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EXPLORATION OF COMPUTATIONAL THINKING SKILLS OF JUNIOR HIGH SCHOOL STUDENT IN TERM OF FI AND FD COGNITIVE STYLE

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ABSTRACT

The purpose of this study is to investigate the computational thinking skills of junior high school students in terms of FI and FD cognitive styles on materials with numerical patterns. The type of research used is qualitative descriptive. The subjects of the study were 57 students from class VIII at one of the public junior high schools in Jepara. The data collection instruments used are computational thinking test questions, GEFT tests, and interviews. Researchers adopted three questions from the Pusmendik Kemdikbud class VIII to test students' computational thinking skills. All questions were validated by three mathematics education experts and tested on 5 grade VIII students before being used. In this study, four components of computational thinking: abstraction, pattern recognition, algorithmic thinking, and generalization were used to analyze students' computational thinking skills. This study focused on exploratory examination of pupils' computational thinking with high categories, researchers selected 3 students on FI cognitive style and 2 students on FD cognitive style. The results showed that students with a FI cognitive style were able to meet all indicators of computational thinking namely abstraction, pattern recognition, algorithmic thinking, and decomposition. In contrast, students with FD cognitive styles are able to meet three indicators of computational thinking: abstraction, pattern recognition and generalization. Thus, it may be said that the ability to think computationally is related to the cognitive style of students.

Keywords : Computational Thinking, Cognitive Style, Mathematics

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PRELIMINARY

The development of technology and information is very rapid in the 21st century, this makes every individual must have basic skills, one of which is computational thinking (Selby, 2015). Lodi & Martini (2021) computational thinking was first introduced by Papert (1980) and subsequently popularized by Wing (2006). Wing (2017) revealed that the essential ability of computational thinking is one that not only understands basic concepts in computer science, but also in the field of education to develop individuals. Cahdriyana, Rima & Richardo (2020) explained that computational thinking is a way of thinking to solve problems by formulating computational problems and structuring

solutions with algorithms. Denning. & Tedre (2019) explains that computational thinking is a universal approach that can be used to solve a problem. Based on the formulation of experts, it may be said that computational thinking thought is a basic skill for solving problems computationally and with algorithmic solutions.

Researchers have varying views on indicators that represent students' computational thinking skills. Csizmadia et al., (2018) outlined how computational thinking has four indicators, namely abstraction and generalization, pattern recognition, algorithmic thinking, decomposition. Abstraction, that is, solving complex problems becomes simpler. Pattern recognition is the first step to complete the resolution process by recognizing patterns that exist in the problem. Algorithmic thinking is a way of steps through thinking activities. Then, decomposition is a way to solve new problems using previously obtained information. Curzon et al., (2019) explained that there are five indicators of computational thinking, namely abstraction, algorithmic thinking, decomposition, generalization, and logical thinking. Meanwhile, Bocconi S et al., (2016) explained that there are six indicators of computational thinking, namely abstraction, algorithmic thinking, automation, debugging, decomposition, and generalization. Veronica et al., (2022) explained that there are four CT indicators, namely abstraction, decomposition, algorithmic thinking, and generalization. Thus, based on the researchers' proposed computational thinking indicators, the indicators used in this study are abstraction, pattern recognition, algorithmic thinking, and generalization.

Computational thinking skills are indispensable for a person, especially junior high school preparing pupils for the difficulties of the 21st century. Computational thinking enhances 21st century skills by designing and implementing solutions to be effective and efficient and correcting them quickly when to spot errors (Lisa, et al., 2024). Additionally, computational thinking might encourage pupils to use their imaginations to solve issues (Widodo et al., 2023). One way to be able to develop computational thinking is to provide questions that are not routine which seeks to instill in pupils a habit of applying computational thinking to solve issues (Azizia et al., 2023). In addition, computational thinking in mathematics learning will be a means of rapid educational development because it touches the cognitive side of students (Maharani et al., 2023). Therefore, research on computational thinking is essential to understand the proper integration process, especially in mathematics learning.

In solving every math learning problem, it is not uncommon for students to have a variety of different computational thinking processes in dealing with it. In line with Kusumaningsih et al., (2020) states that this computational thinking process occurs due to the different cognitive abilities of students. With the cognitive style, students are able to receive and process information, especially in learning. Muyassaroh (2023) states that encouraging students to discuss certain problems in detail in solving various problem-solving problems is the most effective way to improve computational thinking skills.

Cognitive styles as part of the dimension of individual differences refer to a person's abilities to respond to, analyze, store, think through, and use information to complete a task or respond to different types of environmental situations (Arifin et al., 2020). Rejeki & Rahmasari (2022) states that cognitive style is the behavior of individuals in making decisions to collect information, store, develop, and respond to problems in the learning process. This is in harmony with (Karomah, 2020) which states that cognitive style is a person's consistent way of carrying out activities to process information obtained. Based on various opinions about the definition of cognitive style above, researchers can draw conclusions that cognitive style is the way an individual responds, makes decisions, stores, develops various differences in processing the information obtained.

Several experts have determined the classification of cognitive styles from the study of computational thinking. Sahrina et al., (2023) demonstrated that there are two categories of cognitive style, namely Field Independent (FI) and Field Dependent (FD) cognitive styles. Next, Irianti et al., (2021) categorizes cognitive styles into two main sections: Impulsive and Reflektive. Based on the classification of cognitive style components from various experts above, this study uses cognitive style components from Alfi Sahrina, namely Field Independent (FI) and Field Dependent (FD) cognitive styles.

Researchers have examined computational thinking skills in students. Maharani et al., (2023) in his research shows that computational thinking skills in mathematics tend to provide ideas and instructional strategies for both teachers and students, leaving gaps that require more research. Then Widodo et al., (2023) stated that the computational thinking skills of elementary school students in experimental and control classes were at the same level, namely at a high category when they received 3D-based learning compared to those who received conventional learning. Furthermore, the results of the study Susandi & Widyawati, (2017) shows that students with Field Independent cognitive style types are less likely to be influenced by the environment and are able to cope with distracting

impressions, elements, backgrounds. While students with Field Dependent cognitive style types tend to be unable to free themselves from background elements that interfere or are more influenced by the environment. Research results Mubarokah et al., (2023) shows that there are differences in computational thinking skills between high, medium, and low ability students seen from indicators of computational thinking decomposition, algorithmic thinking, pattern recognition, and abstraction and generalization.

Although research that examines computational thinking skills has grown rapidly in 10 years, research related to students' computational thinking skills based on cognitive styles still needs to be done, especially studies on each component of computational thinking (Evendi, 2022). Since measuring computational thinking abilities in the current digital world requires an understanding of each component of computational thinking, this study is essential. The four components of computational thinking: abstraction, pattern identification, algorithmic reasoning, and generalization must be recognized by students. Through FI and FD cognitive styles may assist students in developing computational thinking abilities by comprehending the components of computational thinking.

Based on the problems above, the problem formulation was obtained, namely how to explore students' computational thinking skills in solving problems based on FI and FD cognitive styles. The purpose of this study is to examine and characterize computational thinking abilities in the context of FI and FD cognitive styles addressing mathematical issues numerical pattern material. Specifically, the research will focus on component of abstraction, pattern recognition, algorithmic thinking, and generalization.

METHODS

Reseach Design

This study, which is qualitative in nature and descriptive in nature, attempts to investigate how junior high school pupils with certain FD and FI cognitive styles can use computational thinking to solve issues on their own. In addition, based the criteria of their ability to solve test questions, selected students have high computational thinking skills.

Participants

The research participants were 57 class VIII student at a state school in Jepara Regency, Central Java. Including 27 student from class VIII B and 30 from class VIII D. Additionally, 5 of the 57 student who took the computational thinking exam were chosen

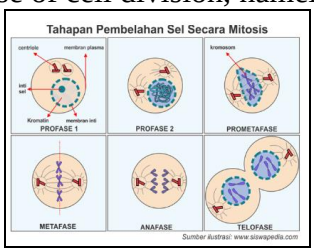
to be interviewed in order to learn more about the high skill students. The study was carried out during the school year 2023–2024's odd semester with material on number patterns, especially arithmetic and geometric sequences.

Instrument

The research instruments used are three instruments, namely written tests on computational thinking, GEFT tests or cognitive style questionnaires, and interviews. The preparation of computational thinking test question instruments adapted from Asesmenpedia questions (https://pusmendik.kemdikbud.go.id/asesmenpedia/) for class VIII. Researchers compile 5 questions consisting the components of abstraction, pattern recognition, algorithmic thinking, and generalization. Before being implemented, the questions underwent validation from 3 mathematics learning experts and were tested on 5 kids outside the subject who would be participating in data collection for the study. After the researcher corrected the questions according to the advice and input of experts and the results of student trials, the instrument was used for data collection. When the questions were tested on 5 students, students were only able to complete 3 questions correctly from the given time of 40 minutes. Thus, researchers only use 3 computational thinking test questions as an instrument for collecting and student abilities. The computational thinking test question instrument used to reveal skills of pupils to answer questions is connected to the cognitive styles shown in Table 1.

Table 1. Computational Thinking Test Question

No	Question
1	Rose is a type of shrub plant that comes from the Genus Rosa as well as being the name of the flowers produced by the plants below. If the rose petals increase by 3 every day. It begins with the appearance of 2 petals for the first time. How many rose petals after a week? 
2	In art constructing, there are seats arranged with the number of seats in the first row is 12, the second row is 16 and so on to the back always increases by 4 seats. If in the building there are 12 rows of seats. How many spectators can be accommodated in the art building? 

3	The cell cycle part is proven to have a mitotic phase that includes mitosis as well as cytokinesis which is the cell cycle's shortest segment. Division of mitotic cell will alternate utilizing a longer phase of cell division, namely *interphase*.  When an amoeba undergoes mitotic division into two every 15 minutes. If at 8:45 there are thirty amoebas. At 10:15, how many amoebas are present?

This research the Group Embedded Figures Test (GEFT) is utilized instrument, a standard test tool created by Witkin (1997) to group students into FI cognitive style categories or FD cognitive styles. The categories of GEFT test scores shown in Table 2.

Table 2. GEFT Test Score Classification

Cognitive Style	Score
Field Independent	10 – 18
Field Dependent	0 – 9

Based on GEFT test scores, the results of cognitive style questionnaires given to 57 students obtained the data presented in Table 3.

Table 3. Student Cognitive Style Test Result

Cognitive Style	Student
Field Independent	46
Field Dependent	11
Total	57

Based on the data in Table 3. 46 students have an FI cognitive style whereas 11 students have a FD cognitive style. Next, researchers selected five students with the highest test results to be interviewed and analyzed. Researchers selected five subjects: three FI subjects and two subject with FD cognitive style. In order to expedite the data analysis, S1, S2 and S3 coded the FI subjects, while FD subjects were coded S4 and S5.

Data Analysis Techniques

The data obtained from the document analysis responses students to computational thinking skills test questions in accordance with indicators were further analyzed using the assessment rubric shown in Table 4.

Table 4. Computational Thinking Skills Assessment Rubric

Indicator	Information	Score
Abstraction	Students are able to represent mathematical concepts in the form of symbols or mathematical language appropriately	3
	Students are able to represent mathematical concepts in the form of symbols or mathematical language, but partially	2
	Students are able to represent mathematical concepts in the form of symbols or mathematical language, but are not precise	1
	Students are unable to represent mathematical concepts in the form of symbols or mathematical language	0
Pattern Recognition	Students are able to recognize the patterns used appropriately	3
	Students are able to pattern recognition that are used but partially	2
	Students are able to recognize patterns that are used but are not precise	1
	Students are unable to recognize the patterns/formulas used	0
Thinking Algorithms	Students are able to complete algorithms or steps in sequence and precisely	3
	Students are able to complete algorithms or steps sequentially, but partially	2
	Students are able to complete algorithms or steps, but are less precise	1
	Students are not able to complete algorithms or steps appropriately	0
Generalization	Students are able to present conclusions from problem problems appropriately	3
	Students are able to present conclusions from the problem, but some	2
	Students are able to present conclusions from problem problems, but are not precise	1
	Students are unable to present conclusions from the problem	0

At this point, researchers assess students' computational thinking abilities based on abstraction, pattern recognition, algorithmic thinking, and generalization. In order to learn more about students processes and methods for resolving issues related to computational thinking indicators, researchers also conducted interviews. The purpose of this interview is to verify the information provided by the student on their answer sheet. In this study, from three questions based on the explanation above, researchers analyzed three questions, each of which consisted of four indicators of computational thinking. In the next stage, according to a review of the interviews and responses from the students, researchers make conclusions related to students' computational thinking skills.

RESULT AND DISCUSSION

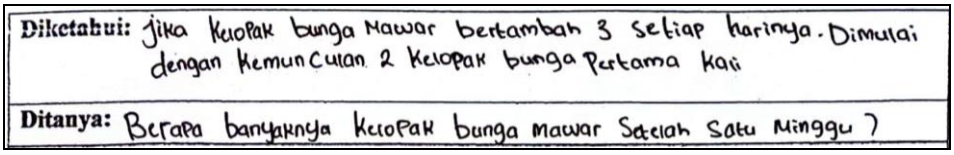
Result

In this section, students' answers regarding the computational thinking skills of the FI and FD cognitive styles are displayed.

Subject Field Independent

Abstraction

In the abstraction indicator, the three subjects were capable of expressing the concepts contained in the issues in the form mathematical language correctly. This can be seen in example S1 answer in solving number 1 presented in Figure 1 below.



English Version

Is Known: If the rose petals increase by three every day. Starting with the appearance of two petals every day?

Asked: How many petals did the rose have after a week?

Figure 1. S1 Answers of Number 1 Abstraction Indicator

Based on Figure 1, it proves that S1 is able to represent the appearance of roses petals as an element of arithmetic rows, namely the appearance of 2 rose petals for the first time as the first term and the appearance of petals every day increases by 3 as a difference. S1 is also able to obtain the details requested in the question by representing number of rose petals after one week. S1 proves the idea of articulating concepts in mathematical terms supported by the interview presented as follows (Q: Researcher).

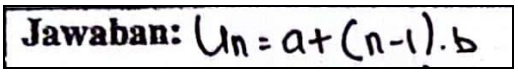
Q : After reading the questions, what do you understand about the information?

S1 : The information obtained from the question of the first 2 petals indicates the first term and the difference or difference will increase by 3 every day, and what is asked is the number of petals after one week.

Thus, based on the interview and analysis document student, it may be said that the S1 with FI cognitive style is able to demonstrate the capacity for thought computationally of mathematics on abstraction indicators, namely representing mathematical concepts in the form of mathematical language in the problem.

Pattern Recognition

In the pattern recognition indicator, all three subjects to use FI cognitive style were able to recognize the pattern or formula used appropriately. This can be seen in example the S1 answer of number 1 is presented in Figure 2.



English Version

Response: $U_n = a + (n - 1) . b$

Figure 2. S1 Answers of Number 1 Pattern Recognition Indicator

Figure 2 shows that S1 competent write patterns or formulas correctly. S1 able to recognize patterns to specify number of rose petals after one week using arithmetic row patterns, namely $U_n = a + (n - 1) \times b$. Subjects with this FI cognitive style can provide logical reasons for writing down their pattern assumptions. This is supported from an excerpt of an interview with S1 on question number 1 (Q: Researcher).

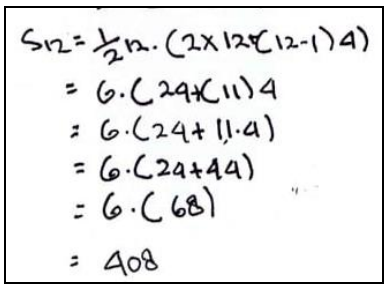
Q : How do you determine the pattern used to solve the problem?

S1 : If from the question number 1 that determines the term or number of rose petals, then use the arithmetic row formula, namely $U_n = a + (n - 1) \times b$.

Thus, based on document analysis and interviews, it may be said that S1 with FI cognitive styles able to demonstrate mathematical computational thinking skills on pattern recognition indicators, namely recognizing patterns used in solving problems.

Thinking Algorithms

On the indicator of algorithmic thinking, all three subjects with FI cognitive style is able to complete the algorithm or steps sequentially and accordingly precisely. This can be seen in the example S2 answer of number 2 presented in Figure 3 below.



English Version

S_{12} = ½ . 12 . (2 × 12 + (12 – 1) 4)
= 6 . (24 + (11) 4)
= 6 . (24 + 11 . 4)
= 6 . (24 + 44)
= 6 . (68)
= 408

Figure 3. S2 Answers Q2 Indicator Thinking Algorithm

Based on Figure 3, it can be seen that S2 of FI cognitive style is competent write down the step to solve problems correctly. S2 was able to complete step to determine the number of spectators that could be accommodated if there were 12 rows of seats in the art building and generated a total of 408 viewers. Excerpts from the S2 interview attest to S2's capacity to compose the steps needed to answer the question (Q: Researcher).

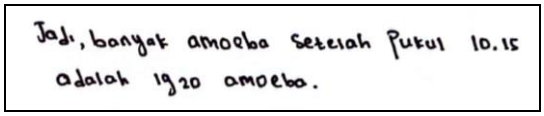
Q : Explain the steps for solving question number 2 in detail!

S2 : Right number 2 seats in the 1st row there are 12 and the 2nd row there are 16 continue to increase 4 every 1 row back means 12 = a or first term and 4 = b or difference and what is asked when there are 12 rows of seats in the art building means n = 12. Next, put it into the formula S_n that I wrote, 6 is from $\frac{1}{2} \times 12$, 24 is from 2 × 12, and 11 from 12 – 1. The value 11 is multiplied by 4 to produce 44, then is added to 24 to become 68, and 68 multiplied by 6 to get the final result 408.

Based on the interview and analysis of student document, it may be said that S2 with the FI cognitive style is capable exhibiting mathematical computational thinking skills on algorithm thinking indicators, namely solving problem solving steps coherently and precisely.

Generalization

In the generalization indicator, the three subjects with FI cognitive style can present conclusions from the issues appropriately. This is shown in example S3 answer in solving question number 3 is presented in Figure 4.



English Version

So, the number of amoebas after 10.15 is 1920 amoebas.

Figure 4. S3 Answers Q3 Generalization Indicator

Based on Figure 4, demonstrates that S3 in the FI cognitive accurately concluded at 10:15 a.m. that there were 1920 amoeba. S3 in concluding the problem is linked to the interview quote as follows (Q: Researcher).

Q : What is the final conclusion of the solution? Explain your reasoning!

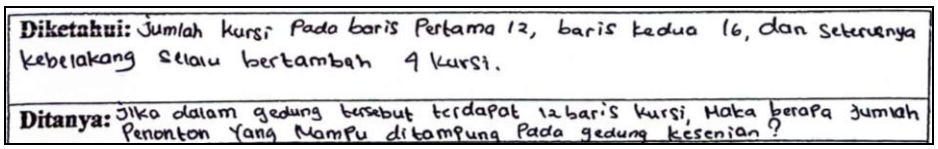
S3 : So, the number of amoebas at 10:15 is 1920. My conclusion was obtained from the calculation results in the step of solving the problem.

Thus, based on interview and analysis document result, it may be said that S3 with FI cognitive style is able to demonstrate mathematical computational thinking skills on generalization indicators, namely presenting conclusions from question problems with the right answers.

Subject Field Dependent

Abstraction

In the indicator, both students were able to accurately use mathematical language to express the ideas included in the problem. This can be seen in example S5 answer S5 of number 2 presented in Figure 5 below.


Diketahui: Jumlah kursi pada baris pertama 12, baris kedua 16, dan seterusnya kebelakang selalu bertambah 4 kursi.

Ditanya: Jika dalam gedung tersebut terdapat 12 baris kursi, Maka berapa jumlah Penonton yang mampu ditampung pada gedung kesenian?

English Version

Is Known: The number of seats in the first row is 12, the second row is 16, and so on backwards always increases by 4 seats.

Asked: If there are 12 rows of seats in the building, then how many spectators can be accommodated in the art building?

Figure 5. S5 Answers Number 2 Abstraction Indicator

Figure 5, it demonstrates that S5 may express the number of seats in the art building as an arithmetic row element, meaning that the number of row chairs increases by 4 in the following row once there is an initial term of 12 in the first. S5 is also able to determine the information asked on the question representing the large number of spectators that can be accommodated when there are 12 rows of seats in the art building. The following quotes from S5 interview proves that S5 can express problem statements in mathematical language (Q: Researcher).

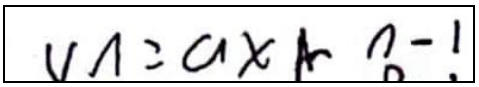
Q : Try to explain the information you know and ask that you wrote when reading the question!

S5 : Question number 2 is that first there are 12 rows of seats, second there are 16 rows of seats and increase by 4 every back, so the third row has 20 seats. If there are 12 rows of seats in the building, how many spectators can be accommodated, it means that the number of spectators is asked if the building has 12 rows of seats.

Thus, based on the analysis document student and interviews, it can be concluded that S5 with FD cognitive style is able to demonstrate the ability to think computationally of mathematics on abstraction indicators, namely representing mathematical ideas expressed as mathematics language in the problem.

Pattern Recognition

In pattern recognition indicators, both subject FD cognitive styles were able to recognize the patterns or formulas used appropriately. This can be seen in example of the number 3 solution of S4 in presented in Figure 6 below.



English Version

$U_n = a \times r^{n-1}$

Figure 6. S4 Answers Q3 Pattern Recognition Indicator

Figure 6. states that S4 is capable of write patterns or formulas correctly. S4 was able to pattern recognition to ascertain the number of amoebas at 10:15 a.m. using geometric row patterns, namely $U_n = a \times r^{n-1}$. Subjects with this *Field Dependent* cognitive style can provide logical reasons writing down their pattern assumptions. This is supported from an excerpt of an interview with S4 on question number 3 as follows (Q: Researcher).

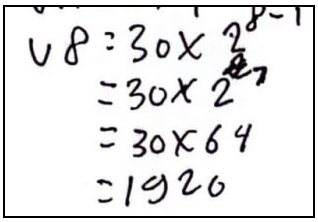
Q : Try to describe the pattern you used to solve the problem?

S4 : Because the teacher has given an example of question number 3 in class, but the numbers written in the question are different. Thus, I use a geometric row pattern., which is $U_n = a \times r^{n-1}$.

Thus, based on the interview and analysis document test, the conclusion is that S4 of FD cognitive style is able to demonstrate mathematical computational thinking skills on pattern recognition indicators, namely recognizing patterns used in solving problems.

Thinking Algorithms

On indicators of algorithmic thinking, both subjects with FD cognitive styles unable to complete algorithm or steps sequentially and accordingly. This can be seen in the example S4 answer of question number 3 presented in Figure 7.



English Version

$U_8 = 30 \times 2^{8-1}$
$= 30 \times 2^7$
$= 30 \times 64$
$= 1920$

Figure 7. S4 Answers Number 3 Indicator Thinking Algorithm

Based on Figure 7. it shows that S4 subjects FD cognitive style unable to write down the step to solve problems correctly. S4 was unable to complete the steps to determine the number of amoebas at 10:15 a.m. because there was a miscalculation of 2^7 what should have been 128 but S4 wrote the result 64. S4 proves that writing the steps to solve the questions is supported by S4 interview excerpts as follows (Q: Researcher).

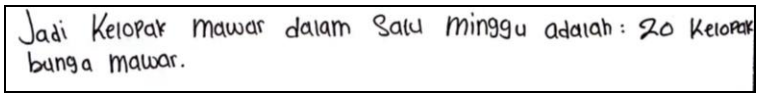
Q : In your native tongue, provide a detailed explanation of how to answer number 3!

S4 : Number 3 is a matter of geometric rows because it determines the number of amoebas with the first division there are 2. Then for the ratio from 08.45 to 10.15 I think that there are 8 times fertilization should be this calculation 128 because 2^7 just multiplied by 30, that's from the result of the first division of 30, the final result should be 3840, but I wrote 1920, that calculation was wrong.

After analyzing student answers and interview, the conclusion that S4 with FD cognitive style is unable to demonstrate computational mathematical thinking skills on algorithmic thinking indicators, namely problem-solving steps in sequence and precisely.

Generalization

In the generalization indicator, both student with FD cognitive styles can present conclusions from problem appropriately. This can be seen in example answer of the S5 solution of number 1 presented in Figure 8.



English Version

So, the rose petals in one week are: 20 rose petals

Figure 8. S5 Answers Number 1 Generalization Indicator

Based on Figure 8, it shows that S5 subjects of FD cognitive style correctly wrote down the conclusion that there were 20 rose petals after one week. An extract from S5's interview that was used to write the problem-solving conclusion is provided below (Q: Researcher).

Q : What is the solution's conclusion? Explain your reasoning!

S5 : In conclusion, there are 20 rose petals in one week. That conclusion was not obtained from the calculations in the previous step on my answer sheet.

Thus, based on the analysis document result and interviews, it can be determined to be S5 of FD cognitive style is able to demonstrate the ability to think computationally mathematically on generalization indicators, namely presenting conclusions from problem problems with the right answers.

Based on interview and document analysis of Field Independent and Field Dependent cognitive styles, similarities and differences of computational capabilities can be formulated in Table 5.

Table 5. Similarities and Differences in FI and FD Computational Thinking Skills

Indicator	FI	FD
Abstraction	Students are able to represent mathematical concepts from problems in problems correctly using mathematical language sentences.	Students are able to represent mathematical concepts from problems in problems correctly using mathematical language sentences.
Pattern Recognition	Students are able to recognize the patterns used appropriately and provide logical reasons in determining the patterns.	Students are able to recognize the patterns used appropriately and provide logical reasons in forming the patterns.
Thinking Algorithms	Students are able to complete algorithms or steps sequentially and accordingly to get the right answer.	Students are not able to complete algorithms or steps sequentially and accordingly to get the right answer.
Generalization	Students are able to present conclusions from problems appropriately.	Students are able to present conclusions from problems appropriately.

Discussion

Based on the results of the analysis computational thinking skills, five subjects in solving the number pattern problem presented in Table 5. it shows that all subjects can explain the data in the issues correctly. The data composed by the subjects FI and FD correctly is capable of expressing mathematical concepts in the form of mathematical language correctly. The study's findings are consistent with previous research Rejeki & Rahmasari (2022) which reveals that subjects with FI or FD cognitive styles can find information problem such as items that are understood and information that is ask with sentences or mathematical language. Sutama et al., (2021) reveals that subject the FI cognitive style can understand problems well, note down the information that is known and information asked appropriately. In students of FD cognitive style, Nur Afifah & Ningrum (2018) it demonstrates that by accurately asking questions and recording the knowledge they have, kids are able to comprehend the situation. Thus, it can be concluded that there is no difference that affects the computational thinking skills of student on abstraction indicators.

Table 5. It also shows that all participants is capable of identifying the right patterns and provide logical reasons for solving problems. Research opinions by Maharani et al., (2021), which states that FI students when doing calculations can write down the general structure and find patterns that are formed to determine the solution to solve the problem. In line with research Nuraida et al., (2022), which states that students with FD cognitive style can put their knowledge and ability in writing formulas used to solve problems. Thus, judging from the cognitive style of students' computational thinking abilities on pattern recognition indicators there is also no difference.

Next, Table 5. shows that all students are able to complete algorithms or steps use ideas and calculations in solving problems in the problem. As stated to Lockwood et al., (2016), One of the characteristics of computational thinking indicators is algorithmic thinking or the application of formal methods to achieve certain goals in solving problems to obtain solutions. Thinking algorithms in this study are one of the students' strategies in solving problems (Maharani et al., 2021). Research by Nur & Palobo, (2018) supports this, showing that FI students are accurate in following the processes necessary to solve problems using the appropriate method. Furthermore, FD students in completing the steps of thinking algorithms are generally coherent, but there are some errors, such as errors in calculations, lack of precise formulas used so that the steps obtained are not appropriate

(Suhatini et al., 2019). Thus, FI students capable to write down the steps of thinking algorithmic correctly in solving problems. While FD students can carry out the steps of thinking algorithms quite smoothly, but less precisely.

Table 5. It also shows that all subjects are able to present conclusions appropriately the solving problems. Research by Mahfiroh (2021) support this, which states that students with a FI cognitive style can make problem-solving conclusions. According to Sahrina et al., (2023), FI students can conclude answers correctly including providing detailed explanations. Nuraida et al., (2022) his research found that the cognitive style of FD students were able to find solutions to solve problems and make conclusions. In line with research Safitri & Khotimah, (2023) which states that students with FD cognitive style are able to meet the indicators of reasoning by concluding answers on solving problems. Thus, it clear from this that variations in students' cognitive styles do not affect variations in students' computational thinking abilities on generalization indicators.

Based on the explanation above, the computational thinking skills of students with a FI cognitive style is capable of fulfilling indicators computational thinking. According to the outcomes of the study Danindra et al., (2022) which states that the computational thinking ability of students with a FI cognitive style meets all indicators of computational thinking conversely, students with FD cognitive style do not meet in the indicator of computational thinking i.e. algorithmic thinking. Thus, this study shows that computational thinking skills concerning the cognitive types of FD and FI have differences in algorithmic thinking indicators in solving mathematical problems in students who have high abilities. Differences in cognitive styles can provide differences related to the emergence of indicators of students' computational thinking ability. In subjects with the FI cognitive style appear indicators of abstraction, pattern recognition, algorithmic thinking, and generalization. In subjects with the cognitive style FD appear indicators of abstraction, pattern recognition, and generalization. The findings of this research are supported by research Kusuma & Masduki, (2023) which suggests that students' problem-solving abilities related to cognitive styles vary.

The outcome showed that subjects the FI cognitive style were generally capable perform all computational thinking skills on indicators of abstraction, pattern recognition, algorithmic thinking, and generalization. While subjects with a FD cognitive style are able to perform computational thinking skills on indicators of abstraction, pattern recognition and generalization. However, FD subjects are not able to perform computational thinking

skills on indicators of algorithmic thinking. This is consistent with research Agoestanto et al., (2019) which states that the FI students is able to satisfy all indicators of computational thinking. FD subjects were only able to fulfill three computational thinking markers.

CONCLUSION

Computational thinking skills in terms of FI cognitive styles and FD cognitive styles have differences. Students who possess the FI cognitive style can generally perform all computational thinking skills on indicators of abstraction, pattern recognition, algorithmic thinking, and generalization. Abstraction indicator, the individual can represent known information and is asked using mathematic language appropriately. In the pattern recognition component, the subject is able to recognize patterns by using previous information in solving problems. Then, algorithmic thinking component, the student is capable complete to the algorithm or step using the precisely found pattern. Furthermore, in the generalization component, the person can conclude the answer to the problem correctly. While subjects with a FD cognitive style are only able to perform computational thinking skills on indicators of abstraction, pattern recognition, and generalization. The study's findings demonstrate the association between students' cognitive styles and their capacity for computational thinking. Thus, information related to students' cognitive styles needs to be the teacher's attention in order to facilitate appropriate learning strategies to explore students' mathematical thinking skills, one of which is computational thinking.

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