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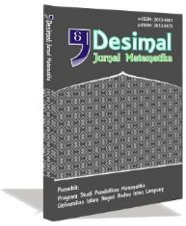

Exploration students' computational thinking skills in mathematical problem solving based on field independent and dependent cognitive style

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ABSTRACT

Computational thinking skills play an important role in helping students solve mathematical problems. Students' problem-solving ability is influenced by cognitive style. The purpose of this study was to explore the computational thinking ability of prospective mathematics teachers based on field-independent and field-dependent cognitive styles. This research uses a qualitative approach with a case study design. Data collection instruments used are test questions, cognitive style questionnaires, and interview guidelines. Before use, the test questions were validated by two mathematics education experts and tested on five prospective mathematics teacher students. The subjects of this study were 47 prospective math teacher students at one of the private universities in Surakarta. Based on the test results and cognitive style questionnaire, researchers selected 3 field independent students and 2 field dependent students to be interviewed. The results showed that at the abstraction stage, all subjects can represent mathematical concepts in symbols or mathematical language appropriately. While at the stage of thinking algorithms and generalization, subjects with a field-dependent style tend to give answers that are less precise. Thus, it can be concluded that there are differences in the ability in the computational thinking process of students based on cognitive style.

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INTRODUCTION

Computational thinking (CT) is a critical skill considered important in the 21st century, given its ability to solve complex problems using computer science concepts and techniques. This concept is not only limited to computers and mathematics but is also applied in everyday contexts to improve a person's logical, analytical, and creative thinking skills (Maharani, Nusantara, Rahman Asari, & Qohar, 2020; Yadav, Hong, & Stephenson, 2016). Therefore, learning mathematics requires the development of computational thinking skills (Azizah, Roza, & Maimunah, 2022).

Computational Thinking (CT) is considered to be a fundamental skill that is as important as reading, writing, and arithmetic. It is a problem-solving approach that uses basic computational concepts to develop systems and understand human actions (Lee, Tu, Chen, & Lin, 2023; Wing, 2006). According to Bocconi et al. (2016), computational thinking involves designing, evaluating, and solving problems using analysis techniques and algorithms. CT comprises four key skills: abstraction, pattern recognition, algorithmic thinking, and generalization. These skills enable students to solve complex problems in a structured and efficient manner (Gadanidis, 2017; Tabesh, 2017). Csizmadia et al. (2015) also suggest that the main components of computational thinking are abstraction, pattern recognition, algorithms, and generalization. Therefore, the indicators of computational thinking ability are abstraction, pattern recognition, algorithmic thinking, and generalization.

The incorporation of computational thinking (CT) into the Indonesian education curriculum holds significant importance as it is anticipated to enhance students' performance in global assessments like PISA and equip them with essential skills to tackle international challenges (Suryani, 2022; Zahid, 2020). As per Rosana, Widodo, Setianingsih, & Setyawarno (2020) PISA assesses problem-solving and reasoning abilities. It is suggested that poor PISA results could indicate inadequate computational thinking skills, as these skills are evident in how individuals' approach and resolve mathematical problems (Supiarmo, Hadi, & Tarmuzi, 2022).

The characteristics of students' learning styles are one of the factors that influence problem-solving abilities (Firmansyah & Syarifah, 2023). In addition, mathematical comprehension skills are also very much needed, because one of the important goals in learning is to provide an understanding that the material taught to students is not just memorization, but more than that, with understanding, students can better understand the concept of the subject matter itself (Komarudin, Suherman, & Anggraini, 2021). Each student has their own methods and techniques for understanding information (Sheromova et al., 2020). One effort to improve the quality of education and mathematical problem-solving abilities in students is to pay more attention to the development of cognitive styles in the mathematics learning process (Alfiyah, 2022). The way an individual receives, remembers, and thinks, or as special ways of receiving, storing, forming, and utilizing information, is the definition of cognitive style (Muhtarom, 2019).

Cognitive style plays a crucial role in the learning process, influencing how individuals receive, remember, organize, process, and solve problems. There are two main types of cognitive styles: field-independent (FI) and field-dependent (FD). Field-independent cognitive style refers to individuals who tend to handle information, think, and solve problems independently. On the other hand, field-dependent refers to individuals who rely more on social context or external sources of information in their cognitive processes (Amaliah, Wahyuddin, & Andi Quraisy, 2022).

Previous studies have shown that cognitive style has a significant influence on the learning process. For example, Kusnadi & Mardiani (2022) examined the relationship between cognitive style and mathematics learning, while Widayanti (2010) investigated the relationship between field-independent and field-dependent cognitive styles with teaching methods in mathematics. According to

Witkin and Goodenough (as cited in Altun & Cakan, 2006), individuals with field-independent cognitive styles have a better ability to remember and manage information from memory, which has an impact on the efficiency of their learning process.

Computational Thinking (CT) is now considered a basic skill on par with reading, writing, and arithmetic. In the context of education in Indonesia, the integration of CT into the curriculum is expected not only to improve students' results in international tests such as PISA but also to equip them with relevant skills to face the ever-growing global challenges (Suryani, 2022; Zahid, 2020). CT involves four core skills: abstraction, pattern recognition, algorithmic thinking, and generalization. These skills enable students to handle and solve complex problems with a structured and efficient approach, making it an essential tool in education (Gadanidis, 2017; Tabesh, 2017).

Cognitive style plays a crucial role in the learning process. It refers to an individual's characteristic way of processing information, remembering, organizing, and solving problems. There are two main types of cognitive styles: field-independent (FI) and field-dependent (FD). People with a field-independent cognitive style tend to process information independently, relying on their thinking and problem-solving abilities without depending much on external context or assistance. On the other hand, individuals with a field-dependent cognitive style tend to rely more on information from their surrounding environment and often perform better in social or group settings (Amaliah et al., 2022).

Research has consistently demonstrated the profound impact of cognitive style on learning effectiveness. For example, Kusnadi & Mardiani (2022) delves into the correlation between cognitive style and mathematics learning, while (Widayanti, 2010) investigates the interplay of field-independent and field-dependent cognitive styles with teaching methods in mathematics. Witkin and Goodenough (as cited in Altun & Cakan, 2006) have observed that individuals with field-independent cognitive styles excel in recalling and managing information from memory, thereby enhancing their success in the learning process. Cognitive style not only reflects personal learning preferences but also shapes students' adaptability to diverse learning strategies and academic challenges. By comprehending and accommodating students' cognitive styles, educators can craft more impactful learning experiences and tailor teaching methods to cater to individual cognitive needs, fostering the optimal development of critical thinking and other essential skills.

METHOD

This study used a qualitative approach to explore the computational thinking (CT) of prospective mathematics teachers. The research subjects were 1st semester students of the Mathematics Education Study Program at one of the universities in Surakarta. Data collection during this study used 3 instruments, namely question instruments, cognitive style questionnaires, and interviews. Researchers looked for reference questions from questions tested by lecturers in mathematics learning courses in English and Primaga print books, then selected questions according to the appropriate. With the material on the topic of this research. The questions that meet the criteria consist of 5 items. Before being used, the questions were first validated by two experts, namely lecturers of mathematics education study programs, and tested on 5 students. Based on the trial of the question, the researcher made improvements to the question instrument so that students could more easily understand the problem. After the trial was carried out, students were only able to solve 3 questions out of 5 questions within the allotted time of 90 minutes. Thus, the researcher only used 3 test questions as a data collection instrument for students' computational thinking ability. The three questions used for data collection of students' computational thinking are presented in Table 1.

Table 1. Computational Thinking Ability Test Questions

No.	Inquiry
1.	SOAP FACTORY A home-based soap production CV keeps records for every product they make. The CV records daily production costs and then recapitulates them into weekly production cost records. After analyzing the graph obtained from the records, it was found that the daily production costs of the soap CV formed a quadratic function as follows: $B(x) = 2x^2 - 800x + 105.000$ B(x) is the daily production cost of the CV, which results in hundreds of rupiah, while x is a variable that states the number of units of laundry soap made on that day. Then what is the minimum daily production cost incurred by the CV, and how much soap is made at the minimum production cost?
2.	The art gallery has a chiseled wall with an arch that can be represented by a quadratic function $f(x) = -x^2 - 4x + 12$, where x is in feet. The wall space under each arch must be painted a different color than the different colors of the arch itself. Graph the quadratic function of the arches in the art gallery and determine how wide each arch is along the floor!
3.	A figurine has length and width of 45 cm and 36 cm, respectively. If the area of the photo in the figurine is 1,036 cm^2 and the distance between the edge of the photo and the edge of the figurine is the same width. Find the width of that distance!

Furthermore, researchers used a cognitive style questionnaire developed using cognitive style field-dependent and field-independent to identify the cognitive style preferences of students arranged based on cognitive style indicators. Based on the results of the cognitive style questionnaire given to 47 students, we obtained data as presented in Table 2.

Table 2. Cognitive Style Questionnaire Result Data

No.	Cognitive Style	Total Students
1.	Field Independent	26
2.	Field Dependent	21

Based on Table 2, there are 26 students who have a cognitive style field-independent; 21 students have a cognitive style field-dependent. Furthermore, researchers chose 3 students of field independent style and 2 students of field dependent style to be further explore related to the process of computational thinking through interviews. Data obtained from students' answers to the test questions on computational thinking skills were then analyzed using the assessment rubric as presented in Table 3.

At this stage, the researcher obtained the score of each student's computational thinking ability on each indicator, namely the score of abstraction indicators, pattern recognition, algorithm thinking, and generalization. Furthermore, to be able to understand more deeply the students' computational thinking ability, researchers conducted in-depth interviews to find out the students' thought processes in solving problems associated with computational thinking indicators. At the next stage, based on the analysis of answers and interviews, researchers made conclusions related to students' computational thinking ability.

Table 3. Rubric for Assessment of Computasional Thinking Skills

Indicator	Form of Assessment	Score
Abstract	Students can represent mathematical concepts in the form of symbols or mathematical language correctly in the problem.	3
	Students can represent mathematical concepts in the form of symbols or mathematical language in the problem, but only partially.	2
	Students can represent mathematical concepts in the form of symbols or mathematical language in the problem but still need to be improved.	1
	Students did not represent mathematical concepts in the form of symbols or mathematical language in the problem or did not work.	0
Pattern Recognition	Students can determine the correct pattern or formula that is suitable for the problem.	3
	Students can determine the appropriate pattern or formula for the problem, but only partially.	2
	Students can determine the pattern or formula that matches the problem but is not correct.	1
	Students cannot determine the pattern or formula that matches the problem or do not work on it.	0
Algorithmic Thinking	Students can complete the algorithm or problem solving sequentially correctly.	3
	Students can complete the algorithm or problem solving sequentially but partially.	2
	Students can complete algorithms or solve problems sequentially but less accurately.	1
	Students cannot complete the algorithm, solve the problem, or work on it.	0
Generalization	Students can draw conclusions on problem solving correctly.	3
	Students can conclude the solution to the problem, but only partially.	2
	Students can conclude the problem solving, but not correctly.	1
	Students are unable to conclude the problem-solving or do not work on it.	0

RESULTS AND DISCUSSION

These results present student answers related to mathematical computational thinking skills in terms of cognitive styles of field-independent and field-dependent styles. With this students with a field-independent cognitive style were given codes S10, S18, and S26, and students with a field-dependent style were given codes S31 and S40. The difference between the two styles is explained as follows:

Field Independent Subject (FI)

Abstract

Based on the results of the answer analysis, it shows that the three FI subjects, namely S10, S18, and S26, can represent mathematical concepts in the form of symbols or mathematical language correctly. This can be seen in the example of the answer to question number 1 on S10, as presented in Figure 1.

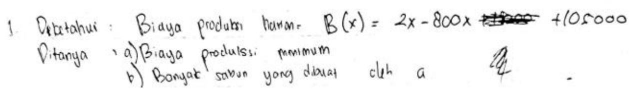

Figure 1. S10's Answer to Question Number 1 of the Abstraction Indicator

Figure 1 shows the answer of subject S10 is able to know the important information in the problem. S10 presented the daily production cost problem $B(x) = 2x - 800x + 105000$. S10 presented the question of daily production costs: what is the minimum daily production cost incurred by CV and how much soap is made at the minimum production cost. The ability of subject S10 is supported by the following interview excerpt:

P : "Can you re-explain why you wrote the known and the questioned like that?"

S10 : "I grouped the data to make it easy to analyze; I wrote it down to make it easier for me to get a solution. So we got the daily production cost $B(x) = 2x -$

$800x + 105000$, and asked for the minimum production cost and the amount of soap A makes."

Based on the analysis of the subject's answers, it can be concluded that subjects with a field-independent cognitive style can represent mathematical concepts in the form of symbols or mathematical language correctly. Thus, the field-independent subject is able to demonstrate the ability of mathematical computational thinking on abstraction indicators.

Pattern Recognition

Based on the results of the answer analysis, it shows that the three FI subjects, namely S10, S18, and S26, can determine the pattern correctly or the appropriate formula for the problem. This can be seen in the example of the answer to question number 2 on S18, as presented in Figure 2.

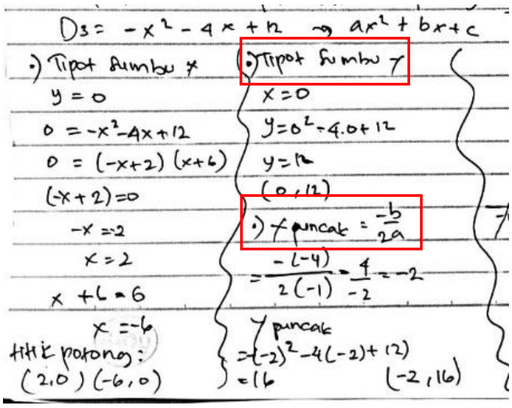

Figure 2. S18's Answer to Question Number 2 of the Pattern Recognition Indicator

Figure 2 shows the answer subject S18 is able to determine the pattern correctly; the pattern in question is looking for the intersection point on the x-axis and on the y-axis and can write the formula $x = \frac{-b}{2(a)}$. The ability of subject S18 is supported by the following interview excerpt:

P : "Based on your answer, why did you find the intersection of the x and y axes first?"

S18 : "Because in the vertex, we have to find the x and y axes first."

P : "Why did you write $x = \frac{-b}{2(a)}$?"

S18: "The formula is the cusp formula. So, to find the solution, I used this formula to define the graph."

Based on the analysis of the subject's answer, it can be concluded that the subject with a field-independent cognitive style can determine the appropriate pattern or formula correctly or the appropriate formula for the problem. Thus, the field-independent subject is able to demonstrate the ability of mathematical computational thinking on the indicator of pattern recognition.

Algorithmic Thinking

Based on the results of the answer analysis, it shows that FI subjects, namely S10, S18, and S26, can complete the algorithm or problem solving sequentially. This can be seen in the example of the answer to question number 1 on S10, as presented in Figure 3.

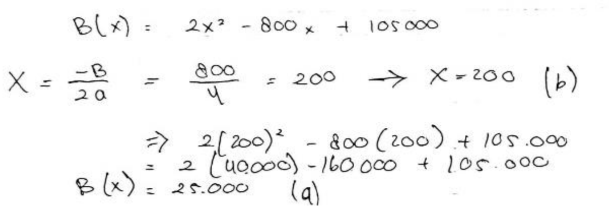

Figure 3. S10's Answer to Question Number 1 of the Algorithm Indicator

Figure 3 shows the answer of subject S10. Subject S10 is able to solve the problem from start to finish coherently and correctly, namely by finding the values of x and y from the equation $B(x) = 2x^2 - 800x + 105000$. S10's ability is supported by the following interview excerpt:

P : "Explain the steps from start to finish."

S10 : "$B(x) = 2x^2 - 800x + 105000$

$a = 2, b = -800, c = 105000$
Find the value of x from the equation:
$\frac{-b}{2a} = \frac{800}{2(2)} = \frac{800}{4} = 200$. So, the value of $x = 200$
Find the y value of the equation:

$$\frac{D}{-4a} = \frac{b^2 - 4ac}{-4a}$$
$$= \frac{(-800)^2 - 4(2)(105000)}{-4(2)}$$
$$= \frac{640000 - 840000}{-8} = \frac{-200000}{-8}$$
$$= 25000$$

Based on the analysis of the subject's answers, it can be concluded that subjects with a field-independent cognitive style can complete the algorithm or problem solving in sequence correctly. Thus, the subject with a field-independent cognitive style is able to demonstrate the ability to think computational mathematics on indicators of thinking algorithms.

Generalization

Based on the results of the answer analysis, it shows that the FI subjects, namely S10, S18, and S26, can draw conclusions about problem solving correctly. This can be seen in the example of the answer to question number 3 on S26, as presented in Figure 4.

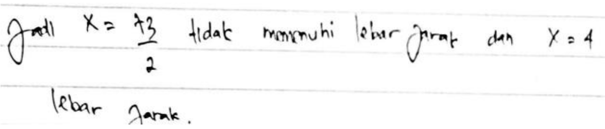

Figure 4. Answer S26 Question Number 3 Generalization Indicator

Figure 4 shows the answer of subject S26 was able to conclude the solution of the problem correctly, that $x = \frac{-3}{2}$ does not meet the width of the distance and $x = 4$ meets the width of the distance. The ability of the FI subject is supported by the following interview excerpt.

P : "Do you think the conclusion is correct? Please explain."

S26 : "Already. Because it's not possible for length to have a negative value."

Based on the analysis of the subject's answer, it can be concluded that the subject with a field-independent cognitive style can conclude problem-solving correctly. Thus, the subject with a field-independent is able to demonstrate the ability of mathematical computational thinking on indicators of generalization.

Field Dependent Subject

Abstract

Based on the results of the answer analysis, it shows that FD subjects, namely S31 and S40, can represent mathematical concepts in the form of symbols or mathematical language correctly. This can be seen in the example of the answer to question number 2 on S31, as presented in Figure 5.

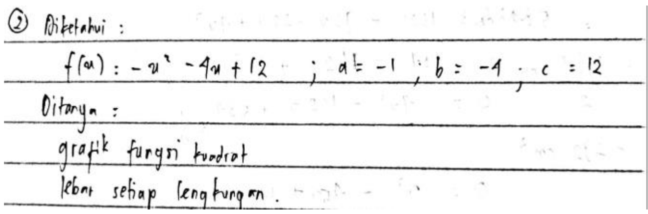

Figure 5. Answer S31 Question Number 2 Indicator of Abstraction

Figure 5 shows the answer of the subject S31. S31 is able to know the information known and asked; S31 is able to write the information $a = 1, b = -4, c = 12$, and what is asked is the graph of the square function and the width of each arch. S31's ability is supported by the following interview excerpt:

P : "Explain again why you wrote the known and the questioned like that."

S31 : "For that, I wrote according to what was asked, Sir. So that I can work more easily without repeating the questions."

Based on the analysis of the subject's answers, it can be concluded that subjects with a field-dependent cognitive style can represent mathematical concepts in the form of symbols or mathematical language correctly. Thus the field-dependent subject is able to demonstrate the ability of mathematical computational thinking on abstraction indicators.

Pattern Recognition

Based on the results of the answer analysis, it shows that FD subjects, namely S31 and S40, can determine the correct pattern or formula that is suitable for the problem. This can be seen in the example of the answer to question number 1 in S40, as presented in Figure 6.

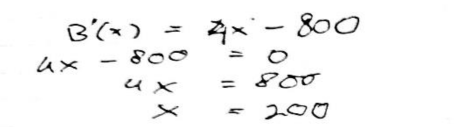

Figure 6. S40's Answer to Question Number 1 of the Pattern Recognition Indicator

Figure 6 shows the answer of subject S40 is able to recognize patterns correctly; this is supported by S40's answer in using the cusp formula, namely $x = \frac{-b}{2a}$. S40's ability is supported by the following interview excerpt:

P : "Explain why is the solution to determine the minimum amount of soap production? And why do you use the cusp with the formula $x = \frac{-b}{2a}$?

S40 : "I think it matches the question."

Based on the analysis of the subject's answer, it can be concluded that the subject with a field-dependent cognitive style can determine the appropriate pattern or formula correctly or the appropriate formula for the problem. Thus the field-dependent subject is able to demonstrate the ability of mathematical computational thinking on the indicator of pattern recognition.

Algorithmic Thinking

Based on the results of the analysis of the answers, it shows that FD subjects, namely S31 and S40, can complete the algorithm, but there is still an inappropriate order of work in the solution steps. This can be seen in the example of the answer to question number 1 on S40, as presented in Figure 7.

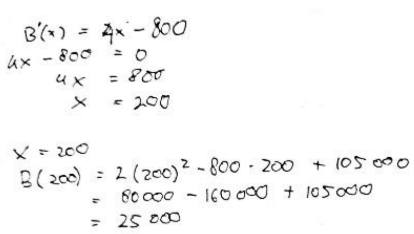

Figure 7. S40's Answer to Question Number 1 of the Algebraic Thinking Indicator

Figure 7 shows the answer of subject S40 in solving the problem is not correct. S40 enters the formula by finding the value of x and finding the number of daily production costs and minimum costs. S40's ability is supported by the following interview excerpt:

P : "Explain the steps from beginning to end."

S40 : "By finding the value of x and then entering the value of y."

P : "Then, after you solved the problem, did you check the result again?"

S40 : "No, sis."

Based on the analysis of the subject's answers, it can be concluded that subjects with a field-dependent cognitive style can complete the algorithm or problem-solving sequentially but partially. Thus, the subject with a field-dependent does not show the ability to think computational mathematics on indicators of thinking algorithms.

Generalization

Based on the results of the analysis of the answers, it shows that FD subjects, namely S31 and S40, cannot make conclusions about problem solving or do not do it. This can be seen in the example of the answer to question number 3 on S31, as presented in Figure 8.

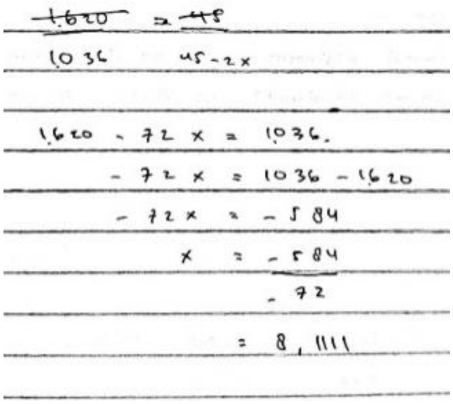

Figure 8. Answer S31 Question Number 3 Generalization Indicator

Figure 8 shows that S31 could not make a conclusion of problem solving or did not do it. S31's ability is supported by the following interview excerpt:

P : "Why did you conclude your answer like that?"
S31 : "I just wrote the answer like that and without writing the conclusion back."

Based on the analysis of the subject's answers, it can be concluded that the subject with a field-dependent cognitive style cannot make a conclusion about problem-solving or does not do it. Thus, the field-dependent subject does not show the ability to think computational mathematics on indicators of generalization.

Based on data analysis of test results and interviews, it can be formulated that both cognitive styles have similarities and differences in computational thinking ability.

Table 4. Comparison of Computational Thinking Ability of Field Independent and Field Dependent Cognitive Styles

Indicator	Field Independent	Field Dependent
Abstraction	Students can represent mathematical concepts in the form of symbols or mathematical language correctly in problems.	Students can represent mathematical concepts in the form of symbols or mathematical language correctly in the problem.
Pattern Recognition	Students are able to determine the correct pattern or formula that is suitable for the problem.	Students are able to determine the correct pattern or formula that is suitable for the problem.
Algorithmic Thinking	Students can complete the algorithm or problem solving sequentially correctly.	Students can complete the algorithm or problem solving sequentially but partially.
Generalization	Students can draw conclusions on problem solving correctly.	Students are unable to conclude the problem-solving or do not work on it.

Table 4 shows that the subjects can present the mathematical concepts of the problems presented appropriately. FI and FD subjects were generally able to understand the problem well. FI and FD subjects rewrote the information given, namely what was known about the problem, using their language. On the other hand, in writing the conclusion, the FI subject was categorized as able to complete the final step carefully and could cover all the results. This is different from the FD subject; the FD subject cannot write the conclusion of the results obtained in solving the problem, so the FD subject is categorized as unable to write the conclusion.

Research by Amaliah et al. (2022) highlighted students' understanding of certain mathematical concepts, especially linear inequality. Meanwhile, Armstrong, Cools, & Sadler-Smith (2012) and Bouck, Sands, Long, & Yadav (2021) focused on the relationship between cognitive style and computational thinking. The findings from Amaliah et al.'s study provide valuable insights into how the cognitive styles of field-independent and field-dependent students affect their ability to understand complex mathematical concepts.

Research by Amaliah et al. (2022) focused on students' understanding of mathematical concepts, especially linear inequality, by considering their cognitive style. The results of this study showed that students with field-independent cognitive styles tend to have a better understanding of linear inequality compared to students with field-dependent cognitive styles. In conclusion, cognitive style plays an important role in the process of learning mathematics, and adjusting teaching methods according to students' cognitive style can improve their understanding of mathematical concepts.

On the other hand, research by Bouck et al. (2021) examined the relationship between cognitive style and the application of computational thinking in mathematics learning. This study found that students with field independent cognitive style showed better ability in applying computational thinking principles to solve complex mathematical problems. This research emphasizes the importance of integrating computational thinking in the mathematics curriculum and shows that cognitive style can influence how students use these skills in academic contexts.

Armstrong et al. (2012) also explored the relationship between cognitive style and computational thinking ability. The results of their study indicated that students with a field-independent cognitive style are more able to adapt and apply computational thinking strategies in various learning situations. The conclusion of this study is that an understanding of students' cognitive styles can help in designing more effective teaching strategies that enable students to develop computational thinking skills optimally.

Furthermore, (Susanto, Rachmadtullah, & Rachbini, 2020) explored the relationship between field-independent and field-dependent cognitive styles and computational thinking skills in students majoring in Informatics Engineering at a state university in Bandung. The results showed that students with a field-independent cognitive style have a better ability to analyze and solve computational problems independently compared to field-dependent students, who tend to need more external help and guidance. This study concludes that cognitive style plays an important role in students' computational thinking ability and recommends teaching tailored to students' cognitive style to improve learning outcomes.

Examines the effect of cognitive style on the effectiveness of project-based learning in improving computational thinking skills in mathematics education students. The results showed that project-based learning significantly improved computational thinking skills in both groups, but the increase was higher for students with field-independent cognitive styles. Students with a field-independent style showed better ability in designing and implementing computational projects independently, while field-dependent students showed significant improvement in collaboration and group problem-solving. This study recommends the integration of project-based learning in the mathematics education curriculum by considering differences in student cognitive styles to achieve optimal learning outcomes.

The results of this study are in line with several previous studies. Research by Amaliah et al. (2022) found that students with a field-independent cognitive style have a better understanding of complex mathematical concepts, especially linear inequality. These results are consistent with findings showing that students with field-independent cognitive styles have superior computational thinking skills.

In addition, research by Armstrong et al. (2012) and Bouck et al. (2021) also supports the results of this study by showing that students with a field-independent style are more able to adapt and apply computational thinking in various learning situations. The research of Susanto et al. (2020) also strengthens the research results by showing that field-independent students are better at analyzing and solving computational problems independently than field-dependent students.

An additional perspective by finding that although field-independent students excelled in designing and implementing computational projects, students with a field-dependent style showed significant improvements in collaboration and group problem-solving. Although the results of this study are generally in line with my findings, Ramadhani and Hartono's research highlights the strength of collaboration in field-dependent students, which may not have been prioritized in the study.

What distinguishes the results of this study from previous studies are the possible influencing factors, such as variations in teaching methods, differences in academic and cultural contexts, and the type of tasks given. The learning methods used, such as project-based or collaborative learning, may give more advantage to students with a field-dependent style. In addition, the complexity and type of task may influence how each cognitive style affects student performance.

This research emphasizes the importance of understanding how various cognitive styles affect students' learning processes, especially in the context of technology and computational thinking, so that more adaptive teaching methods can be designed that suit the needs of individual students. This can not only improve students' understanding of mathematical concepts but also facilitate more effective application of technology in the learning process.

CONCLUSIONS AND SUGGESTIONS

Subjects with FI cognitive style consistently showed good ability in understanding the problems presented. They were able to organize the information well and express it in their own language, reflecting a deep understanding of the mathematical concepts tested. The problem-solving process of FI subjects showed rigor in each step, which included comprehensive analysis and thorough conclusions. In contrast, FD subjects tended to only partially grasp the results obtained, leading to less in-depth and less comprehensive conclusions.

Recommendations for further research are to develop and test more specific learning methods that can accommodate individual learning styles and more factors that can influence computational thinking abilities and a comprehensive understanding in mathematics learning.

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