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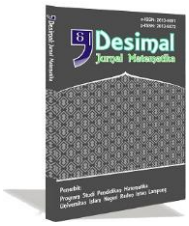

Cognitive style: Student problem solving on integer count operations

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ABSTRACT

This study aims to describe the profile of students who have Field Independent (FI) and Field Dependent (FD) cognitive styles in solving integer counting operation problems. This type of research is descriptive research. The approach used in this study is a qualitative approach. The results of this study show the profile of student problem solving with FI and FD cognitive styles in solving integer counting operation problems. (1) Student problem-solving profile with FI cognitive style in solving integer counting operation problems. Subject FI can determine and declare the elements that are known, that are questioned, and the sufficiency of other elements. Subject FI shows good ability in implementing problem-solving strategies with correct and thorough steps. Subject FI can explain the results of the completion orally and in writing. (2) Student problem-solving profile with FD cognitive style in solving integer counting operation problems. Subject FD can determine and state the elements that are known, that are asked, and the sufficiency of other elements, even though Subject FD reads the question repeatedly and takes a little longer, but Subject FD seems to understand the problem because it can determine and express the information from the question. Subject FD can compile a mathematical model from the problem. However, the mathematical model that was written did not use parentheses, so the sequence of operations did not correspond to the context of the story. Subject FD is still wrong in solving the problem so that the answers obtained are not correct. Subject FD can explain the results of the settlement orally, but does not write them in writing on the answer sheet.

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INTRODUCTION

Mathematics learning expects students to be able to understand the given problems so that they can solve them correctly. Solving problems is an important part of learning mathematics because learning mathematics is essentially a series of problem-solving activities (Afrilia, Sugita, & Rochaminah, 2022). Krulik and Rudnick (as cited in Budiarti & Lestariningsih (2018)) stated that problem solving is a way that a person

uses knowledge, skills, and understanding to meet the demands of students who are not routine. Therefore, in solving the problem, students must understand the meaning of the question, know the information in the question, and be able to use the correct procedure or completion steps in order to be able to do it well.

According to Haryati, Suyitno, & Junaedi (2016), the competence that students must have in solving a story problem is verbal ability, which means the ability to understand problems and interpret them so that they can turn them into mathematical models. In addition, algorithmic ability is also needed, namely the ability of students to determine the right algorithm in solving problems, the accuracy of calculations, and the ability of students to draw conclusions from the results of calculations that students do and relate them to the initial questions to be solved. But in reality, students' mastery of mathematics is still not as expected because there are still many students who have not been able to solve the questions given correctly.

According to Meisura, Risnawati, & MZ (2019), difficulty learning mathematics is a disruption to one or more basic psychological processes in understanding or using written and spoken language, which will be seen in the ability to listen, think, read, and complete mathematical calculations. The important thing for students when solving problems is that they manage to find the information in the question and can correctly complete each procedure or step to solve it so that they get the correct final answer in the question. One of the materials that students have not mastered and completed correctly is integer counting operations. One of the factors causing students' difficulties in solving problems is the lack of students' ability to understand the meaning of the story questions well, as expressed by Baskorowati (2021). According to Utami & Zulkarnae (2019), students have difficulty solving story problems because they are not proficient in understanding the language used in the questions and lack the ability to manipulate the questions.

Based on the results of interviews with the mathematics teacher of 7th grade at SMP Negeri 4 Palu, information was obtained that some students were still unable to solve problems in the integer calculation operation material, especially when faced with story problems and problems that are directly related to daily life, and have not been able to explain the information in the form of mathematics. Some students get the final answer and the right completion process. Some students get the final answer right, but the completion process is still wrong. In fact, there are students who are still wrong both in the final answer and the completion process. However, teachers at school also do not know exactly the characteristics of students in solving math problems, so they have not provided appropriate learning strategies.

Some previous research that are relevant to this research are: (1) research conducted by Guci, Ismaimuza, & Lefrida (2024). The research has relevance to this research, which lies in the focus of research on the problem-solving profile and discussing cognitive styles. The difference from previous research lies in the material used and the selection of research subjects. Previous research discussed geometry material, while researchers wanted to discuss integer count operation material; (2) research conducted by Bakri, Awuy, Ishariyadi, & Hadjar (2022). The relevance of the previous research to this study lies in the focus of the research on the profile of problem-solving and discussing cognitive style, field-dependent and field-independent. The differences from previous research are the material studied, the selection of research subjects, and the place of research; and (3) research

conducted by Latuputty, Laurens, & Ngilawajan (2024). The relevance of previous research with this study is to discuss the profile and discuss the cognitive styles of field-dependent and field-independent. The difference from the previous research is that the previous research discussed the problem-solving profile while the researcher discussed the problem-solving profile. Another difference is the research subject and the location of the research.

According to Syadiah, Yulianti, & Zanthy (2020), students' mistakes in doing math problems tend to be story problems because students experience several difficulties. There are several factors that affect students in solving math problems, one of which is cognitive style. Each individual has a different cognitive style, one of which is cognitive style Field Dependent (FD), and cognitive style Field Independent (FI) is a type of cognitive style that describes the process of analyzing a person interacting with their environment (Mubarok & Kurniasari, 2019). Each student has a different level of cognitive ability. Individual differences in cognitive development point to differences in learning ability and speed. There are some students who are fast in understanding the material taught by the teacher, but there are some students who are slow (Azizaha, Zaenurib, & Kharisudin, 2020).

According to Wakit & Hidayati (2020), the FI cognitive style is a type of cognitive style of an individual with a character that tends to look at a problem analytically so that it can analyze and separate relevant information, find patterns, and critically assess a problem. FI's cognitive style is able to distinguish objects from the surrounding context more easily and can express a picture regardless of the background of this picture and has an analytical view and is able to complete tasks about analysis and differences. While FD is the opposite of FI, where the individual will view things universally and tend to be highly social and consider themselves to be part of a group. The individual will be perceptive and have a high social spirit (Mayanto, Zulfikar, & Faisal, 2020).

Based on this description, the objectives to be achieved in this study are (1) describe the profile of students who have a field-independent (FI) cognitive style in solving integer calculation operation problems and (2) describe the profile of students who have a field-dependent (FD) cognitive style in solving integer calculation operation problems.

METHOD

In this study, the researcher used indicators of solving mathematical problems according to Sumarmo (as cited in Budiarti & Lestariningsih (2018)), namely:

a. Identify the elements that are known, that are being questioned, and the adequacy of the elements that are needed.
b. Formulating mathematical solutions or compiling mathematical models.
c. Apply strategies to solve various problems (similar and new problems) in or outside of mathematics.
d. Explain or interpret the results of the solution using mathematics in a meaningful way.

Figure 1 provides an overview of the design and flow of research conducted in this study.

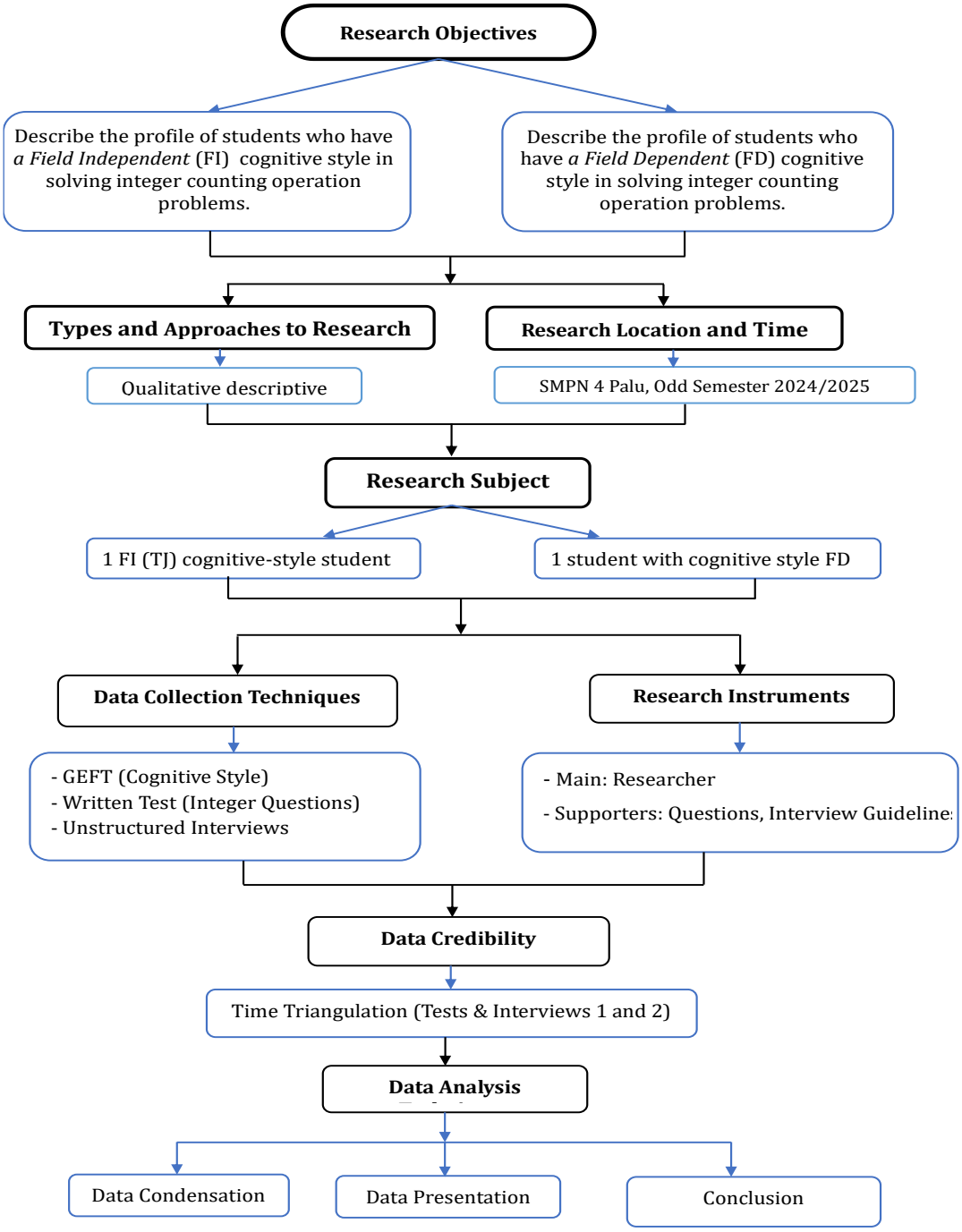

Figure 1. Research Design

RESULTS AND DISCUSSION

The subjects in this study were determined by giving a cognitive style test in the 7th grade at Delima SMP Negeri 4 Palu. The cognitive style test used is the Group Embedded Figure Test (GEFT). Based on the results of the GEFT test, the researcher took data from 2 students, namely one student with the Field Independent (FI) cognitive style category and one student with the Field Dependent (FD) cognitive style category.

Table 1. Research Subject

Yes	Subject Code	Test Scores	Categories Cognitive Styles
1.	TJ	17	Field Independent (FI)
2.	MN	2	Field Dependent (FD)

Data exposure was followed by a data credibility test using time

triangulation. Based on the data credibility test, it was obtained that the TJ subjects and MN subjects in solving the questions had shown credible data.

Data Analysis of TJ Subjects' Independent Field Cognitive Style in Solving Problems Based on Problem-Solving Indicators

a) Exposure to TJ subject problem-solving data in identifying the elements that are known, asked, and the adequacy of the necessary elements

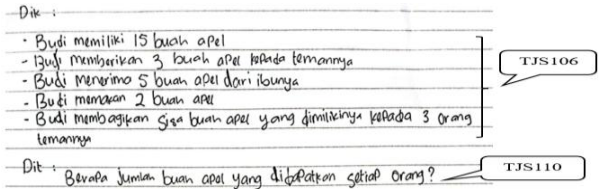

Figure 2. Analysis of TJ Subject's Written Test Answers in Completing S1

Here are the results of the interview:

NJS105 : Okay, then what information is known about the question?

TJS106 : What is known from the question is that Budi has 15 apples. Then he gave 3 apples to his friend, then he received 5 apples from his mother. Budi also ate 2 apples and distributed the rest of the apples he had to 3 of his friends.

NJS109 : Okay then what is being asked in this matter deck?

TJS110 : What was asked was how many apples each person or Budi's friend got.

NJS113 : Do you think the information in the question is enough to answer this question?

TJS114 : Yes, that's enough.

Based on the written test answers seen in Figure 2 and the interview data, it shows that the TJ subject can write and mention in detail the known elements of the question and the elements asked, and realize the sufficiency of the necessary elements.

b) Display of TJ Problem Solving Data in formulating mathematical solutions or compiling mathematical models

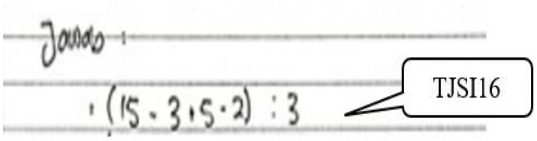

Figure 3. Analysis of TJ Subject's Written Test Answers in Completing S1

Here are the results of the interview:

NJS115 : Okay, here you write $(15 - 3 + 5 - 2)/3$. Can you explain why you wrote this operation?

TJSI16 : I wrote a mathematical model of this problem. Initially 15, then given 3, so it was reduced. After that, you can get another 5 so it is added. Continue to eat 2, so less so. Well, the rest of the apples were only divided among 3 friends, so they were divided into 3.

Based on the written test answers seen in Figure 3 and the interview data, it shows that TJ subjects can formulate mathematical solutions or construct mathematical models of the problem correctly.

c) Exposure to TJ Problem Solving Data in applying strategies to solve various problems (similar and new problems) in or outside mathematics

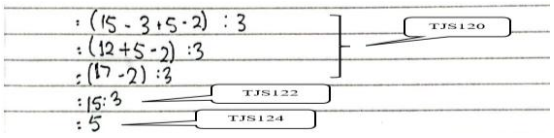

Figure 4. Analysis of TJ Subject's Written Test Answers in Completing S1

Here are the results of the interview:

NJS117 : Okay, what strategy do you use to solve this problem?

TJS118 : First, I looked for the leftover apples owned by Budi before distributing them to 3 of his friends.

NJS119 : How do I do the deck?

TJS120 : Initially, Budi had 15 apples. Then he gave 3 apples to his sister, so that the rest of the apples fell to $15 - 3 = 12$ fruits. After that, Budi gets an additional 5 apples from his mother, so that the number of apples he has becomes $12 + 5 = 17$ pieces. Furthermore, Budi ate 2 apples, so the number of apples left was $17 - 2 = 15$ apples. So, Budi has 15 apples.

NJS121 : Next, how about the deck? Why do you write $\frac{15}{3}$ here?

TJS122 : If this is my brother, I wrote because the number of apples that Budi had before they were distributed to his friends was 15 pieces. I divided it by 3 because Budi had 3 friends who would receive apples.

NJS123 : So, what is the final result of the deck?

TJS124 : The result is 5, Sir. So, each of Budi's friends gets 5 apples.

Based on the written test answers seen in figure 4 and the interview data, it shows that TJ's subjects can apply strategies to solve various problems (similar and new problems) in or outside mathematics; namely, TJ first searches for the remaining apples owned by Budi before distributing them to his friends, and then, after knowing the number of apples left over that TJ has, divides the remaining number of apples owned by 3. TJ applies the correct strategy and does the correct calculations in solving the problems.

d) Exposure of TJ Problem Solving Data in explaining or interpreting the results of solving using mathematics in a meaningful way

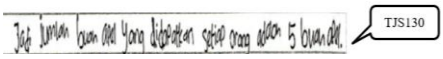

Figure 5. Analysis of TJ Subject's Written Test Answers in Completing S1

Here are the results of the interview:

NJS125 : Okay, are you sure of this answer?

TJS126 : Yes, I am sure.

NJS127 : Then, do you recheck your answer?

TJS128 : Yes, sir, I recalculated before I collected my answers.

NJS129 : Oh, yes. So, what is the conclusion of the problem?

TJS130 : The conclusion is that each of Budi's friends gets 5 apples.

Based on the written test answers seen in Figure 5, the interview results show that TJ subjects can explain or interpret the results of the completion using mathematics in a meaningful way; namely, TJ feels confident in the answer, TJ also double-checks the answers, and TJ can write conclusions on the answer sheet and reveal the conclusions of the problem-solving process.

Data Analysis of MN Subjects' Field Dependent Cognitive Style in Solving Problems Based on Problem-Solving Indicators

a) Exposure to MN Problem-solving data in identifying the elements that are known, asked, and the adequacy of the elements needed

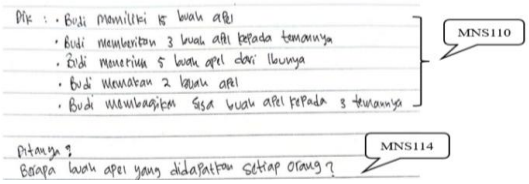

Figure 6. MN Subject Written Test Answer Analysis in Completion

Here are the results of the interview:

NJS109 : Okay, then what information is known about the question?

MNS110 What is known is that Budi has 15 apples. Then he gave 3 apples to his friend, then Budi received 5 apples from his mother. Budi also ate 2 apples and distributed the rest of the

apples he had to 3 of his friends.

NJS113 : Okay, good. Then, what is the question asked?

MNS114 : What was asked was the number of apples that each of Budi's friends got.

NJS117 : Do you think the information in this question is enough to answer that question?

MNS118 : Hmmm, yes, that's enough.

Based on the written test answers seen in Figure 6 and the interview results data, it shows that MN subjects can write and explain the known elements of the question, the elements asked, and the sufficiency of the necessary elements.

b) Exposure of MN Problem-solving data in formulating mathematical solutions or compiling mathematical models

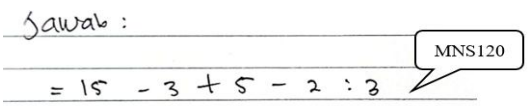

Figure 7. Analysis of MN Subject Written Test Answers in Completing S1

Here are the results of the interview:

NJS119 : Okay, I see in your answer you wrote $= 15 - 3 + 5 - 2 : 3$. Why do you write down mathematical operations like this? What do you think each number and sign here means?

MNS120 : I wrote $= 15 - 3 + 5 - 2 : 3$ because initially there were 15 apples, then I subtracted 3 because they were given by friends, plus 5 because they were obtained from my mother, subtracted by 2 because they were eaten, and then the rest was divided among 3 friends.

Based on the written test answers seen in Figure 7 and the interview data, it shows that MN subjects show the initial ability to formulate mathematical solutions from story problems by relating each piece of information in the problem to the form of mathematical operations. However, the mathematical model that was written did not use parentheses, so the sequence of operations did not correspond to the context of the story. This shows that MN has not yet understood the formal structure of compiling mathematical models.

c) Exposure to TJ Problem-solving data in applying strategies to solve various problems (similar and new problems) in or outside mathematics

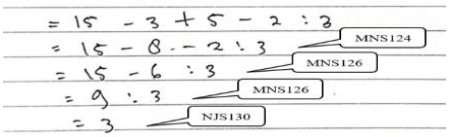

Figure 8. Analysis of MN Subject Written Test Answers in Completing S1

Here are the results of the interview:

NJS121 : When you calculate this, which step do you do first, second, and so on, until you get answer 3?

MNS122 : First, I write the mathematical model like this (showing the answer in the first line).

NJS123 : Well, in the second line you write $15 - 8 - 2/3$. Where does this number 8 come from?

MNS124 : Oh yes, I immediately added 3 and 5 to 8.

NJS125 : Then in the next line you write $15 - 6/3$. How do you get a 6 there?

MNS126 : That... I am confused in the division. So, I immediately calculated $8 - 2 = 6$.

NJS127 : So, you do the subtraction before the division?

MNS128 : Usually multiplication equals division first, then adds equal less. But here I seem to be straight from the left.

MNS129 : Yes, I do.

NJS130 : Now, look at your final answer, which is 3. What does the

number 3 mean in this matter? That is, what are 3?

MNS131 : That means that each of Budi's friends gets 3 apples.

Based on the written test answers seen in Figure 8 and the interview data, it shows that MN subjects can apply strategies to solve various problems (similar and new problems) within or outside mathematics. Subject MN has a fairly good initial understanding of solving problems, shown by his ability to turn verbal problems into mathematical models. However, the settlement strategies used are still procedural and mechanical, without a deep conceptual understanding. The subject has not fully applied the rules of mathematical operations correctly, even though MN has figured out the sequence in theory.

d) Exposure of TJ Problem-solving data in explaining or interpreting the results of solving using mathematics in a meaningful way

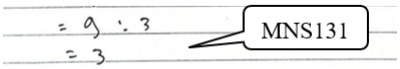

Figure 9. Analysis of MN Subject Written Test Answers in Completing S1

Here are the results of the interview:

NJS130 : Now, look at your final answer, which is 3. What does the number 3 mean in this matter? That is, what are 3?

MNS131 : That means that each of Budi's friends gets 3 apples.

NJS132 : Oh yes, did you double-check your answer before you got together?

MNS133 : No, sir.

NJS134 : Okay, what is the conclusion of your answer?

MNS135 : The conclusion is that each of Budi's friends gets 3 apples.

Based on the written test answers seen in Figure 9 and the interview data, it shows that MN subjects have a good understanding of interpreting the results of the completion meaningfully. MN is able to explain the meaning of the final result of the calculation and convey conclusions orally. However, this understanding is not yet fully reflected in the written answer sheet, and the aspect of reflection on the answers (through re-examination) still needs to be improved.

Field Independent (TJ) Cognitive Style Student Problem Solving Profile

The subject of TJ is identifying the elements that are known, that are asked, and the sufficiency of the necessary elements; that is, TJ can determine and state the elements that are known, that are questioned, and the sufficiency of other elements. TJ can understand the problem because he can determine and state the information from the problem. This is in line with Maghfiroh & Wantika (2020), which states that the subject field independent is able to understand the problem very well. This is because the subject can identify information and problems accurately and correctly and express the information in the problem clearly. In addition, the subject can. Identify available data to resolve issues appropriately.

TJ's subject in formulating mathematical solutions or compiling mathematical models, can compile mathematical models from the information in the problem. This is in line with Satila, Prayitno, Novitasari, & Baidowi (2024), which states that FI students are able to relate information and write it down because FI has the ability to remember information that has been worked on in detail to help design a plan in compiling steps to get the correct and appropriate solution.

TJ's subject in applying strategies to solve problems (similar and new problems) in or outside mathematics, TJ first looked for the remaining number of apples owned by Budi before distributing them to 3 of his friends. TJ also carried out calculations and correct calculation

operation steps in solving problems. The subject's ability to choose strategies, apply strategies, and perform calculations correctly reflects the individual's predisposition to cognitive style, Field Independent who tend to be analytical in solving problems. As stated by Haryanie, Siregar, & Elvi (2024), students with cognitive styles who are field independent can use all information in detail, can apply information by solving problems well, and can distinguish surrounding objects. This is in line with Satila et al. (2024), which states that FI students are meticulous in doing calculations with the correct procedures and the correct final result in solving problems because FI can correct errors in calculations so as to get the correct final result.

TJ's subject in explaining or interpreting the results of the completion using mathematics in a meaningful way; that is, TJ can explain the results of the completion orally and in writing. TJ can also believe in the process and final results of solving questions that are done orally, and reveal that he has re-examined the answers. This is in line with Satila et al. (2024), which states that FI students are able to make appropriate conclusions and check the answers to calculations because FI is skilled in organizing concepts so that the solution is appropriate.

Field Dependent (MN) Cognitive Style Student Problem Solving Profile

MN subjects in identifying the elements that are known, that are asked, and the sufficiency of the necessary elements, namely, MN can determine and state the elements that are known, that are asked, and the sufficiency of other elements, even though MN reads the question repeatedly and takes a little longer, but MN seems to understand the problem because it can determine and express the information from the question. Characteristics of students with cognitive styles of field dependent are seen in the way MN subjects identify the information from the problem. This is according to the characteristics of field dependent which tends to depend on the completeness of the context and requires more information to understand the meaning of the problem as a whole. As stated by Rahmasari & Setyaningsih (2023), students with cognitive styles of field dependent have limitations in analyzing problems, which results in difficulties in interpreting problems. This makes MN need more effort in sorting out information from the question, but it can be seen that MN can still determine and state the elements that are known and asked from the question. This is in contrast to research by Simanjuntak, Dewi, & Simamora (2022), which states that FD students are less able to decipher the information received on the question to be rewritten on the answer sheet.

MN subjects in formulating mathematical solutions or compiling mathematical models, namely MN can compile mathematical models from problems; this shows the initial ability to formulate mathematical solutions from story problems by relating each piece of information in the problem into the form of mathematical operations. However, the mathematical model that was written did not use parentheses, so the sequence of operations did not correspond to the context of the story. This is in line with the research of Wulan & Anggraini (2019), which stated that FD subjects completed the process accompanied by making operational errors and did not even carry out the process of carrying out the plan.

MN subjects in applying strategies to solve problems (similar and new problems) in or outside mathematics, in the process of solving MN problems, are still wrong in solving problems so that the answers obtained are not correct because in the process of solving MN problems perform mathematical operations without considering the meaning of these numbers

in the context of the problem. This is in line with the research of Wati, Setiawan, & Anwar (2023), who stated that at the stage of implementing a solution strategy for subjects with a cognitive style, field-dependent subjects are less able to solve problems according to the plan that has been made previously. MN's mistake in carrying out the settlement strategy shows that MN still needs more information and guidance to avoid procedural errors. As stated by Janah, Rasiman, & Handayanto (2021), FD characteristics tend to have difficulty processing separate or unstructured information, receiving information globally, and require clearer instructions from teachers or friends on how to solve problems.

MN subjects in explaining or interpreting the results of the completion using mathematics in a meaningful way, namely, MN can explain the results of the completion orally, but do not write in writing on the answer sheet. This is in accordance with the results of research by Annisa & Kartini (2021) that the mistakes of field-dependent students are not knowing how to correct their answers correctly, and being too lazy to double-check the final answers they obtained. MN was not sure of the answer to his work and did not re-examine his answer because he thought the answer was wrong. This is in line with the research conducted by Wulan & Anggraini, 2019), stating that FD subjects did not check the re-examination of the settlement because the settlement plan used was less relevant.

CONCLUSIONS AND SUGGESTIONS

The solving profile of integer counting operations of students with FI cognitive style is that TJ can determine and state the elements that are known, that are asked, and the sufficiency of other elements of the problem. TJ can compile a mathematical model from the information in the problem. TJ shows good ability in implementing problem-solving strategies with correct and careful steps, and TJ can explain the results of the solution orally and in writing. The profile of solving the problem-solving of integer calculation operations of students with the FD cognitive style is that MN can determine and state the elements that are known, that are asked, and the sufficiency of other elements, even though MN reads the question repeatedly and takes a little longer, but MN seems to understand the problem because it can determine and express the information from the question. MN can compile a mathematical model from the problem. However, the mathematical model that was written did not use parentheses, so the sequence of operations did not correspond to the context of the story. MN is still wrong in solving the problem so that the answers obtained are not correct, and MN can explain the results of the solution orally, but do not write them in writing on the answer sheet.

Based on the discussion and conclusions, the researcher suggests (1) it is recommended to teachers to better recognize the characteristics of students in their classes, because differences can affect the way students process and receive information in the form of learning materials, and (2) it is recommended to teachers to use learning methods and other supporting factors that are more in accordance with the characteristics of students, especially students with a field-dependent cognitive style.

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