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Mathematical Communication of Junior Secondary School Students: A Review of Cognitive Styles and Self-Confidence

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Abstract
This study presents the characterization of mathematical communication skills of junior secondary school students in terms of cognitive style and self-confidence. The data collected for cognitive style, self-confidence, and mathematical communication skills were 47 data each, and 3 transcripts of interview data. The research design is a multi-case study with a single unit of analysis. The results showed the characteristics of students in communicating their ideas: field independent student with high self-confidence tends to represent with images, graphs, mathematical symbols, and mathematical models with systematic arguments both in writing and orally. Cognitive field independent style student with low self-confidence tends to resonate with images and graphs, but arguments are less systematic both in writing and orally. Students, a cognitive field dependent on high self-confidence, tend to represent with images and mathematical symbols with verbally systematic arguments but less systematically in writing. Field-dependent type cognitive-style student with low self-confidence tends to be with images and mathematical models with less systematic arguments both in writing and orally. From these findings, it is concluded that there is a correlation between cognitive style, self-confidence, and the characteristics of mathematical communication skills.

Keywords*: Mathematical Communication; Cognitive Style; Self Confidence.*

INTRODUCTION

Partnership For 21st Century Skills emphasizes 4 competencies that are very important in the 21st century, namely *communication*, *collaboration*, *critical thinking*, and *creativity* (Indaraswati et al., 2020). One of the attributes that are very important to develop in students is *communication* skills. A brilliant idea is worthless if it is not well-documented. Mathematics is one of the vehicles for developing reasoning ability, high-level thinking ability, problem-solving ability, and mathematical *communication* abilities. Decision making Furthermore, Hendriana et al. (2016) classify mathematical skills into five types of competencies, namely (1) understanding of mathematics; 2) problem solving; 3) communication; 4) mathematical connections; 5) mathematical reasoning. Based on this statement, one of the skills that need to be developed in the learning process, especially mathematics, is communication skills.

Communication in learning is a way to express ideas related to what you want to convey in the learning process to build a strong understanding of a field of science. Through good communication, one can express ideas in the form of systematic and logical sentences. Mathematical communication skills are one of the components of *hard* and *soft* mathematics skills in the 2013 curriculum that need to be owned and developed in students who learn mathematics (Hendriana et al., 2016). As stated by Kaya and Aydin (2016), mathematical communication helps students understand abstract concepts, reduces students' fear of mathematics, and is effective in developing students' mathematical thinking skills. So good communication skills will also influence students' mathematics learning achievement.

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This is in line with Riswandha & Sumardi (2020), who states that mathematical communication performance affects students' mathematics learning achievement.

> The ability of students to communicate their ideas or ideas about information is influenced by several factors, one of which is the cognition force. As stated by Maryanto & Siswanto (2021), the different abilities to process and use information experienced by students influence cognitive styles. Some researchers have also suggested that mathematical communication is related to cognitive styles because cognitive styles affect the processing of information in students' brains which causes differences in the way in which mathematical ideas are conveyed by students in each cognitive style (Saputra & Zulmaulida (2020), Achir et al., (2017), alaya et al., (2021))

Cognitive styles are divided into *field-dependent* cognitive styles (FD) and *filed independent*-type cognitive styles (FI). Student with a cognitive style type FI sees parts of a problem separately, has strong analytical abilities, and processes more information independently, while the cognitive style of FD considers the situation as a whole, describes the problem in general, and prioritizes social relationships and working in groups (Inayah, 2016). Differences in ways of thinking between students with *field-independent* (FI) type cognitive styles and *field-dependent* (FD) type cognitive styles in processing information allow differences in students' communication skills in solving mathematical problems. As stated by Kamid et al. (2021) that there is a significant difference in communication skills between field-dependent type cognitive-style students and *field-independent* type cognitive-style students. Therefore, it is necessary to obtain an overview of the mathematical communication skills of the two types of cognitive styles to determine the right solution to each problem or the difficulty of students communicating their ideas or ideas in solving mathematical problems.

Students' ability to convey or communicate ideas or ideas is also influenced by self-confidence. Each student has a different level of *self-confidence*. This can be seen when the learning process is in the direct process. Where some students dare not or feel doubtful in expressing their opinions. So the communication process in learning is not carried out properly, especially in mathematics learning.

According to Mashlihah and Hasyim (2019), s*elf-confidence* is a person's belief in the abilities he has that are learned and formed in the learning process. Furthermore, Çiftçi & Yildiz (2019) argues that *self-confidence* is one of the important predictors of mathematics learning because the success rate of students in mathematics learning is generally in line with their level of confidence in mathematics. Pangestu et al. (2020) stated that with good self-confidence, a person could actualize all his potential. Students with good *s elf confidence* can communicate their ideas and encourage them to improve their achievements (Noviyana et al., 2019). Research results conducted by Muniroh et al. (2018) also showed a linear relationship between *self-confidence* and students' mathematical communication skills. The higher the student's *self-confidence*, the higher the mathematical communication skills. Vice versa, the lower the *student's self-confidence*, the lower his mathematical communication skills.

Seeing the importance of *self-confidence* and cognitive style to students' mathematics learning achievement, it is important to know students' difficulty in solving mathematical problems, especially those related to mathematical communication skills. Based on the exposure to these problems, researchers are interested in conducting a study titled "Analysis of students' mathematical communication skills in terms of cognitive style and *self-confidence* in class VIII of SMP Negeri 10 Palopo". This study aims to determine: 1) Mathematical communication skills of students with cognitive style field independent type (FI) with high *self-confidence* in class VIII SMP Negeri 10 Palopo. 2) Mathematical communication ability of students who are cognitive field independent type (FI) with low *self-confidence* in class VIII SMP Negeri 10 Palopo. 3) Mathematical communication

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skills of field-dependent type cognitive-style students with high *self-confidence* in class VIII of SMP Negeri 10 Palopo. 4) Mathematical communication skills of cognitively styled field-dependent type (FD) students with low *self-confidence* in class VIII of SMP Negeri 10 Palopo.

RESEARCH METHOD

This type of research is descriptive qualitative research that aims to reveal facts about students' mathematical communication skills regarding cognitive style and *self-confidence*. This research was conducted on November 15, 20214, January 2022,– at SMP Negeri 10 Palopo. The determination of subjects in this study was based on the test results of students' mathematical communication skills, cognitive styles, and *self-confidence*. Based on the steps of taking the subjects carried out in this study, 4 students were obtained as research subjects. The supporting instruments are mathematical communication skills tests, GEFT tests, *self-confidence* questionnaires, and interview guidelines. The technique of collecting data in this research uses the technique of written tests and interviews. The data analysis technique in this study consists of three activities: condensation data, data d*isplay*, and *conclusion*. Testing the validity of the data is carried out by triangulation of techniques.

RESULTS AND DISCUSSION

Research Results

Mathematical communication skills of students in the cognitive style of field independent type (FI) with high self-confidence (t) on the questions of the mathematical communication ability test (TKKM)

The test and interview results of subjects in the cognitive style of the field independent type with high *self-confidence* (FI-t) on the mathematical communication ability (TKKM) test questions for each indicator are presented as follows:

a. Data on mathematical communication ability of cognitive field independent-style subjects with high self-confidence in the TKKM-01 question

Data from the test results of low mathematical communication ability with aspects of the ability to connect real objects, drawings, or diagrams/graphs, into mathematical ideas in FI-t subjects in the TKKM-01 questions can be seen in Figure 1.

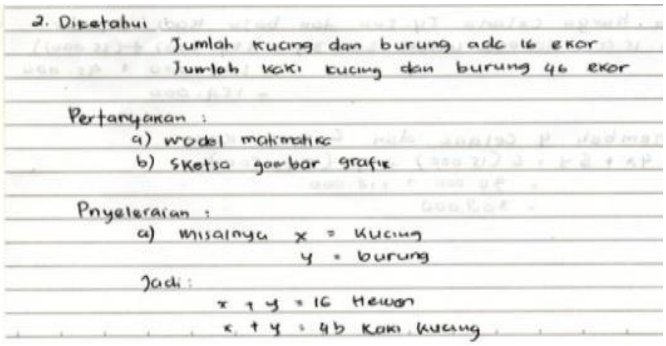

Figure 1. FI-t Subject Test Results on TKKM-01 Questions

Based on the results of the FI-t subject test in Figure 4.1, data were obtained that the FI-t Subject can express his mathematical ideas by writing down the solving steps to determine the coordinate values of two points and XY of the two equations systematically and

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accompanied by a caption for each equation so that it is easier to understand. Although in performing the counting operation, there was a misconception that resulted in the final result of the wrong answer, so the subject could not show that the system of equations satisfies the graph image in question.

b. Data on mathematical communication ability of field-independent cognitive-style subjects with high self-confidence in the TKKM-02 question

The results of the FI-t subject test on the TKKM-02 question regarding students' ability to explain mathematical ideas, situations, and relationships orally or in writing with real objects, images, graphs, or algebraic forms can be seen in Figure 2**.**

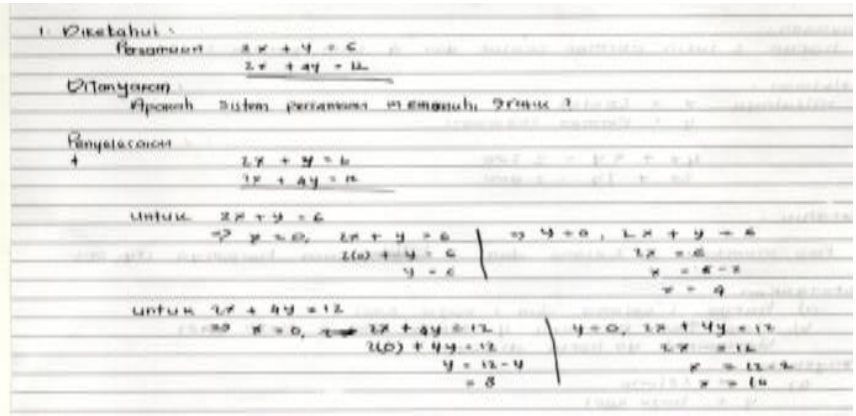

Figure 2. FI-t Subject Test Results on TKKM-02 Questions

Based on the test results, it can be seen that the subject cannot represent mathematical ideas or ideas about mathematical situations in the problem in algebraic and graphic forms. The subject states the mathematical situation on the given problem in an algebraic form, but it is inappropriate. Furthermore, the subject cannot state the idea of solving the equations created.

c. Data exposure to mathematical communication ability of field-independent cognitive-style subjects with high self-confidence in the TKKM-03 question

The results of the FI-t student test on the TKKM-03 question regarding the aspect of stating daily events in the mathematical language can be seen in Figure 3.

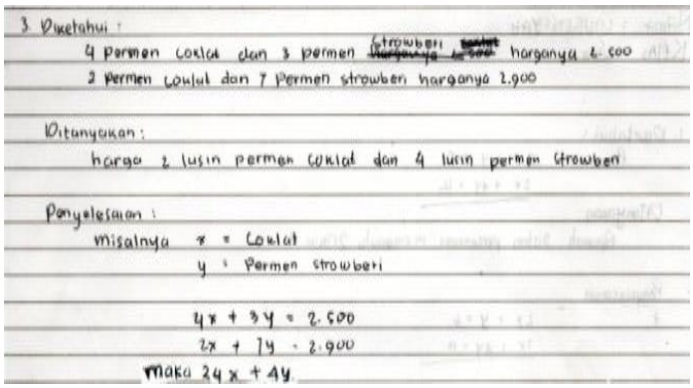

Figure 3. FI-t Subject Test Results on TKKM-03

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The results of the FI-t subject test on the TKKM-03 question show that the subject can state the mathematical situation on the problem in an algebraic form but is not appropriate and difficult to understand, especially in equations that are $24x + y$ not accompanied by explanations. The subject does not state the idea of solving for the system of equations created to determine the solution of mathematical events or situations on the problem.

d. Exposure to data on mathematical communication skills of field-independent cognitive-style subjects with high self-confidence in the TKKM-04 question

The results of the FI-t subject test on the TKKM-04 question regarding aspects of making conjectures, compiling arguments, and formulating definitions and generalizations can be seen in Figure 4.

Figure 4. FI-t Subject Test Results on TKKM-04 Questions

The results of the FI-t subject test show that the subject can write down the information on the question clearly and completely. The subject can express his mathematical ideas or ideas in the exact form of symbols or mathematical notations. The arguments are accompanied by explanations so that they can be understood by making price calculations for values x and so that results are obtained according to the information on the questions. The subject can also relate between the answer to the part 4a question and the part 4b question so that the correct final result is obtained. Although the subject does not write the final conclusion of the answer given

Data on the mathematical communication ability of students in the cognitive style of field independent type (FI) with low self-confidence (r) on the mathematical communication ability test (TKKM) questions

a. Exposure to data on mathematical communication skills of cognitive field independent-style subjects with high self-confidence in the TKKM-01 question

Data from the FI-r subject test results on the TKKM-01 questions on the aspect of connecting real objects, drawings, or diagrams/graphs, into mathematical ideas show that the subject can write down information related to the given question but is not clear and difficult to understand. The subject writes down his mathematical ideas or ideas to show the relationship between the image and the system of equations that exist in the problem but are difficult to understand. In the test results, the subject tried to perform calculations to determine the two coordinate points of the system of equations on the question. Still, the results did not correspond to the situation in the graph image.

b. Exposure to data on mathematical communication skills of field-independent cognitive-style subjects with high self-confidence in the TKKM-02 question

Data from the FI-r subject test results on the TKKM-02 question on aspects of explaining mathematical ideas, situations, and relationships orally or in writing, with real objects, images, graphs,

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or algebraic forms, show that the subject communicates his mathematical ideas or ideas to the given problem by writing down information in the form of what is known and asked on the problem with

Complete and clear. The subject can create an equation to describe the mathematical situation of the problem. Still, it is not accompanied by a description or explanation of the equation's meaning, so it is difficult to understand. The subject does not write down the idea of solving the equations or algebraic forms created and cannot state or indicate the situation of the problem in a graph form.

c. Data exposure to mathematical communication ability of field-independent cognitive-style subjects with high self-confidence in the TKKM-03 question

Data on the results of the FI-r subject test on the TKKM-03 question on the aspect of stating daily events in the language of mathematics showed that subjects could write down information about the mathematical situation given by writing down what was known and asked but was incomplete and a little difficult to interpret. The subject expresses his mathematical ideas in the form of equations equipped with the meaning of variables and supporting information so they can be understood. However, the subject does not write down the solution steps to determine the solution to the problem in the problem.$24x + 48y$

d. Exposure to data on mathematical communication skills of field-independent cognitive-style subjects with high self-confidence in the TKKM-04 question

Data on the results of the FI-r subject test on the TKKM-04 questions in the aspect of making conjectures, compiling arguments, formulating definitions and generalizations, showing that the subject can state his mathematical ideas or ideas regarding the mathematical situation in the problem, starting with writing down information about the mathematical situation on the problem completely and clearly. The subject makes a forging in the form of arguments about the price for variable values x and on the questions y. The subject communicates the problem situation in the form of a notation or mathematical model equipped with a supporting description or explanation so that it is easy to understand. The subject can make generalizations from the answers written to solve the problem, although the subject does not write down the conclusions of the answers made.

Data on mathematical communication skills of students with cognitive-style field dependent (FD) type with low self-confidence (r) on the mathematical communication ability test (TKKM) questions

a. Exposure to data on mathematical communication skills of cognitive field independent-style subjects with high self-confidence in the TKKM-01 question

The data of the FD-t subject test results on the TKKM-01 questions with aspects of connecting real objects, drawings, or diagrams, to mathematical ideas showed that the subjects wrote down information about the given questions in full. The subject communicates his idea or ideas to show that the shape of the graph corresponds to a known system of equations. Still, the completion steps are not precise, so the subject cannot show the conformity between the graph and the system of equations.

b. Exposure to data on mathematical communication skills of field-independent cognitive-style subjects with high self-confidence in the TKKM-02 question

Data from the FD-t subject test results on the TKKM-02 question on aspects of explaining mathematical ideas, situations, and relationships orally or in writing, with real objects, images, graphs, or algebraic forms, show that the subject wrote down mathematical information on the problem. Still, it was incomplete and a little difficult to interpret. The subject communicates his mathematical ideas in

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the form of symbols or variables accompanied by a description to express the mathematical situation on the problem in the form of a mathematical model or equation, but it is still not appropriate. The subject cannot state the mathematical model that has been made into the form of a graphic image.

c. Data exposure to mathematical communication ability of field-independent cognitive-style subjects with high self-confidence in the TKKM-03 question

Data on the results of the FD-t subject test on the TKKM-03 question on the aspect of stating daily events in the language of mathematics shows that the subject can write down the question information completely and clearly and easily understood. The subject can create symbols or notations complete with information to express the mathematical situation of the problem in the form of a mathematical model. Still, the subject does not present an appropriate solution method to determine the solution to the mathematical problem in the given problem.

d. Exposure to data on mathematical communication skills of field-independent cognitive-style subjects with high self-confidence in the TKKM-04 question

The data of the FD-t subject test results on the TKKM-04 question on the aspects of making a conditioner, compiling arguments, and formulating definitions and generalizations, showed that the subject communicated the information completely and clearly that it was easier to understand. The subject communicates ideas in the form of arguments or statements to solve mathematical problems in the problem. The subject communicates his ideas and ideas using the form of symbols or mathematical notations accompanied by some supporting information, but the answer is not yet complete.

Data on mathematical communication skills of students with cognitive-style field dependent (FD) type with low self-confidence (r) on the mathematical communication ability test (TKKM) questions

a. Exposure to data on mathematical communication skills of cognitive field independent-style subjects with high self-confidence in the TKKM-01 question

Data from the FD-r subject test results in TKKM-01 on the aspect of connecting real objects, images, or graphs to mathematical ideas that the subject can communicate information from mathematical situations that exist in the given questions but are incomplete and difficult to understand. The subject cannot communicate his mathematical ideas or ideas to express the situation of graphic images into a system of equations according to those in the problem.

b. Exposure to data on mathematical communication skills of field-independent cognitive-style subjects with high self-confidence in the TKKM-02 question

Data from the FD-r subject's test on the TKKM-02 question on aspects of explaining mathematical ideas, situations, and relationships orally or in writing, with real objects, images, graphs, or algebraic forms, show that the Subject writes down information from the given mathematical problems completely. Still, the subject cannot express his mathematical ideas or ideas in the form of notations, symbols, or mathematical models that are appropriate to describe the mathematical situation of the problem. The subject only writes down $kucing + burung = 16\, kaki\, kucing + kaki\, burung = 46$ sentences and explains the situation on the question.

c. Data exposure to mathematical communication ability of field-independent cognitive-style subjects with high self-confidence in the TKKM-03 question

Data from the FD-r subject test on the TKKM-02 question on the aspect of stating daily events in the mathematical language showed that the subject could write down the information about the problem completely and clearly. Still, the subject could not state the mathematical situation of the

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problem in an algebraic form or an appropriate mathematical model. The subject communicates or states his mathematical ideas and ideas in not using symbols or mathematical notation but simply writes down sentences of 4 candies + 3 candies = 2500 and 2 candies + 7 candies = 2900 to state the mathematical situation of the problem.

d. Exposure to data on mathematical communication skills of field-independent cognitive-style subjects with high self-confidence in the TKKM-04 question

The data of the FD-r subject test results on the TKKM-04 question on the aspects of making conjectures, compiling arguments, and formulating definitions and generalizations, shows that the subject can write down the information on the question completely and clearly. But the subject cannot create notations or symbols to describe the mathematical situation of the problem. The subject writes down ideas or ideas for solving the problem. Still, it is difficult to understand because the subject does not provide information or explanations that support the answers written.

DISCUSSION

Students' mathematical communication skills are cognitively styled field independent (FI), with high *self-confidence*.

Subjects who have a field-independent type cognitive style are FI-t. Based on the analysis carried out on the results of tests and interviews, the mathematical communication ability of cognitive-style subjects of field independent (FI) type with high *self-confidence* (FI-t), namely On indicators of connecting real objects, drawings, or diagrams, into mathematical ideas, FI-t subjects can write down and explain their mathematical ideas to express the situation in the graph image that exists on the problem into a system of equations, however, the final result is not yet correct. It does not yet match the graphic image in question. In line with the research conducted by (Malaya et al, 2021), students with an independent field-type cognitive style can express and explain their mathematical ideas precisely but are still less than perfect. Individuals with independent field-type cognitive styles can process information analytically (Sayogo et al., 2020). Further research conducted by Rizqi et al. (2021) also revealed that highly *self-confiden*t individuals could better communicate their mathematical ideas or ideas in sequence. This makes the subject of FI-t able to explain his mathematical ideas well and clearly, even though the final result of the calculation to determine the value x and the coordinates of the two points on the given graph is not yet correct. y

The indicator explains mathematical ideas, situations, and relationships orally or in writing with real objects, graphic images, or algebraic forms; from the test results, it is determined that the subject makes a mathematical model or equation to state the mathematical situation on a given problem, but the mathematical model created has not been able to represent the situation of thematic ma on the problem correctly. This is because the subject does not understand the method or step of solving that must be done.

In the indicators expressing everyday events in the language of mathematics, based on the test results, the subject can make mathematical notations to present ideas or ideas in expressing mathematical situations on the problem into the form of mathematical equations based on the information on the problem. However, the subject has not been able to determine the steps to obtain the right final result as a solution to the question on the question. This is because the subject cannot understand the steps or methods of misrepresentation for the system of equations that have been created.

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This study's results align with Malaya et al. (2021), which suggests that subjects with an independent field-type cognitive style can understand and explain information about the given questions. Furthermore, Rizqi et al. (2021) posited that highly *self-confiden*t subjects can use terms and notations to present their mathematical ideas. Then with good *self-confidence*, students will be more willing to express opinions (Putri et al., 2020). This is what allows fi-t subjects to write down their ideas or ideas to describe the mathematical situation on the problem in the form of language or mathematical model using symbols or notations even though they have not been able to complete the complete steps to determine the right solution to the question on the problem.

On indicators of making conjectures, making arguments, formulating definitions and generalizations, fi-t subjects can write information about mathematical situations on the problem clearly and completely. The test results show that the subject can state his mathematical ideas or ideas using appropriate mathematical symbols or notations. The subject can make arguments accompanied by supportive and easy-to-understand explanations. The subject can understand the relationship between the answer to the part 4a question and the part 4b question so that the correct final result is obtained.

Based on the description above, it can be concluded that the subject can make a condition, compile arguments, formulate definitions and generalize mathematical ideas written to answer the problem well in line with research conducted by Saputra & Zulmaulida (2020), which suggests that a person who has an independent field-type cognitive style can understand and explain a verbal sentence analytically into a mathematical sentence. In addition, high *self-confidence* makes students feel less anxious and afraid to express their opinions (Purnomo & Wahyudi, 2021). This is what makes the FI-t subject able to state his ideas or ideas in solving the given mathematical problems, starting from formulating definitions, compiling arguments, making conjectures, and making generalizations of the answers that have been written systematically in accordance with the information on the problem.

Students' cognitive-style cognitive-communication skills are field independent (FI) type with low *self-confidence*.

The results showed that cognitively styled subjects of *field independent* type with *lace self-confidence*, namely FI-t subjects in the first indicator of mathematical communication ability to connect real objects, drawings, or diagrams, into mathematical ideas, based on the results of the test subjects could make mathematical notations to express their ideas or ideas in determining the steps of completion to show the relationship between images graph with a system of equations on the question. Still, the final answer is not yet correct. This is because the subject is wrong in performing the procedure/step to determine the value of the coordinates of the two points in the graph image.

This result is in line with the research conducted by Nurmalia et al. (2019), which says that subjects with an independent field-type cognitive style can respond, organizing information from the given problem to determine the step of completion. But furthermore, Purnomo & Wahyudi (2021) also explained that subjects with low *self-confidence* tend to struggle to express their ideas or ideas and find it difficult to express their mathematical information. This makes the subject of FI-t less able to explain his mathematical ideas well, so the completion step used is not precise, and the final result of the calculation to determine the value x and y as the coordinates of the two points in the given graph image is incorrect.

The second indicator is to explain mathematical ideas, situations, and relationships orally or in writing, with real objects, images, graphs, or algebraic forms, based on the test results showing that the subject can write down information about what is known and asked about the problem completely and

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clearly. The subject can make notations in the form of foraling using variables x and y accompanied by the meaning of each variability so that it can be understood. The subject makes two equations for the mathematical situation on the problem, but it is not accompanied by an explanation of the equations' meaning, so it is less clear. Furthermore, the subject has not been able to decipher the idea of solving the equations or algebraic forms created to express or denote the mathematical situation of the problem in the form of a graph.

This analysis's results align with the statement (Malaya et al., 2021) that subjects with an independent field-type cognitive style can write and explain mathematical ideas well even though they are still not quite right. Furthermore, research conducted by Rini & Roza (2020) also revealed that subjects with low self-confidence have a low ability to communicate their mathematical ideas and ideas in the form of pictures, graphs, diagrams, or tables, as well as the ability to use mathematical symbols.

In the third indicator, which is to state everyday events in the language of mathematics, the subject of FI-r can present his ideas or ideas to express the mathematical situation on the problem in the form of mathematical equations accompanied by supporting information so that the intention of the equations made can be adequately understood. However, the mathematical equations created have not been able to describe the entire mathematical situation of the problem. Furthermore, the subject cannot state the completion step to determine the final answer to the mathematical model that has been created. The results of this study, in line with the research conducted by (Purnomo & Wahyudi, 2021), revealed that subjects with *self-confidence* could express ideas using symbols and mathematical notations even though they were still not quite right.

The fourth indicator is to make contours, compile arguments, and formulate definitions and generalizations; based on the test results, showing that FI-r subjects can write down and explain information about mathematical situations on the given questions clearly and easily understood. The subject creates a notation or mathematical model to state the situation of the problem equipped with supporting information so that it cannot be easily understood. The subject makes an argument in the form of a price or value for the variable x and as a step to determine the solution to the given problem. The subject can also make generalizations from the answers or arguments made in the section 4a question to solve the section 4b problem. But in the final result, the subject does not conclude the answers made to clarify the solutions obtained y. The results of this study are in line with research conducted by (Cholis, 2018) that students with an independent field-type cognitive style can relate their mathematical thinking in a separate but correct way, as well as write down ideas and relate a daily problem to a mathematical form well.

Students' mathematical communication skills are cognitively styled field dependent (FD), with high *self-confidence*.

Cognitive-style students of field-dependent type with high *self-confidence*, i.e., FD-t. There is an indicator of connecting real objects, drawings, or diagrams, to mathematical ideas, showing that the subject of FD-t tried to make a mathematical notation to determine the value x and of the system of equations as a step of determining the coordinates of two points of the system of equations, but the steps did not correspond to the method that has to be done. This is in line with research conducted by Rini & Roza, (2020) which states that students with high self-confidence are less able to describe mathematical ideas correctly to determine problem-solving. Further research conducted (Cholis, 2018) also revealed that subjects with field-dependent type cognitive styles in linking their mathematical ideas tend to make completion steps that are less in accordance with the procedure.

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In indicators explaining mathematical ideas, situations, and relationships orally or in writing, with real objects, images, graphs, or algebraic forms, FD-t can communicate mathematical ideas or ideas to express mathematical situations on problems into algebraic forms or mathematical equations using symbols or notations accompanied by supporting information for each variable of the linear equation system created, but the mathematical equations created have not been able to represent the whole mathematical situation on the problem, especially in the second equation written. This is in line with Andriyani (2018) research that students with *field-dependent* type cognitive styles make mistakes in making mathematical models for given problem situations. Furthermore, Nurmalia et al. (2019) also revealed that subjects with *a field-dependent* cognitive style in using mathematical language could not write down mathematical symbols and operations perfectly and could not understand the mathematical problem-solving strategies given.

The third indicator is to state everyday events in the language of mathematics. The test results show that the subject can write down information about the mathematical situation on the question completely and clearly so that the intention of the question can be understood. The subject can state the mathematical situation of the problem in the form of a mathematical model or equation using symbols and mathematical notation accompanied by supporting information or explanations. Still, the idea of solving to determine the solution to the problem's mathematical problem is not correct, so the results written are not appropriate.

In the indicators of making contours, compiling arguments, and formulating definitions and generalizations, based on the test results showed that the subject of FD-t can make arguments for the form of price reversals for the value of each variable x and in the equations made adjusted to the information obtained in the questions to obtain results that are in accordance with the total value of the price specified in the question. However, the subject does not generalize the answers that have been made to the part 4a questions to answer the section 4b questions. From this presentation, it can be concluded that the subject of FD-t can communicate mathematical ideas or ideas to solve mathematical problems in problems by making arguments and formulating definitions but not making generalizations from the ideas or arguments made.

Overall, the results of this analysis align with research conducted by Cholis (2018), which said that subjects with field-dependent type cognitive styles are still less careful in using mathematical language to express their mathematical ideas. Further research (Rini & Roza, 2020) also revealed that students with high *self-confidence* could not correctly represent their mathematical ideas in written form to solve math problems.

Students' mathematical communication skills are cognitively styled field-dependent (FD) with low *self-confidence*.

Field-dependent type cognitive-style students with low self-confidence are FD-r. In indicators connecting real objects, drawings, or diagrams, the subject writes down information from the given questions that is incomplete and difficult to understand. The subject cannot express mathematical ideas or ideas to show the relationship between graphic images and equations in the problem. The subject is having difficulty in stating the relationship between the graphic image and the equation system in the problem because the subject does not understand the steps to determine the coordinates of the point and from the equation system in the problem as part of the step of connecting the graphic image into the mathematical equation on the problem. This study's results align with the results of research conducted (Purnomo & Wahyudi, 2021), which revealed that subjects with low xy *self-confidence* could not correctly explain their mathematical ideas or ideas from the form of images.

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In the indicator of explaining mathematical ideas, situations, and relationships orally or in writing, with real objects, images, graphs, or algebraic forms, the subject of FD-r can understand the mathematical problems that exist in the problem. However, the subject cannot express his mathematical ideas or ideas in the form of notations, symbols, or mathematical models that correspond to the situation on the problem. The subject writes the sentence *kucin*g + bird=16 and cat's foot + bird's foot =46 to describe the situation on the question. The subject does not write down the completion steps to determine the solution to the given mathematical problem. The results of this study are in line with research conducted by Yuzalia et al. (2021) also stated that subjects with dependent field-type cognitive styles were unable to express mathematical ideas in the form of images and were wrong in transforming mathematical ideas into the form of notation in determining the meaning of mathematical problems given.

On the indicator of stating everyday events in mathematical language, the subject of FD-r cannot express mathematical ideas or ideas in the form of symbols or mathematical notations but simply writes down sentences of 4 candies + 3 candies = 2500 and 2 candies + 7 candies = 2900 to state the mathematical situation on the problem. In addition, the subject also does not write down the idea of solving the problem. In line with the results of a study conducted by Cholis (2018), subjects with field-dependent type cognitive styles are less able to use mathematical language in expressing their mathematical ideas in the form of symbols.

In the fourth indicator, namely making a condition, compiling arguments, and formulating definitions and generalizations, the subject cannot compile an argument to determine a solution in the form of a price foralization corresponding to the amount of the price of pants and t-shirts known to the question. The subject cannot put forward the idea of completion using appropriate notations, models, or mathematical procedures. In line with research conducted by Badjeber & Mailili (2018), students with *field-dependent* cognitive styles cannot apply appropriate procedures in solving a problem, and it is difficult to modify the procedure using mathematical symbols to perform problem-solving.

Similarly, it was also stated by Witkin (1977) that students with *field-dependent* cognitive styles have difficult characteristics in ordering and organizing information. The subject is difficult to accept the change of context. In addition, low *self-confidence* also affects the subject's ability to express mathematical ideas or ideas. As stated (Triana & Rahmi, 2021), the low level *of self-confidence* possessed by the subject also affects low communication skills, particularly in expressing mathematical concepts by stating everyday events into mathematical models. Subjects with low self-confidence give up more easily or, in other words, have weak fighting power in facing or solving a problem (Dini et al., 2018).

Based on the description of the discussion of the research results that have been presented, it can be seen that students' cognitive styles and self-confidence affect the way students communicate mathematical information. *Self-confidence* has an important role in communication skills, where good *self-confidence* will encourage a bold attitude in students to express opinions of their mathematical ideas or ideas (Purnomo & Wahyudi, 2021).

The different level of *self-confidence* that students have also affects the student's ability to communicate mathematical ideas that have to solve a problem. Students with high *self-confidence* are better able to express their mathematical ideas or ideas, even though the final result of the solution given is not yet correct. This can be seen in the results of students' answers, who can write down the idea of solving and explain information related to the problem situation clearly equipped with supporting information so that it is easy to understand, even though the results of the solution given are not yet correct. Meanwhile, students with low *self-confidence* tend to find it difficult to communicate their mathematical ideas using language or mathematical models that are in accordance

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with the situation information on the given questions. The results of the research were also carried out by (Rizqi et al., 2021) revealed that mathematical communication skills in terms of student *self-confidence* showed mixed results in solving mathematical communication problems.

Furthermore (Ali et al., 2019), their research also generally concluded that there are differences in mathematical communication for each level of *self-confidence*. Thus, it can be concluded that cognitive styles and *self-confidence* influence a person's way of processing and recommunicating information to his ideas or ideas. However, students' cognitive style and *self-confidence* are not necessarily the main factors for whether or not students' mathematical communication skills are good but are also influenced by the student's learning process. This can be seen from several student statements in the interview results, which revealed that students could not understand the material learned during the learning process. Students cannot understand the mathematical concepts of the material studied, so they find it difficult to relate their ideas or ideas with the steps or methods of solving that will be used in explaining a mathematical situation. So it is concluded that students' mathematical communication skills are influenced by their cognitive style and self-confidence and need to be developed through the learning process. This is in line with (Saputra & Zulmaulida, 2020), who revealed that the differences in cognitive styles students have will also change their mathematical communication skills depending on the learning process. Mathematical communication skills and *self-confidence* can be grown through the learning process, of course, with the participation of teachers as facilitators and motivators for students (Pangestu et al., 2020). The same thing is stated (Nurqolbiah, 2016) that the main shaper of *self-confidence* in mathematics learning is through interaction between teachers, students, and fellow students.

CONCLUSION

Based on the results of research and discussion, it can be concluded that overall the subject has not been able to meet the four indicators of mathematical communication skills. Still, each student has characteristics in communicating their mathematical ideas or ideas, namely:

1. The mathematical communication ability of students who are cognitively styled field independent (FI) type with high self-confidence, namely: a) The subject can communicate his mathematical ideas to express the mathematical situation in the graph image into the form of linear equations in the problem. However, the Subject cannot write down conclusions about the relationship between the graphic image and the n-equivalent system present in the problem. b) The subject cannot communicate the idea of solving to express the mathematical situation in an algebraic form or a graphic image. c) The subject cannot communicate mathematical ideas or ideas. It is to appropriately express the mathematical situation on the problem in the form of language or mathematical model using symbols or mathematical notation. The subject cannot state the idea of solving from the mathematical model created to determine the solution of the mathematical problem to the problem. d) The subject can process the information on the problem and state the idea or idea of solving mathematics clearly and easily understood. The subject can make contours, compose arguments, and formulate definitions and generalizations of mathematical ideas written to answer the problem well.
2. The mathematical communication skills of cognitively styled field independent (FI) type students with low *self-confidence* are: a) The subject does not meet the indicators of connecting graphic images into mathematical ideas appropriately. This can be seen when the subject can state the idea of solving the situation in the graph image as a mathematical equation but not according to the step

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of solving. b) The subject cannot meet the indicators of explaining mathematical ideas, situations, or relations with algebraic and graphic forms precisely because the subject does not understand the methods or steps of solving the problem. c) The subject cannot meet the indicators of declaring everyday events in the language of mathematics, i.e., the subject cannot communicate the idea of solving to express the mathematical situation on the problem into the appropriate algebraic form or mathematical equation. But the subject can communicate information regarding what is known and what is asked on the question clearly. d) The subject can meet the indicators of making conjectures, formulating definitions, composing arguments, and making generalizations because the subject can communicate his mathematical ideas starting from formulating definitions, stating arguments, and generalizing to determine the solution to the problem.

3. Students' cognitive-style mathematical communication skills of field dependent type (FD) with*in self-confidence* I, namely: a) The subject cannot communicate his mathematical ideas or ideas to express graphic images into the form of mathematical equations appropriately. The subject cannot determine the method or step of completion to show the relationship between the graphic image and the system of equations in the problem. b) The subject cannot communicate mathematical ideas or ideas to express the solution to the problem situation in algebraic forms and graphic images. c) Subject cannot communicate his mathematical ideas or ideas to state the situation of the problem in the mathematical language and present solutions to mathematical problems in the problem, d) The subject can compose arguments and formulate definitions equipped with supporting information. Still, the subject does not make generalizations from the answers that have been made to solve all the problems in the problem.
4. The mathematical communication ability of students who are cognitively styled field dependent (FD) type with low *self-confidence*, namely: a) The subject cannot communicate his mathematical ideas or ideas to show that the situation in the graph image meets the mathematical equations in the problem. b) The subject cannot communicate his mathematical ideas or ideas to express the mathematical situation that exists in the problem in the form of algebra or the corresponding graphic image because the subject can not find a notation or symbol to represent the mathematical situation on the problem and does not understand the method of solving the solution to the problem. The subject cannot communicate his mathematical ideas or ideas using the right notations or symbols to express the situation on the problem in the right language or mathematical model. d) The subject cannot clearly and precisely communicate the arguments presented to solve the mathematical problems in the problem. The subject cannot present the mathematical situation in the form of notation or the appropriate mathematical model. However, it can be seen that the subject can communicate mathematical information on the problem by writing down what is known and asking about the problem clearly.

   Overall, the main obstacle to students' mathematical communication skills that belong to the low category is the lack of mathematical understanding of students, especially regarding the concepts and methods of solving the system of linear equations they learn, resulting in students not being able to communicate their mathematical ideas correctly and clearly.

REFERENCES

Achir, Y. S., Usodo, B., & Retiawan, R. (2017). Analisis Kemampuan Komunikasi Matematis Siswa Dalam Pemecahan Masalah Matematika Pada Materi Sistem Persamaan Linear Dua Variabel (Spldv) Ditinjau Dari Gaya Kognitif. *Paedagogia*, 20(1), 78-87

ISBN: 978-623-7496-62-5
Vol, 11 Issue 4

Ali, R. H., Roza, Y,. & Maimunah. (2020). Analisis Kemampuan Komunikasi Matematis Siswa Ditinjau dari Self Confidence Siswa MTs. *Jurnal Pendidikan Matematika APOTEMA*, 6 (1), 34-43.

Andriyani, A. (2018). Analisis kesalahan siswa dalam menyelesaikan soal cerita pada materi program linear ditinjau dari gaya kognitif siswa. *Pendekar: Jurnal Pendidikan Berkarakter*, *1*(1), 16–22.

Badjeber, R., & Mailili, W. H. (2018). Analisis Pengetahuan Prosedural Siswa Kelas SMP pada Materi Sistem Persamaan Linear Dua Variabel Ditinjau dari Gaya Kognitif. JPPM (Jurnal Penelitian Dan Pembelajaran Matematika), 11(2).

Cholis, N. (2018). *Gaya Komunikasi Matematis Siswa Ditinjau Dari Gaya Kognitif Peserta Didik Di Sekolah Berbasis Madrasah*.

Çiftçi, S. K., & Yildiz, P. (2019). The Effect of Self-Confidence on Mathematics Achievement: The Metaanalysis of Trends in International Mathematics and Science Study (TIMSS). *International Journal of Instruction*, *12*(2), 683–694.

Dini, M., Wijaya, T. T., & Sugandi, A. I. (2018). Pengaruh Self Confidence Terhadap Kemampuan Pemahaman Matematik Siswa SMP. *JURNAL SILOGISME: Kajian Ilmu Matematika Dan Pembelajarannya*, *3*(1), 1–7.

Hendriana, H., Sumarmo, U., & Rohaeti, E. E. (2016). Kemampuan Komunikasi Matematik serta Kemampuan dan Disposisi Berpikir Kritis Matematik (Eksperimen terhadap Siswa SMA Melalui Pembelajaran Berbasis Masalah). *Delta-Pi: Jurnal Matematika dan Pendidikan Matematika*. 2 (1), 35-45.

Inayah, N. (2016). Pengaruh Kemampuan Penalaran Matematis dan Gaya Kognitif terhadap Kemampuan Komunikasi dan Koneksi pada Materi Statistika Siswa SMA. *Journal of EST*, 2 (2), 74- 80.

Indraswati, D., Marhayani, D. A., Sutisna, D., Widodo, A., & Maulyda, M. A. (2020). Critical thinking dan problem solving dalam pembelajaran ips untuk menjawab tantangan abad 21. *Sosial Horizon: Jurnal Pendidikan Sosial*, *7*(1), 12–28.

Kamid, Rusdi, M., Fitaloka, O., Basuki, F. R., Anwar, K. (2020). Mathematical communication skills based on cognitive styles and gender. *International Journal of Evaluation and Research in Education (IJERE)*. 9 (4), 847-856.

Kaya, D., & Aydin, H. (2016). Elementary Mathematics Teachers' Perceptions and Lived Experiences on Mathematical Communication. *Eurasia Journal of Mathematics, Science & Technology Education.* 12(6), 1619-1629.

Malaya, Y., Sridana, N., Happi, Prayitno S. (2021). Analisis kemampuan komunikasi matematis tertulis dalam menyelesaikan masalah matematika ditinjau dari gaya kognitif siswa kelas VIII SMP. *Griya Journal of Mathematics Education and Application*. 1 (3). 442-447.

Maryanto, N. R., & Siswanto, R. D. (2021). Analisis Kemampuan Berpikir Kritis Matematis Ditinjau Dari Gaya Kognitif dan Gender. *ANARGYA: Jurnal Ilmiah Pendidikan Matematika*, 4(1), 109–118.

Mashlihah, L. N., & Hasyim, M. (2019). Pengaruh self-esteem, self-regulation, dan self-confidence terhadap kemampuan pemecahan masalah matematika. *JP2M (Jurnal Pendidikan dan Pembelajaran Matematika)*. 5 (2), 44-50.

Muniroh, S., Rosyana, T., & Hendriana, H. (2018). Hubungan Self-Cofidence dengan Kemampuan Komunikasi Matematik Siswa SMP. *JPMI–Jurnal Pembelajaran Matematika Inovatif*, 1 (4), 479-486.

Noviyana, I.N., Dewi, N.R., & Rochmad. (2019). Analisis Kemampuan Komunikasi Matematis Ditinjau dari Self Confidence. *PRISMA, Prosiding Seminar Nasional Matematika 2*. 704-709.

Nurmalia, I., Yuhana, Y., & Fatah, A. (2019). Analisis Kemampuan Komunikasi Matematis Ditinjau dari Gaya Kognitif pada Siswa SMK. *Journal of Authentic Research on Mathematics Education (JARME)*. 1 (2), 105 – 111.

Nurqolbiah, S. (2016). Peningkatan Kemampuan Pemecahan Masalah, Berpikir Kreatif dan Self-Confidence Siswa Melalui Model Pembelajaran Berbasis Masalah. *Jurnal.unsil.ac.id/index.php/jp3m*. 2 (2) 143–158.

ISBN: 978-623-7496-62-5
Vol, 11 Issue 4

Pangestu, C., Sujati, H., & Herwin, H. (2020). Pengaruh Self Efficacy dan Pengasuhan Orang Tua terhadap Keercayaan Diri Siswa. *FOUNDASIA*. 11(1), 35-42.

Purnomo, R. W. A., & Wahyudi. (2021). Peran Self Confidence Bagi Kemampuan Komunikasi Matematis Siswa. *Jurnal Edupedia Universitas Muhammadiyah Ponorogo*. 5(2), 1-17.

Putri, T. A. E., Jamiah, Y., & Sayu, S. (2020). Kemampuan Komunikasi Matematis Siswa Dikaji dari Self Confidence. *Jurnal Alpha Euclid Edu*. 1 (2), 83-93.

Rini, R. H. A., & Roza, Y. (2020). Analisis Kemampuan Komunikasi Matematis Siswa Di Tinjau Dari Self Confidence Siswa MTs. *APOTEMA: Jurnal Program Studi Pendidikan Matematika*, *6*(1), 34–43.

Riswandha, S. H., & Sumardi, S. (2020). Komunikasi Matematika, Persepsi pada Mata Pelajaran Matematika, dan Kemandirian Belajar terhadap Hasil Belajar Siswa. *Jurnal Mercumatika: Jurnal Penelitian Matematika dan Pendidikan Matematika*. 4 (2), 84-93.

Rizqi, H. Y., Waluya, S. B., & Wiyanto, W. (2021). Mathematics communication skill viewed from self-confidence in Auditory Intellectually Repetition (AIR) learning model with RME approach. *Unnes Journal of Mathematics Education Research*, *10*(A), 162–167.

Saputra, E. & Zulmaulida, R. (2020). Pengaruh Gaya Kognitif terhadap Kemampuan Komunikasi Matematis melalui Analisis Koefisien Determinasi dan Uji Regresi. *Jurnal Ilmiah Pendidikan Matematika AL-QALASADI*. 4 (2), 69-76

Sayogo, T. H., Siswanto, R. D., & Nurafni. (2020). Analisis Kemampuan Koneksi Matematis Peserta Didik Ditinjau dari Gaya Kognitif Materi Kubus dan Balok. *UNION: Jurnal Pendidikan Matematika*. 8 (2), 277-288.

Triana, C. R., & Rahmi, D. (2021). Kemampuan Komunikasi Matematis Pada Materi Lingkaran: Analisis Deskriptif Berdasarkan Self Confidence Siswa SMP IT Insan Utama 2. *JURING (Journal forResearch in Mathematics Learning)*, *4*(1), 19–28.

Witkin, G. A., Moore C. A., Goodenough, D. R., & Cox, P. W. (1977). Field-Dependent and Field-Independent Cognitive Styles and Their Educational Implications. *Review of Educational Research Winter*. 47 (1), 1-64.

Yuzalia, Y., Nufus, H., & Hasanuddin, H. (2021). Analisis Newman's Error Penyelesaian Soal-Soal Pada Materi Himpunan Berbasis Kemampuan Komunikasi Matematis berdasarkan Gaya Kognitif dan Habits of Mind. *JURING (Journal for Research in Mathematics Learning)*, *4*(2), 113–122