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Students' problem-solving ability in number patterns topic viewed from cognitive styles

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Abstract

Mathematical problem-solving skills are essential. However, students' ability to solve number patterns problems topic has not been optimal. The results of previous studies show different problem-solving skill profiles in students with Field Dependent (FD) and Field Independent (FI) cognitive styles in geometry and algebra. Therefore, this study aims to describe the problem-solving ability of students in number patterns based on cognitive styles. The research used qualitative methods with a descriptive approach. The study involved all students of grade 8 at a public junior high school in Klaten Regency, Central Java, Indonesia. Four students were selected for in-depth analysis by administering the Group Embedded Figure Test (GEFT) test and many patterns problem-solving test. Instruments used in this study included the GEFT test and the problem-solving test of number patterns. Research data was collected through a test, interviews, and documentation. The triangulation was applied to validate the data. Data were processed by reducing data, presenting data, and verifying. The results showed that FI students are better able to solve number pattern problems than FD students. It can be seen that FD students can understand the problem, devise a plan, and carry out the plan. However, FD students have been unable to look back at the solutions. Meanwhile, FI students can understand problems, devise a plan, carry out the plan, and look back at the solutions well. Therefore, it is needed to focus more on enhancing FD students' ability in the stage of looking back.

Keywords: cognitive style; mathematical ability; number patterns; problem-solving

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Introduction

Mathematics learning invites students to learn meaningfully and think creatively (Damayanti & Sumardi, 2018) and have aspects of knowledge and skills (Anggraini & Rejeki, 2020). Yayuk et al. (2020) concluded that there are still difficulties for students who are low in mathematics and follow problem-solving-based learning. The Indonesian students' ability to solve mathematical problems is still relatively low, so it needs to be improved and considered further (Kurniawan et al., 2020; Nur & Palobo, 2018). One is the ability of students to understand the concept of number patterns that have not been optimal (Ainun et al., 2019). Therefore, students will have difficulty establishing relationships with their environment and life without mathematical abilities.

Mathematics skills are essential for students; one of them is problem-solving skills. Problem-solving has become an integrated part of the mathematics learning curriculum because indispensable in mathematics learning (Pagiling, 2019; Setiyani et al., 2020), including students' mathematical abilities and cognitive activities (Pesona & Yunianta, 2018). In solving problems, students face complex and uncertain situations requiring analysis, reasoning, thinking, and skills to find solutions to the problems (Annizar et al., 2020; Güner & Erbay, 2021). A problem can be a mathematical problem if the problem is non-routine (Suarsana et al., 2019).

According to Noviyanti et al. (2021), some steps must be taken in solving mathematical problems, namely the steps of solving problems by Polya (1973). The problem-solving measures by Polya (1973) include: (1) understanding the problem; (2) devising a plan; (3) carrying out the plan; (4) looking back.

In addition to the availability of related problems, problem-solving skills have a significant role in mathematics learning because in solving problems, students must be able to reason, communicate, connect, represent, and apply knowledge on five mathematical topics (Al-Mutawah et al., 2019). Besides, Nurojab et al. (2019) specified mathematical problem-solving skills as a learning approach that focuses on observation and search methods, observation of existing problems, and preparation of temporary guesses for further re-examining results for conclusions.

Number patterns are an essential topic in grade 8 mathematics subjects (Sari et al., 2020). Number patterns material refers to students' inductive reasoning (Ariyanti & Setiawan, 2019) and can hone students' ability to think (Susanti & Setianingsih, 2019) and generalize number patterns (Raharjo et al., 2020).

Mathematical problem-solving skills and cognitive aspects of students are two things that cannot be separated. There are certainly differences in the way and time needed for each student in the completion process of solving mathematical problems, which is influenced by cognitive style (Indah et al., 2021). According to Kusumaningtyas et al. (2017), cognitive style is the difference between individuals compiling and processing information.

Witkin et al. (1977) classified two types of cognitive styles: Field Dependent cognitive styles (FD) and Field Independent cognitive styles (FI). Moreover, Nur and Palobo (2018) stated that students with field-dependent cognitive styles have global thinking, are more

sensitive to social and interpersonal things, and are more likely to work in groups. Students with field-independent cognitive styles tend to be separated in observing stimuli without the help of teachers, dislike social events, like abstract principles and things, are less capable in interpersonal relationships, feel more efficient when working independently, and tend to use their abilities and do not depend on their environment (Mahfiroh et al., 2021).

The results of previous studies showed that students with FD cognitive style could identify known things and ask questions (Nuraida et al., 2022; Suhatini et al., 2019). The research results by Nuraida et al. (2022) showed that students could plan well. However, according to the results of research by Suhatini et al. (2019), students have not been able to write a complete plan precisely. Students can carry out the plan that has been prepared (Suhatini et al., 2019) to make conclusions (Nuraida et al., 2022), but there are still errors (Suhatini et al., 2019). Students cannot look back at problem-solving (Nuraida et al., 2022; Suhatini et al., 2019).

Based on the research, it can be compared that there are changes in the mathematical ability of FD students in solving problems, namely, in the study by Nuraida et al. (2022) and Suhatini et al. (2019), students can meet the indicators of solving problems at the stage of understanding the problem. However, students have not been able to meet the indicators of devising a plan, carrying out the plan, and looking back. While the latest research conducted by Nuraida et al. (2022), students can meet indicators of problem-solving ability at the stage of understanding the problem, devising a plan, and implementing the plan, students have not been able to meet indicators at the stage of looking back.

The results of previous studies showed that in solving math problems, students with FI cognitive style could write down things that are known and asked in their language in the form of notation. Students can devise a plan in their language appropriately. Students can carry out the plan devised to obtain the right completion results. Students can study and look back on the truth of problem-solving and completion until it concludes (Mahfiroh et al., 2021; Nur & Palobo, 2018).

Based on research conducted by Nur and Palobo (2018) and the latest research conducted by (Mahfiroh et al., 2021), students with FI cognitive style can meet indicators of mathematical problem-solving skills at the stage of understanding the problem, devising a plan, carrying out the plan, and looking back. Students with the cognitive style of FI have mathematical problem-solving skills that are evenly distributed to each individual.

This study focuses on both FI and FD cognitive styles compared to previous studies. Moreover, the problem-solving ability analysis focuses on the number patterns topic, which has not been investigated in the previous studies and can be the novelty of this study. Therefore, this study aims to describe students' mathematical problem-solving skills in number pattern viewing from cognitive styles. With this goal, it is expected to be helpful to improve students' problem-solving ability in number patterns topic and can be an evaluation in enhancing students' problem-solving ability in number patterns topic.

Methods

The research used qualitative methods with a descriptive approach. The author used the descriptive approach because it described the data that had been obtained related to the ability to solve mathematical problems of students on the problem of number patterns. This research was conducted at one of the state junior high schools in Klaten Regency, Central Java, Indonesia.

The subject selection procedure was carried out in stages by administering the Group Embedded Figure Test (GEFT) test (Witkin et al., 1977) and testing the problem-solving of number patterns. The subjects were four out of 32 students (10 males and 22 females) in grade 8 at one of the state junior high schools in Klaten Regency, Central Java, Indonesia. The four students consisted of two students with Field Independent (FI) cognitive style and two with Field Dependent (FD) cognitive style, which was classified based on the GEFT test.

The instruments used in this study consisted of the GEFT test and the problem-solving of number patterns problems. The GEFT test used in this study is a standard test compiled by Witkin et al. (1977). Moreover, the authors designed the problem-solving test on the topic of number patterns and validated it by a lecturer and a mathematics teacher. The Content Validity Index (CVI) coefficient of the problem-solving test is 0.833, and the Cohen's Kappa is 0.811. It ensures the validity and reliability of the research instruments. In this study, the instrument in the form of a number patterns test question consisted of three questions. However, one question that will be analyzed in more depth, namely:

> *An arrangement of food dishes on a plate, forms an arithmetic sequence consisting of 11 lines. If the first row contains five dishes and the last row includes 35 plates, determine the number of dishes of food served.*

Data collection in this study was carried out using a test, interviews, and documentation techniques. The test was conducted to know the type of cognitive style of the students. The interviews aimed to discover more about students' problem-solving ability in number patterns, and the documentation aimed to collect the students' written works on the problem-solving test. The data obtained was then validated by the triangulation technique of the method. Data collection was carried out in January 2022. Data analysis in this study referred to Miles and Huberman's data analysis, i.e., reducing data, presenting data, and inferring or verifying.

Results

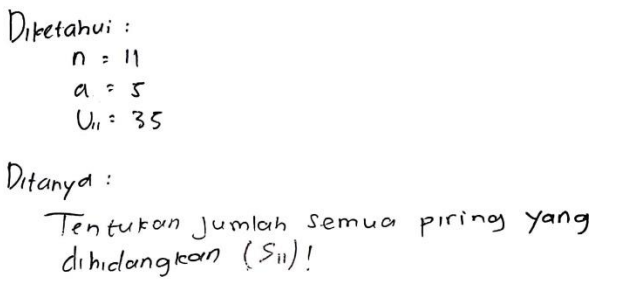
Based on an analysis of GEFT tests from 32 students in grade 8, 20 students with FD cognitive styles were obtained, and 12 students with FI cognitive styles. After the GEFT test, the number patterns problem-solving ability test was carried out. The number patterns problem-solving ability test consists of one description question, where the problem is a non-routine problem. Of the 20 FD students, two students are interviewed and described in this article. These students are FD 1 and FD 2. Of the 12 FI students, two students are interviewed and described in this article. These students are FI 1 and FI 2. Table 1 summarizes those students' problem-solving ability in number patterns topic for each stage.

Table 1. Indicators of students' problem-solving ability in number patterns topic

Indicators	FD 1	FD 2	FI 1	FI 2
Understanding the problem	✓	✓	✓	✓
Devising a plan	✓	✓	✓	✓
Carrying out the plan	✓	✓	✓	✓
Looking back	–	–	✓	✓

Problem solving ability of number patterns in students with field dependent cognitive style

Of the 20 FD students, two students are interviewed and described in this article. These students are FD 1 and FD 2. The results of the number patterns problem-solving ability test by FD 1 at the stage of understanding the problem is shown in Figure 1.



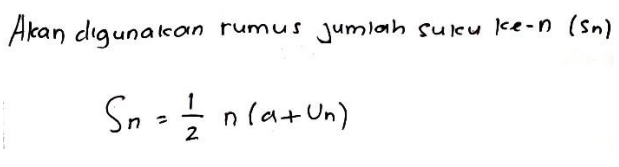
Translation
Given:
n = 11
a = 5
$U_{11} = 35$
Asked:
Find the number of plates which were served (S_{11})!

Figure 1. Stage of understanding the problem by FD 1

Based on the student's written work in Figure 1, FD 1 can understand the problem well. FD 1 can decipher the information contained in the question to write down things that are known and asked on the question. It is supported by the interview results, which can be described as follows. (R = researcher, FD 1 = Field Dependent 1 student).

R : "After reading the questions, what do you know about them?"
FD 1 : "Known, n = 11, a = 5, $U_{11} = 35$."
R : "What is asked about the question?"
FD 1 : "The question is, find the number of food plates which were served or S_{11}."

The results of the number patterns problem-solving ability test by FD 1 student at the stage of devising a completion plan is shown in Figure 2.



Translation
The n^{th} term (S_n) sum formula will be used:
$S_n = \frac{1}{2} n(a + U_n)$

Figure 2. Stage of devising a plan by FD 1

Based on the students' written work in Figure 2, FD 1 can devise a completion plan correctly. FD 1 can connect the problem information with the concept of number patterns and then determine the formula. The interview results state that FD 1 can draw a complete plan with the right ideas and procedures.

R : "From the information you get on the problem, what is the formula and concept of solving the problem?"

FD 1 : "By using the concept of number patterns, which is to find the number of nth-th term (S_n)."
R : "How do you plan to solve the problem?"
FD 1 : "By $S_n = \frac{1}{2} n(a + U_n)$ formula."

The results of the number patterns problem-solving ability test by FD 1 at the stage of carrying out the plan that has been devised is shown in Figure 3.

$S_n = \frac{1}{2} n (a + U_n)$

$S_{11} = \frac{1}{2} \cdot 11 (5 + U_{11})$

$= \frac{1}{2} \cdot 11 (5 + 35)$

$= \frac{1}{2} \cdot 11 (40)$

$= 11 \cdot 20$

$= 220$

Figure 3. Stage of carrying out the plan by FD 1

Based on the students' written work in Figure 3, FD 1 can carry out the plan that has been devised correctly. FD 1 can solve problems in problems by using concepts and formulas of number patterns that have been arranged. It is by the interview results state that FD 1 can carry out the plan devised to solve problems on problems with the right concepts and formulas.

R : "Can you solve the problem by using the concepts and formulas that you have determined? Explain!"
FD 1 : "Yes, I can, by using a $S_n = \frac{1}{2} n(a + U_n)$ formula to find S_{11}."
R : "What is the solution you gave to solve the problem?"
FD 1 : "By calculating S_{11} to find the number of plates food which were served."

The results of the number patterns problem-solving ability test by FD 1 at the stage of looking back on the completion is shown in Figure 4.

Untuk memastikan bahwa $S_{11} = 220$ piring benar, maka:

$U_n = a + (n-1)b$
$U_{11} = 5 + (11-1)b$
$35 = 5 + (10)b$
$35 - 5 = 10b$
$\Leftrightarrow 30 = 10b$
$\Leftrightarrow b = \frac{30}{10}$
$\Leftrightarrow b = 3$

Translation
To ensured that $S_{11} = 220$ plates were correct, so:
$U_n = a + (n - 1)b$
$U_{11} = 5 + (11 - 1)b$
$35 = 5 + (10)b$
$35 - 5 = 10b$
$\Leftrightarrow 30 = 10b$
$\Leftrightarrow b = \frac{30}{10}$
$\Leftrightarrow b = 3$

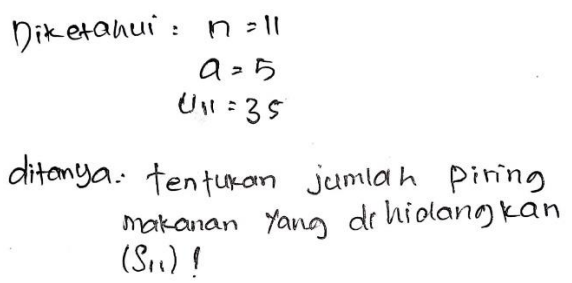
Figure 4. Stage of looking back by FD 1

Based on the students' written work in Figure 4, FD 1 cannot look back at the complete solution. FD 1 has been unable to look back at the solution by proving the correctness and the results obtained. The results of the interview state that FD 1 can look back at the stage of understanding the problem, devising a solution plan, and carrying out the plan that has been

devised. However, FD 1 cannot look back after checking the Sn formula with the given time allocation, so FD 1 cannot make conclusions from the completion of the problem.

R : "How did you convince me that your answer was correct?"
FD 1 : "I'm also still confused. Because I myself am still not so sure of the correctness of my answer."
R : "What can you conclude from solving the problem?"
FD 1 : "I still can't conclude, because my answer has not been proven correct. I haven't done any in-depth proof."

The results of the number patterns problem-solving ability test by FD 2 at the stage of understanding the problem is shown in Figure 5.



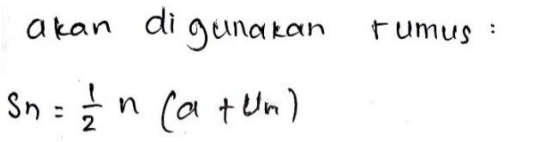
Translation
Given:
n = 11
a = 5
$U_{11} = 35$
Asked:
Find the number of food plates which were served (S_{11})!

Figure 5. Stage of understanding the problem by FD 2

Based on the students' written work in Figure 5, FD 2 can understand the problem well. FD 2 can decipher the information contained in the question to be able to write things that are known and asked on the question. It follows the interview results, which state that FD 2 can understand known things and ask questions. (R = researcher, FD 2 = Field Dependent 2 student).

R : "After reading the questions, what do you know about them?"
FD 2 : "Known, n = 11, a = 5, $U_{11} = 35$."
R : "What is asked about the question?"
FD 2 : "Find the number of food plates which were served or S_{11}."

The results of the number patterns problem-solving ability test by FD 2 at the stage of devising a completion plan is shown in Figure 6 below.



Translation
The n^{th} term (S_n) sum formula will be used:
$S_n = \frac{1}{2} n(a + U_n)$

Figure 6. Stage of devising a plan by FD 2

Based on the students' written work in Figure 6, FD 2 can devise a completion plan. FD 2 can connect the problem information with the concept of number patterns and then determine the formula. It follows the interview results, stating that FD 2 can devise a completion plan with the correct concepts and procedures.

R : "From the information you get on the problem, what is the formula and concept of solving the problem?"
FD 2 : "By using the concept which is to find the number of nth-th term (S_n)."
R : "How do you plan to solve the problem?"
FD 2 : "By $S_n = \frac{1}{2} n(a + U_n)$ formula."

The results of the number patterns problem-solving ability test by FD 2 at the stage of carrying out the plan that has been devised is shown in Figure 7.

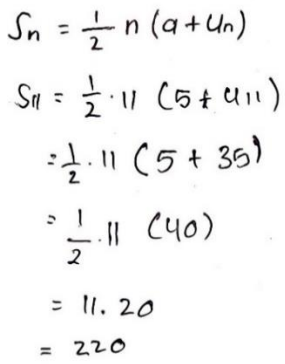


Figure 7. Stage of carrying out the plan by FD 2

Based on the students' written work in Figure 7, FD 2 can carry out the plan that has been devised correctly. FD 2 can solve problems in problems by using concepts and formulas of number patterns that have been compiled. The interview results state that FD 2 can implement the plan devised to solve problems with the right concepts and formulas.

R : "Can you solve the problem by using the concepts and formulas that you have determined?"

FD 2 : "Yes, by using a $S_n = \frac{1}{2} n(a + U_n)$ *formula to find* S_{11}*."*

R : "What is the solution you gave to solve the problem?"

FD 2 : "By calculating S_{11} *to find the number of plates food which were served."*

The results of the number patterns problem-solving ability test by FD 2 at the stage of looking back on the completion is shown in Figure 8.

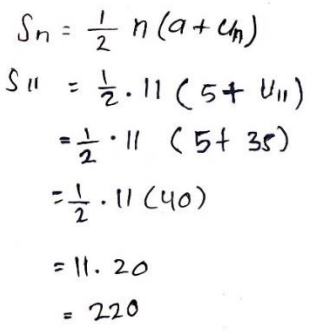


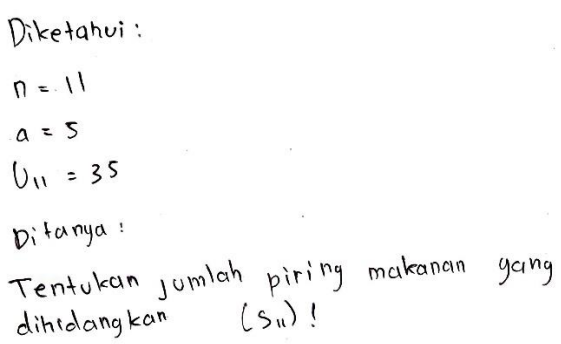
Figure 8. Stage of looking back by FD 2

Based on the students' written work in Figure 8, FD 2 cannot entirely look back at the solution. FD 2 cannot look back at the solution by proving the correctness, and the results obtained and only write back the answers when carrying out the plan that has been devised. It is following the interview results, which show that FD 2 can look back at the stage of understanding the problem, devising a solution plan, and implementing the plan that has been devised. However, FD 2 could not look back after checking the Sn formula because they felt confused. Hence, FD 2 could not make conclusions from the completion of the problem.

R : "Now, you check again starting from what is known and asked about the problem, the problem completion plan that you wrote, and the solution you did, namely in the calculation. Is it correct?"
FD 2 : "I checked and I think it's correct."
R : "What can you conclude from solving the problem?"
FD 2 : "I still can't conclude, because I haven't been able to do further proof."

Problem solving skills of number patterns in students with field independent cognitive styles

Two of the 12 FI students were interviewed and described in this article. The students are FI 1 and FI 2. The results of the number patterns problem-solving ability test by FI 1 at the stage of understanding the problem are shown in Figure 9.



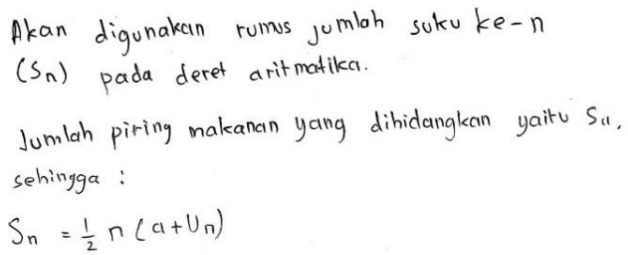
Translation
Given:
n = 11
a = 5
$U_{11} = 35$
Asked:
Find the number of food plates which were served (S_{11})!

Figure 9. Stage of understanding the problem by FI 1

Based on the students' written work in Figure 9, FI 1 can understand the problem well. FI 1 can re-decipher the information contained in the question to write down known and asked things on the question. (R = researcher, FI 1 = Field Independent 1 student).

R : "After reading the questions, what do you know about them?"
FI 1 : "The known about the question is, n = 11, a = 5, $U_{11} = 35$."
R : "What was asked about the question?"
FI 1 : "The asked about the question is, find the number of food plates which were served or S_{11}."

The results of the number patterns problem-solving ability test by FI 1 at the stage of devising a completion plan is shown in Figure 10.



Translation
The n^{th} term (S_n) sum formula will be used on the arithmetic series to solve the problem. The number of food plates which served is S_{11}, so that:

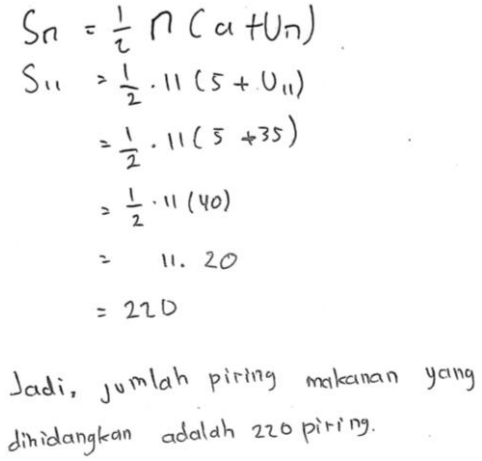
$$S_n = \frac{1}{2} n(a + U_n)$$

Figure 10. Stage of devising a plan by FI 1

Based on the students' written work in Figure 10, FI 1 can devise a solution plan appropriately. FI 1 can connect the information on the problem with the concepts of number patterns and then determine the formula.

R : "From the information you get on the problem, what is the formula and concept of solved the problem?"
FI 1 : "By using the concept of number patterns, which is to find the number of n^{th} term (S_n)."
R : "How do you plan to solve the problem?"
FI 1 : "My plan is by using $S_n = \frac{1}{2} n(a + U_n)$ formula."

The results of the number patterns problem-solving ability test by FI 1 at the stage of carrying out the plan that has been devised is shown in Figure 11.



Translation

$S_n = \frac{1}{2} n(a + U_n)$
$S_{11} = \frac{1}{2} . 11(5 + U_{11})$
$= \frac{1}{2} . 11(5 + 35)$
$= \frac{1}{2} . 11(40)$
$= 11 . 20$
$= 220$

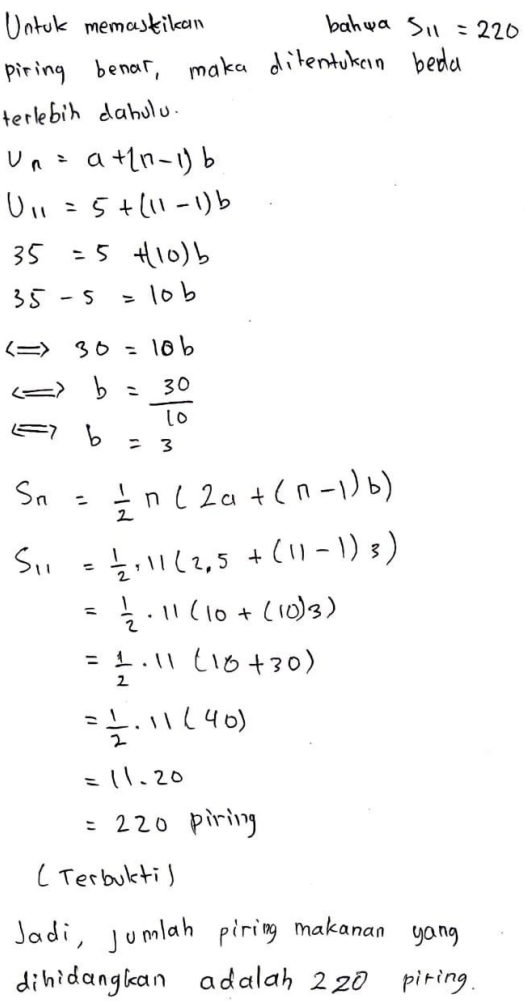
So, the number of plates of food served were 220 plates.

Figure 11. Stage of carrying out the plan by FI 1

Based on the students' written work in Figure 11, FI 1 can carry out the plan that has been prepared correctly. FI 1 can solve problems in problems by using concepts and formulas of number patterns that have been compiled.

R : "Can you solve the problem by using the concepts and formulas that you have determined?"
FI 1 : "Yes, I can, that is, by using a $S_n = \frac{1}{2} n(a + U_n)$ formula to find S_{11}."
R : "What is the solution you gave to solve the problem?"
FI 1 : "The solution is by calculating S_{11} to find the number of plates food which were served."

The results of the number patterns problem-solving ability test by FI 1 at the stage of looking back on the solution is shown in Figure 12.



Translation

To ensured that S_{11} = 220 plates were correct, it was determined in advance the difference between terms.

$U_n = a + (n - 1)b$
$U_{11} = 5 + (11 - 1)b$
$35 = 5 + (10)b$
$35 - 5 = 10b$
$\Leftrightarrow 30 = 10b$
$\Leftrightarrow b = \frac{30}{10}$
$\Leftrightarrow b = 3$
$S_n = \frac{1}{2} n(2a + (n - 1)b)$
$S_{11} = \frac{1}{2} \cdot 11(2.5 + (11 - 1)3)$
$= \frac{1}{2} \cdot 11(10 + (10)3)$
$= \frac{1}{2} \cdot 11(10 + 30)$
$= \frac{1}{2} \cdot 11(40)$
$= 11 \cdot 20$
$= 220$ plates

(Proven)

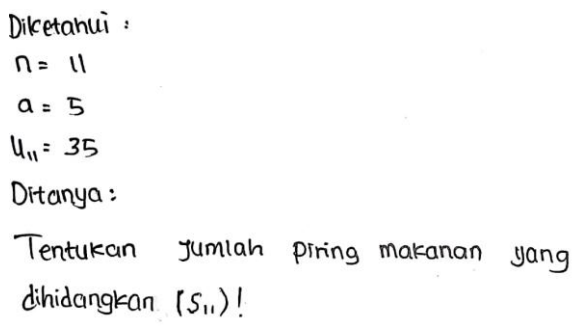
So, the number of food plates which served served were 220 plates.

Figure 12. Stage of looking back by FI 1

Based on the students' written work in Figure 12, FI 1 can look back at the total completion. FI 1 can look back at the solution by proving the correctness and the results obtained. The interview results state that FI 1 can verify the correctness of the solution by checking the Sn formula. The student can make conclusions from the completion of the problem.

R : "How do you convince me that your answer is correct?"
FI 1 : "I looked back everything that was known and asked about the problem, the problem completion plan that I wrote, and the solution I did was in the calculation. In addition, I also proved the correctness of my answer, which is to $S_n = \frac{1}{2} n(a + U_n)$ *formula in another way, so that it is evident that the sum of all plates of food served were 220 plates."*
R : "What can you conclude from solving the problem?"
FI 1 : "What I can conclude from solving the problem is: So, the number of food plates which served were 220 plates."

The results of the number patterns problem-solving ability test by FI 2 at the stage of understanding the problem is shown in Figure 13.



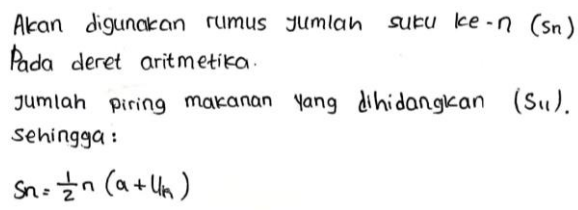
Translation
Given:
n = 11
a = 5
$U_{11} = 35$
Asked:
Find the number of food plates which were served (S_{11})!

Figure 13. Stage of understanding the problem by FI 2

Based on the students' written work in Figure 13 and interview results, FI 2 can understand the problem well. FI 2 can re-decipher the information contained in the question to be able to write things that are known and asked on the question. (R = researcher, FI 2 = Field Independent 2 student).

R : "After reading the questions, what do you know about them?"
FI 2 : "Known, n = 11, a = 5, $U_{11} = 35$."
R : "What is asked about the question?"
FI 2 : "Asked, find the number of food plates which were served or S_{11}."

The results of the number patterns problem-solving ability test by FI 2 at the stage of devising a completion plan is shown in Figure 14.



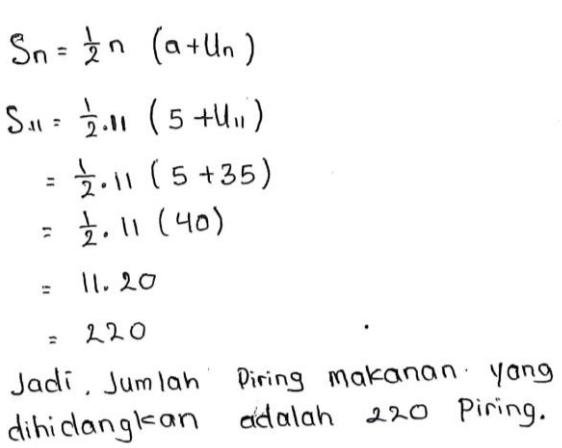
Translation
The n^{th} term (S_n) sum formula will be used on the arithmetic series to solve the problem. The number of food plates which served is S_{11}, so that:
$S_n = \frac{1}{2} n(a + U_n)$

Figure 14. Stage of devising a plan by FI 2

Based on the students' written work in Figure 14 and interview results, FI 2 can devise a solution plan appropriately. FI 2 can connect the information on the problem with the concepts of number patterns and then determine the formula.

R : "From the information you get on the problem, what is the formula and concept of solved the problem?"
FI 2 : "By using the concept of number patterns, which is to find the number of n^{th} term (S_n)."
R : "How do you plan to solve the problem?"
FI 2 : "The plan by using $S_n = \frac{1}{2} n(a + U_n)$ formula."

The results of the number patterns problem-solving ability test by FI 2 at the stage of carrying out the plan that has been devised is shown in Figure 15.



Translation

$S_n = \frac{1}{2}\, n(a + U_n)$

$S_{11} = \frac{1}{2}\, .\, 11(5 + U_{11})$

$= \frac{1}{2}\, .\, 11(5 + 35)$

$= \frac{1}{2}\, .\, 11(40)$

$= 11 \,.\, 20$

$= 220$

So, the number of food plates which served were 220 plates.

Figure 15. Stage of carrying out the plan by FI 2

Based on the students' written work in Figure 15 and interview results, FI 2 can carry out the plan that has been prepared correctly. FI 2 can solve problems in problems by using concepts and formulas of number patterns compiled.

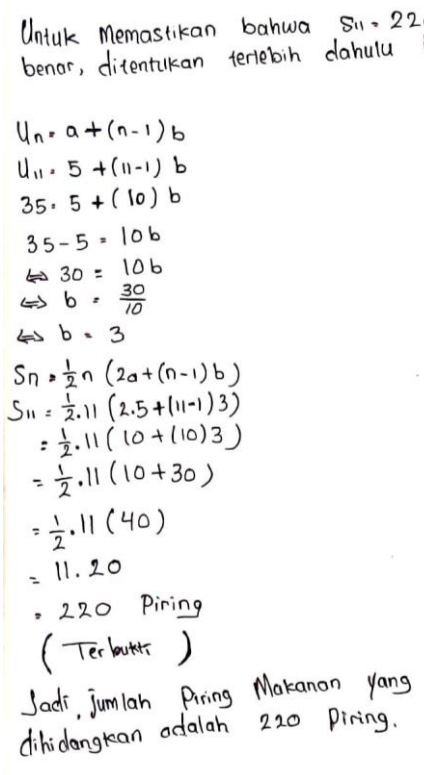
R : "Can you solve the problem by using the concepts and formulas that you have determined? Explain!"

FI 2 : "Yes, I can, by using a $S_n = \frac{1}{2}\, n(a + U_n)$ *formula to find* S_{11}*."*

R : "What is the solution you gave to solve the problem?"

FI 2 : "The solution is by calculating S_{11} *to find the number of plates food which were served."*

The results of the number patterns problem-solving ability test by FI 2 at the stage of the completion are shown in Figure 16.



Translation

To ensured that $S_{11} = 220$ plates were correct, it was determined in advance the difference between terms.

$U_n = a + (n - 1)b$

$U_{11} = 5 + (11 - 1)b$

$35 = 5 + (10)b$

$35 - 5 = 10b$

$\Leftrightarrow 30 = 10b$

$\Leftrightarrow \quad b = \frac{30}{10}$

$\Leftrightarrow \quad b = 3$

$S_n = \frac{1}{2}\, n(2a + (n - 1)b)$

$S_{11} = \frac{1}{2}\, .\, 11(2.5 + (11 - 1)3)$

$= \frac{1}{2}\, .\, 11(10 + (10)3)$

$= \frac{1}{2}\, .\, 11(10 + 30)$

$= \frac{1}{2}\, .\, 11(40)$

$= 11 \,.\, 20$

$= 220$ plates (Proven)

So, the number of food plates which served were 220 plates.

Figure 16. Stage of looking back by FI 2

Based on the students' written work in Figure 16, FI 2 can look back at the complete solution. FI 2 can look back at the solution by proving the correctness and the results obtained. The interview results state that the FI 2 can verify the correctness of the solution by checking the Sn formula, and the student can make conclusions from solving the problem.

R : "How do you convince me that your answer is correct?"
FI 1 : "By looked back everything that was known and asked about the problem, the problem completion plan that wrote, and the solution I did was in the calculation. I also proved the correctness of my answer, which is to $S_n = \frac{1}{2} n(a + U_n)$ *formula in another way, so that it is evident that the sum of all plates of food served were 220 plates."*
R : "What can you conclude from solving the problem?"
FI 1 : "The conclude from solving the problem is: So, the number of food plates which served were 220 plates."
R : "Are you sure of the answer you got?"
FI 1 : "Yes, I am sure, because I have done further proof and proved to be true."

Based on the results of this study, it can be seen that FD 1 students and FD 2 students can meet the indicators of understanding the problem well, devising a plan and determining formulas to solve problems, and carrying out the plan using predetermined formulas. However, FD 1 students are less able to look back at completions and conclude, whereas FD 2 students are incapable of looking back at completions and conclusions. FI 1 and FI 2 students can meet all indicators of problem-solving steps at the stage of understanding the problem, devising a plan and determining the formula to solve the problem, carrying out the plan using predetermined formulas, and looking back at the solution to make conclusions.

Discussion

At the stage of understanding the problem, both students with an FD and FI cognitive styles can capture the information on the problem, know what concepts are contained in the problem, be able to write known things and ask questions with mathematical symbols. It is in line with the research by Mahfiroh et al. (2021) and Nur Afifah and Ningrum (2018), which revealed that students with strong FD cognitive styles could understand problems where they can write down things that are known and ask questions with the correct symbols. Regarding students with FI cognitive styles, Mahfiroh et al. (2021) and Sutama et al. (2021) revealed that students could understand problems well, where students can explain the process of students can understand issues, write down known things, and ask questions appropriately.

At the stage of devising a plan, students with an FD and FI cognitive styles can determine ways to facilitate the problem-solving process following their knowledge. Students can choose the form, concepts, and formulas for solving problems by looking at the information on the problem, and students can devise a problem resolution plan. It is similar to the research conducted by Nuraida et al. (2022), which shows that students with FD cognitive style can use their knowledge and skills to devise a completion plan that is then used to solve the problem. However, the results of research by Suhatini et al. (2019) revealed that FD students have not

been able to understand the concept of developing a completion plan. Whereas, for students with FI cognitive style, Mahfiroh et al. (2021) and Nur and Palobo (2018) found that students could plan completion with appropriate procedures.

When carrying out the plan devised, students with an FD and FI cognitive style can determine the steps taken to apply appropriate concepts and formulas to solve problems in problems that can provide problem-solving using the most effective and proper concepts and procedures. It is following research conducted by Nuraida et al. (2022) which revealed that students with FD cognitive style have the ability in the stages of solving problems on problems. However, Mahfiroh et al. (2021) research show that FD students are less able to apply formulas to solve problems. Regarding students with FI cognitive style, Nur and Palobo (2018) and Zakiah (2020) revealed that students have accuracy in solving problems with appropriate strategies.

At the stage of looking back, students with FD cognitive style cannot prove the correctness of the answer with a complete and precise formula application strategy, so students cannot conclude the completion that has been done. Suhatini et al. (2019) research revealed that students with FD cognitive style could not prove the correctness of the completion of known data, making it difficult to make conclusions. However, Nuraida et al. (2022) found that FD students can look back at the solution and make conclusions. In contrast, at the stage of looking back at the completion, students with the FI cognitive style can prove the correctness of the answer with a strategy of applying the formula in a concise, complete, and precise manner so that students can conclude the completion that has been done. It is supported by research conducted by Mahfiroh et al. (2021) and Nur and Palobo (2018), which revealed that students with FI cognitive style could look back at the plans and completions and make conclusions.

Based on the explanation above, there is a novelty in the research results compared to previous studies. The results of this study show that the mathematics problem-solving ability in number patterns topic of students with FD cognitive style was not yet optimal. It is shown in the ability of FD students to understand problems, draw up solution plans, and implement plans well, but have not been able to look back at the solution and make conclusions. It might be because, in the learning process, the teacher explains the steps to find the results but does not explain how to interpret the completed and the results obtained.

Meanwhile, in the previous research conducted by Suhatini et al. (2019), the study results were obtained that FD students could not understand the concept of compiling a completion plan. In the research conducted by Nuraida et al. (2022), it was obtained that FD students understood the problem, devised a solution plan, carried out the plan, looking back at the solution to make conclusions. Those studies investigated FD students' problem-solving ability in linear equation systems with two variables. In a research conducted by Mahfiroh et al. (2021), results were obtained that showed that FD students were less able to apply formulas to solve solid geometry problems.

Conclusion

The students with FD cognitive style can solve number patterns problems with poor categories. FD 1 and FD 2 students can understand the problem well, compile formulas to solve problems at the stage of making plans and solve problems using appropriate concepts and formulas. FD 1 students are less able to look back at the solution and conclude, whereas students are only able to do part of the looking backstage. FD 2 students cannot look back at the solution and conclude, whereas FD 2 students only write down the completion that has been carried out at the stage of implementing the plan.

Students with a cognitive FI style can solve number patterns problems with good categories. FI 1 students and FI 2 students can meet all problem-solving indicators well. It is shown by FI 1 and FI 2 students who can understand the problem well, compile a solution plan by determining formulas to solve problems, solve problems using appropriate concepts and formulas, and look back at the solution and conclude correctly. Thus, the problem-solving ability of FI students' number patterns is better than that of FD students' number patterns.

There are limitations in this study, namely time constraints. Researchers who will raise this problem are expected to maximize the time to learn more about students' problem-solving ability in mathematics problems viewed from cognitive styles.

Conflicts of Interest

The authors declare that no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely by the authors.

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