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Students' Mathematical Creative Thinking Skills based on Cognitive Style in Treffinger Learning with a Constructivism Approach

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Abstract

This study aims to describe students' mathematical creative thinking skills based on cognitive style in Treffinger learning with a constructivism approach. The research method used was qualitative research method with descriptive approach. The subjects in this study were students of class VIII A of SMP IT Insan Cendekia in Semarang city. The subjects were selected by 3 students each based on cognitive style type field independent (FI) and cognitive style type field dependent (FD). Data collection techniques used the Group Embedded Figure Test (GEFT), interview guidelines, and observation. The results of this study indicate that students' mathematical creative thinking skills with a cognitive style type field independent (FI) has been able to meet the indicators of fluency, originality and elaboration are good, while the indicators of flexibility are quite good. In terms of students' mathematical creative thinking skills with a cognitive style type field dependent (FD) has been able to meet the indicators of fluency are good, the indicators of originality and elaboration are quite good, while the indicators of flexibility are less good.

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INTRODUCTION

Education has an important role in the progress of a country. The ever-changing challenges of life demand competent and qualified human resources. Therefore, education is a top priority in developing the abilities of everyone optimally in accordance with the needs of society and their personal needs.

Learning in Indonesia is expected to equip students with competencies, including showing a creative attitude (Permendikbud No. 21 of 2016). According to Rochmad, et al. (2018) students' creativity is really needed, especially in analyzing and solving problems so that they are expected to come up with creative new ideas. Creativity is a major part of mathematics learning and has been proposed as one of the main components to be included in mathematics education, because the essence of mathematics is creative thinking.

Meanwhile, according to Arista & Mahmudi (2020) someone who can think creatively can be characterized by their curiosity and ability to develop a variety of new approaches, ways, or methods of solving. In this study, there are four indicators of creative thinking skills, namely fluency, flexibility, originality, and elaboration.

Based on the results of the preliminary study, it was found that students' mathematical creative thinking skills were still low. This was shown by the results of the students' mathematical creative thinking skills test that 85% of students had not completed learning or only 15% of students had exceeded the actual completion limit and students had problems finding different ways of solving with their own language or ideas on the problem given.

One of the factors that causes low mathematical creative thinking skills is that the learning process does not involve students actively developing thinking skills that can increase their creativity. According to Kadir, et al. (2017) through planning and active and fun learning processes, observing, asking questions and reasoning can develop students' knowledge and creative thinking.

Treffinger learning is one of the learning models that addresses creative thinking skills directly. This is in accordance with research conducted by (Isnaini, et al. 2016; Triwibowo, et al. 2017; Oktavia & Masriyah, 2017) that Treffinger is a learning model that can be used to develop students' mathematical creative thinking skills.

There are three important stages in treffinger learning, namely Learning Basic Thinking Tools, Learning and Practicing Problem Solving Models, and Dealing with Real Problems and Challenges (Ilmadi, et al., 2021). According to Lestari, et al. (2015) Treffinger learning is a creative learning model that provides practical suggestions for achieving integration by involving cognitive and affective skills. This means that students are given the flexibility or freedom to be creative in solving their own problems in the desired ways.

Treffinger learning leads to the harmonious use of creative and critical thinking skills, in individuals and groups, to understand challenges and opportunities, create ideas, and develop effective plans for solving problems and managing change (Isaksen, et al., 2011). In learning mathematics with a constructivism approach, students construct their own knowledge in their minds both individually and with their discussion partners (Silva, et al., 2019) with an active role in learning (Sultan, et al., 2011).

The development of mathematical creative thinking skills also requires the right approach in learning. One approach that can be used to develop students' creative thinking skills is the constructivism approach. The constructivism approach requires students to actively construct knowledge through interaction with their environment (Azhari & Somakim, 2013) and teachers cannot directly transmit knowledge to students, but students need to actively build knowledge in their own minds (Bada & Olusegun, 2015; Konita, et al., 2017). The direct involvement of students in applying the knowledge they have or received to new knowledge is expected to move students to make the right decisions and have creativity in solving problems.

There are four cores of constructivism learning (Singh & Yaduvanshi, 2015), the first is that knowledge is physically constructed by students engaged in active learning. Second, knowledge is symbolically constructed by students creating representations of their own actions. Third, knowledge is socially constructed by students conveying their meaning to others. Fourth,

knowledge is theoretically constructed by students trying to explain things they do not fully understand.

According to Purnomo et al. (2017) the way students express their creative ideas is different, this is because the thinking styles of students are different. Mathematical problem solving strategies are influenced by the way students process, save, and use information to respond to a problem. In the world of education this is called cognitive style. In line with this, the position of cognitive style in learning should not be ignored, because it influences students' skills to obtain the information received and the problem solving process.

This is supported by the opinion that the Treffinger learning model can develop students' mathematical creative thinking skills (Ekasari, 2017; Zihni & Isnarto, 2020; Nurzulifa & Dwijanto, 2021; Sugiarto, et al., 2021). Meanwhile, the results of research conducted by Lihu, et al. (2021) there is an increase in mathematical creative thinking skills by using a constructivism approach.

The aim of this study is to describe students' creative mathematical thinking skills based on cognitive style in Treffinger learning with a constructivism approach.

METHOD

This research used descriptive qualitative research. The subjects used in this research were 8th grade students at SMP IT Insan Cendekia in Semarang city for the 2021/2022 even semester academic year. The research sample selection technique uses purposive sampling technique. Then the research subjects were selected 3 students with a cognitive style type field independent (FI) and 3 students with a cognitive style type field dependent (FD) to be analyzed and interviewed the results of the creative thinking skills test.

The data sources in this qualitative research are observation sheets on learning implementation, analysis results of students' mathematical creative thinking skills tests, the results of GEFT, and interviews with students.

In this study, four qualitative data validity tests were carried out, namely the credibility test, transferability test, dependability test, and objectivity test (confirmability). Meanwhile, qualitative data was analyzed following the steps of the Miles and Huberman concept (Sugiyono, 2013), namely data reduction, data presentation, drawing conclusions and verification.

RESULTS AND DISCUSSIONS

Cognitive style data of students in this study were obtained through filling GEFT (Group Embedded Figure Test) instrument in class VIII A SMP IT Insan Cendekia as many as 27 students. Based on the results of the qualitative analysis, students were first grouped based on cognitive style after completing the GEFT. Students who get a score of 0 to 11 are included in the field dependent type, while students who get a score of 12 to 18 are included in the field independent type (Zakiah, 2020). The results of filling out the GEFT instrument are presented in Table 1.

Tabel 1. Classification of Students based on Cognitive Style

Category	Number of Student	Precentage (%)
Field Independent	3	11,11
Field Dependent	24	88,89

Data from Table 1. shows that the total number of students in class VIII A is 27 students with 3 students or 11.11% included in the field independent (FI) type and 24 students or 88.89% included in the field dependent (FD) type. Three students were selected for each type as research subjects whose creative thinking skills would be analyzed in more depth.

The description of students' mathematical creative thinking skills based on cognitive style is analyzed by paying attention to indicators of mathematical creative thinking skills, namely fluency, flexibility, originality, and elaboration. The following is an analysis that has been carried out about field independent (FI) and field dependent (FD) cognitive styles, there are differences in students' mathematical creative thinking skills presented in Table 2.

Tabel 2. Differences in Students' Creative Mathematical Thinking Skills Based on Cognitive Styles Type Field Independent (FI) and Field Dependent (FD)

Indicators	Cognitive Style	
	FI	FD
Fluency	Good	Good
Flexibility	Quite Good	Less Good
Originality	Good	Quite Good
Elaboration	Good	Quite Good

Based on Table 2. the creative thinking skills of students with the field independent (FI) cognitive style are good in terms of indicators of fluency, originality, and elaboration. Quite good at the indicator of flexibility. Then students with a field dependent (FD) cognitive style are good at indicator of fluency. Quite good at indicators of originality and elaboration. Less good on the flexibility indicator.

Students' mathematical creative thinking skills for the FI subject in the fluency indicator have met good, meaning that the FI subject is able to solve mathematical problems correctly. They can present the information contained in the problem and then solve it correctly. The flexibility indicator for FI subjects meets quite good, meaning that not all FI subjects are able to solve mathematical problems in various ways correctly. This is because there is one FI subject who has not been able to silve different problem solving strategies. The originality indicator of the FI subject has good, meaning that the FI subject has solved the problem using his own language or his own thoughts. Only one FI subject made a mistake in the calculation process so that the result of the solution was not correct. Meanwhile, the FI subject's elaboration indicators have also met well, meaning that the FI subject has been able to solve problems by developing or detailing a given problem correctly and precisely as well as writing problem solutions in detail and systematically.

Based on the description above, students with a field independent (FI) cognitive style have been able to achieve the four indicators of mathematical creative thinking skills even though they are less than optimal in trying to complete different problem solving strategies.

The mathematical creative thinking skills for subject FD that meets the indicators of creative mathematical thinking good is only an indicator of fluency, meaning that FD research subjects can solve mathematical problems correctly. Subject FDs are able to understand the problem given, and choose the correct solution.

In the indicator of flexibility, the FD subject is less good at solving problems. This is because there are no FD subjects who can solve problems in various ways correctly. There was one FD subject who tried to solve in a different way but there was an error in the calculation process.

In the indicators of originality and elaboration, FD is quite good at solving problems. None of the FD subjects in the originality indicator have been able to solve problems using their own language or thoughts correctly and precisely. Subject FD has tried to write the solution in his own way even though the answer is not correct. Meanwhile, in the elaboration indicator, no FD subject has been able to solve the problem by developing or detailing a given problem correctly and precisely. This is because FD subjects experience difficulties in applying the formulas used and are less careful in the calculation process.

Based on the description of the results of the answers and interviews with the six research subjects regarding students' mathematical creative thinking skills, it was found that FI subjects were more able to fulfill the four indicators of creative thinking skills in problem solving than FD subjects. This is in line with research results (Purnomo, et al., 2017; Napfiah, 2018) that field independent students tend to have higher creativity than field dependent students in solving mathematical problems. This statement is supported by (Baiduri, 2015; Basir, 2015; Marlissa & Widjajanti, 2015; Asmara, 2019) that field independent individuals are superior to field dependent individuals.

CONCLUSION

Based on the results of the analysis and discussion presented above, it can be concluded that students' mathematical creative thinking skills based on cognitive style type field independent (FI) has been able to meet the indicators of fluency, originality and elaboration are good, while the indicators of

flexibility are quite good. On the cognitive style type field dependent (FD) has been able to meet the fluency indicators are good, the originality and elaboration indicators are quite good, while the flexibility indicators are less good.

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