he forgets to write it down, so FDL is unable to express everyday events in the form of language or mathematical sentences.

In indicator II mathematical communication skills, FDL was unable to understand the steps to solve the problem because FDL was wrong in solving the problem even though the calculation operations used were correct, but FDL was wrong in calculating the results of the answer. FDL is unable to explain the answer to the completion of the steps according to the answer and cannot express the reasons for using arithmetic operations. FDL is unable to mention and explain the methods used to solve problems. FDL was only able to evaluate the solution answers that he had worked on. It turned out that he was wrong in calculating the answers in the elimination step so that the calculation results were not correct. This is in line with opinion Ridwanah, RM, & Masriyah, M. (2021) in the implementation stage of the settlement, SFD wrote down

the calculation stages inaccurately, completely, and not smoothly, so FDL is not able to understand, interpret and evaluate mathematical ideas either verbally, in writing or in other visual forms.

In indicator III of mathematical communication ability, FDL cannot write the conclusion of the answer at the end of solving the problem. So, FDL does not summarize the results of the answers orally and in writing.

b. FDP subject's mathematical communication ability profile

In indicator I of mathematical communication ability, FDP is able to write and convey all known information using symbols formed in a mathematical model by making examples first. This is in line with the opinion of Safira (2019). Field Dependent (FD) subjects are able to make examples for values that have not yet been determined into certain variables. Then the subject arranges them into a mathematical model. Then FDP can reveal the use of colons in the example where x is the price of an apple, p . FDP is unable to express how to express the written symbols and FDP does not write down what is asked in the problem but he can express the question in the problem but he forgets to write it, so FDP is able to express everyday events in the form of language or mathematical sentences.

In indicator II of mathematical communication skills, FDP Based on the explanation of the answers and interview results, FDP was unable to understand the steps for solving the problem, that FDP was wrong in solving the problem in determining the x value, he looked for the answer to the x value twice, but FDP was able to explain the solution again from the steps according to the answers he has written in a structured manner. FDP is unable to explain the methods used to solve the problem. FDP is also able to evaluate solution answers, but FDP cannot solve the problem correctly, so FDP is unable to solve problems understand, interpret and evaluate mathematical ideas either verbally, in writing or in other visual forms.

In indicator III of mathematical communication ability, FDP cannot write down and cannot explain the answer conclusions at the end of completing the questions, so FDP is unable to conclude the results of the answers verbally or in writing.

c. Profile of mathematical communication abilities of FIL subjects

In indicator I mathematical communication skills, FIL is able to write all known information using symbols in the form of a mathematical model, FIL is able to express how to express the written symbols. But FIL did not write down what was asked in the question but he was able to express it but he forgot to write it down, so FIL was able to express everyday events in the form of language or mathematical sentences.

In indicator II mathematical communication skills, FIL is able to understand the steps to solve the problem, FIL is also able to explain the answers to the solution of the steps according to the answers he has written. FIL is able to explain the methods used to solve problems. FIL is also able to evaluate the solution answers he has worked on to ensure that the answers he has worked on are correct. This is in line with opinion Ridwanah, RM, & Masriyah, M. (2021) SFI writes down the calculation stages accurately, completely and smoothly, then at the re-checking stage, the conclusions are written accurately, completely and smoothly, so FIL is able to deep understand, interpret and evaluate mathematical ideas either verbally, in writing or in other visual forms.

In indicator III mathematical communication ability, FIL now write it down because you forgot to write it down. However, you can explain the answer conclusions at the end of solving the questions, so that FIL is unable to conclude the results of the answers in writing.

d. Profile of mathematical communication abilities of FIP subjects

In indicator I mathematical communication ability, FIP able to write all known information using symbols in the form of a mathematical model, FIP is able to express how to express the written symbols, but FIP does not write down what is asked in the question but he is able to express it but he forgets to write it down, so FIP is able to express everyday events in form of language or mathematical sentences.

In indicator II mathematical communication skills, FIP is able to understand problem solving steps, FIP is also able to explain the answers to the solutions of the steps in accordance with the answers he has written. This is in line with the opinion of Pane (2019) which states that the ability interpreting mathematical ideas both in writing and in other visual forms, which can be seen when students can write down the concept of the formula that will be used in solving the problem accompanied by the correct steps and correct calculations. FIP is able to explain the methods used to solve problems. FIP is also able to evaluate the solution answers that he has worked on to ensure that the answers he has worked on are correct by checking the results of his answers again, so that FIP is able to understand, interpret and evaluate mathematical ideas either verbally, in writing or in other visual forms.

In indicator III of mathematical communication skills, FIP can write down and explain the conclusion of the answer at the end of solving the problem, so that FIP is able to conclude the results of the answer orally and in writing.

4. CONCLUSION

Based on the results of the research and discussion that the researcher has presented, it was concluded that students' mathematical communication abilities have a Field Dependent cognitive style. Men are less capable because they cannot achieve all the indicators. The student subject has a Field Dependent cognitive style, women are quite capable because they achieve one. The student subject has a Field Independent male cognitive style which is quite capable because it achieves two indicators. The student subject has a Field Independent female cognitive style that is capable of achieving all three indicators. So the conclusion obtained from this research is that students' mathematical communication abilities are generally said to be poor, this is because the majority of students have not met several indicators of the three indicators of students' mathematical communication abilities, only one student has achieved all three indicators.

SUGGESTION

In learning activities, teachers can provide story questions related to daily life that are linked to the material that has been taught to improve students' mathematical communication skills. It is hoped that further research will be carried out regarding the learning process with certain models that can improve students' mathematical communication skills.

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