



# The mathematical creative thinking ability of students viewed from learning motivation by using Treffinger learning model

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## Abstract

The purpose of this study were to (1) know the achievement of the guidance to learn the skills of mathematical creative thinking students in Treffinger learning, (2) know the increase of students' mathematical creative thinking skills in Treffinger learning, and (3) describe students' mathematical creative thinking skills for each category of learning motivation in Treffinger learning. This research method is a mixed methods design with sequential explanatory. The population in the study were all students of class VII Junior High School 3 Semarang Year 2019/2020, and sampling was conducted by random sampling selected to be sampled is a class VII-H. The subject of research conducted by purposive sampling technique. Subjects consisted of 6 students. Subjects were interviewed by the results of tests of creative mathematical thinking skills and student motivation. The results showed that (1) students' mathematical creative thinking abilities in Treffinger learning achieve mastery learning. (2) There is an increase in students' mathematical creative thinking skills in Treffinger learning. Increased mathematical creative thinking skills are medium. (3) Subject to high learning motivation can meet the indicators flexibility, fluency, and novelty. Subject to being able to meet the learning motivation fluency and novelty or just fluency. Subjects with low learning motivation are only able to meet one indicator fluency.

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## 1. Introduction

One of the capabilities that need to be developed and improved in mathematics, namely mathematical creative thinking abilities. Regulation of the Minister of National Education Number 22 Year 2006, stated that mathematics subjects need to be given to all students to equip students with logical, analytical, systematic, critical, creative, and working skills.

Creative thinking skills required in mathematics to solve problems. Students who have the ability to think creatively to solve problems according to Ningsih (2012), students will use various strategies. Kemendikbud (2013) states that the creativity of the students in the learning of mathematics is very important, especially in solving problems that involve students to think creatively, where students are expected to put forward new ideas are creative in analyzing and solving problems.

The creative thinking skills of Indonesian people are relatively low compared to other countries. Based on the results of the survey of PISA (OECD, 2015) Indonesia was 64 from 70 countries. Indonesia gets a score of 386 in mathematics. Even the results of PISA (OECD, 2018) Indonesia was ranked 72 from 77 countries, meaning that Indonesia has decreased compared to previous PISA results. While the results of interviews with the teachers of mathematics of Junior High School 3 Semarang, related to the creative thinking skills of students only a few students who have the ability. Although The teacher has given a question that has several ways but most students still work on the matter as demonstrated by the teacher.

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To support creative thinking ability, motivation to learn is very necessary for a student as a push or force students to learn so as to achieve the desired learning achievement. Slameto (2010) also states there are at least seven factors are classified into factors that affect learning outcomes. These factors, namely intelligence, attention, interest, aptitude, motivation, maturity and exhaustion.

Learning outcomes will be optimum if there is proper motivation (Sardiman, 2014). However, all students have the same motivation. Motivation in a person can be categorized as high, medium or low. A person who has a low learning motivation tend to have a creative that is not optimal. Instead, someone who has a high learning motivation tend to have great creativity. This is supported by the results of research conducted by Eftafiyana, et al. (2018), the higher the ability to think creatively mathematical students will be higher the learning motivation of the students on the contrary if the ability to think creatively mathematics students have less, then so is the motivation owned by students.

It is very important in choosing the right model of learning because it has a large part in a learning process. Suherman et al. (2003) stated that in mathematics, teachers should select and use strategies, approaches, methods, and techniques that involve active student learning, both mentally, physically, and socially which is intended to be able to grow the aims of teaching mathematics creatively and critically. Necessary to apply an appropriate learning models in developing the mathematical creative thinking abilities that Treffinger learning model.

Isaksen, Dorval, & Treffing (2011), states that Treffinger learning model leads to use creative and critical thinking skills in harmony, in individuals and groups, to understand the challenges and opportunities, create ideas, and develop an effective plan to solve problems and manage change. Treffinger Model is one of the few models that deal directly creativity and give practical advice on how to achieve integration (Munandar, 2014). Backed by the research results Isnaini, et al. (2016), there are significant application of learning models Treffinger to increase students' ability to think creatively mathematically. While the results of the research that has been done by Maharani (2018) showed a significant effect of the use of the learning model Treffinger to creative thinking ability in mathematics and an increase in the high category.

Treffinger learning is a model student-centered learning. In this model the students involved in learning that enables students to explore his abilities to the maximum, so as to motivate learners. This is according to research from Puspita (2018) states that using learning model Treffinger can develop learning motivation and creative thinking abilities of learners.

The purpose of this study (1) determine the achievement of mastery learning mathematical creative thinking abilities in teaching students of class VII Treffinger. (2) to increase the ability of creative thinking mathematically seventh grade students in learning Treffinger. (3) describe the mathematical creative thinking abilities seventh grade students for each category of learning motivation in learning Treffinger.

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## 2. Method

This type of research is the study combined (mixed methods). According to Creswell (2014) mixed methods research is research approaches that combine or associate the form of qualitative and quantitative form.

The method used is sequential explanatory design. Sequential explanatory design method is a research method that combines quantitative and qualitative research methods in order, with the first stage of conducting research with kauntitatif method and in the second stage with qualitative methods (Creswell, 2014).

This study research design Experimental forms True One-Group Pretest-Posttest Design. In this design is taken of the group treated. The group was given a pretest before being treated. Thus the results of the treatment can be determined more accurately because it can be compared with the situation before the treated posttest (Sugiyono, 2016).

The population in this study were all students of class VII Junior High School 3 Semarang 2019/2020 academic year is divided into eight classes. The sampling technique is simple random sampling, which means taking members of the sample of the population was randomly without taking into account the existing strata in the population and the obtained sample is class VII H.

Quantitative research is used to determine whether the achievement of mastery learning mathematical creative thinking abilities seventh grade students of Junior High School 3 Semarang on Treffinger learning and knowing the increase in mathematical creative thinking abilities in teaching students of class VII Treffinger. This quantitative data obtained through tests of creative mathematical thinking skills that pretest and posttest. Indicators of mastery learning in this study was a class is said to achieve mastery learning when creative thinking abilities of individual students' mathematical reach minimum submission criteria (MSC) is 75 and in the classical least 75% of the number of students in the class reached the minimum submission criteria. Analysis of quantitative data in this research using the three trials that the average achievement test, test and test classical completeness normalized gain. Average achievement test by testing hypotheses  $H_0 : \mu \leq 74.5$  (The average student mathematical creative thinking ability test results in Treffinger's learning has not yet achieved a learning submission) and  $H_1 : \mu > 74.5$  (The average student mathematical creative thinking ability test results in Treffinger has achieved a learning submission). While the test criteria is rejected  $H_0$  if  $t_{count} \geq t_{1-\alpha}$  with  $t_{1-\alpha}$  obtained from the Student t distribution table using opportunities  $(1 - \alpha)$  and degree of freedom  $= (n - 1)$  (Sudjana, 2005). Classical completeness test with the hypothesis testing  $H_0 : \pi \leq 0.745$  (the percentage of students' creative thinking ability in learning mathematical Treffinger yet reached complete learn classical) and  $H_1 : \pi > 0.745$  (the percentage of students' creative thinking abilities in learning mathematical Treffinger has achieved mastery in classical). While the testing criteria used is received  $H_0$  if  $z > -z_{0.5-\alpha}$  where  $z_{0.5-\alpha}$  obtained from the standard normal list with opportunities  $(0.5 - \alpha)$ . If  $H_0$  are accepted then the study class that acquired fractional material on Treffinger learning achieves a classical learning submission.

Qualitative research is used to determine the ability to think creatively mathematical description seventh grade students of Junior High School 3 Semarang on material fractions using Treffinger learning in terms of motivation to learn. The qualitative data obtained from interviews with study subjects on the results of the test work mathematically creative thinking abilities.

Subjects in this study were 6 students of class VII Junior High School 3 Semarang academic year 2019/2020. Selection of research subjects by making purposive sampling technique. According Sugiyono (2016), a sampling technique with a certain consideration. How to determine the subject of research that is based on the classification of the level of student motivation. Researchers determine the six students based on certain considerations which are composed of two students with high learning motivation, two students with moderate motivation, and 2 students with low motivation. The selected sixth student who has conducted tests of creative mathematical thinking skills and will be interviewed further. Having chosen the subject of research,

### 3. Results and Discussion

#### 3.1. Categorization of Motivation

Classification of learning motivation is done to 32 students in class VII H using a learning motivation questionnaire that has been validated by experts and has been tested for validity and reliability. Based on the interpretation of the score questionnaire, students who received a score of  $\geq 79.4$  is said to have a high motivation to learn, score of 65.4 to 79.4 is said to have moderate learning motivation, and a score  $< 65.4$  is said to have a low learning motivation.

Based on the result of classification of students learning motivation, there are 6 students who have high learning motivation, 22 students who have moderate learning motivation, and 4 students who have low learning motivation. Grouping students in terms of motivation to learn are presented in Table 1.

**Table 1.** Judging from the students' motivation to learn

Category	Number of Students	Percentage (%)
High	6	18.75
Moderate	22	68.75
Low	4	12.5

Selected 6 subjects consisted of two students from a group of students with high learning motivation, two students from a group of students with moderate learning motivation, and two students from a group of students with low learning motivation. The sixth subject has conducted tests of creative mathematical thinking skills will then be interviewed further. The research subject can be seen in Table 2.

**Table 2.** Research Subjects

Code	Score	Level of Motivation
E-01	84	High
E-21	83	High
E-10	67	Moderate
E-25	73	Moderate
E-13	62	Low
E-11	61	Low

### 3.2. Analysis of Quantitative Data

Based on the results of the creative thinking ability (MCTA) test, the average pretest and posttest mathematical creative thinking abilities in the research class were 42.75 and 79.88. Data from these tests then tested as follows.

#### 3.2.1. Normality Test

Normality test result data pretest and posttest mathematical creative thinking abilities of students using the Kolmogorov-Smirnov. The hypothesis proposed is:

$H_0$  : Data comes from a normal distributed population

$H_1$  : Data come from populations that are not normally distributed

Hypothesis testing criteria is received  $H_0$  if the value of  $sig > 0.05$ . The output results of the final data normality test can be seen in Table 3.

**Table 3.** Normality Test Results

MCTA Tests	Mean	Sig
Pretest	42.75	0.517
Posttest	79.88	0.113

Based on the results of the normality test pretest and posttest values in Table 3 shows that, for a value of 0.517 and pretest Sig Sig value 0.108 posttest. Because the value of Sig pretest and posttest  $> 0.05$ , so  $H_0$  it received, which means that the value of pretest and posttest normal distribution.

#### 3.2.2. Classical Completeness Test

Classical completeness test is performed to measure the ability of creative thinking in terms of students' mathematical learning motivation Treffinger learning model can achieve mastery in classical learning in accordance with the minimum completeness criteria (KKM) were determined. Minimal completeness criteria (KKM) classical set of 75%. This mastery test using test proportion of one hand (right) with  $\pi_0 = 0,745$ . From the calculation results obtained  $z_{count} = 2.04$ . With significance level of 0.05 obtained  $z_{table} = z_{0,5-\alpha} = z_{0,45} = 1.64$ . Because of  $z_{count} = 2.04$  and  $z_{table} = 1.64$ . Obviously  $z_{count} > z_{table}$ , it is rejected  $H_0$  and received  $H_1$ . This means that the ability of creative thinking in the students' mathematical learning model Treffinger has achieved mastery in the classical.

#### 3.2.3. Average Achievement Test

The average value of creative thinking abilities mathematical posttest using predefined KKM is 75. To find out the average achievement, the right-side t test with  $\mu_0 = 74.5$ . From the calculation obtained the value  $t_{count} = 3.95$  and  $t_{1-\alpha} = 1.71$ . So  $t_{count} \geq t_{1-\alpha}$  that  $H_0$  was rejected and accepted  $H_1$ . This means that the average student's ability to think creatively mathematical learning KKM Treffinger over the limit.

### 3.2.4. Normalized Gain Test

Calculations performed using Paired Sample T Test. The criteria acceptable  $H_0$  if the significance of  $> 0.05$  and otherwise. Based on the calculation results obtained by the Sig =  $0.000 < 0.05$ , which means reject  $H_0$  and accept  $H_1$ . This means that there is a difference and an improvement between pretest and posttest value creative thinking abilities Treffinger learning mathematical model.

Having in mind the difference in the average, in this study researchers to test the gain is normalized by Hake (1998: 65). From the calculation obtained  $\langle g \rangle = 0.648$ . Gain normalized 0.648 criteria is in the interval  $0.3 \leq \langle g \rangle \leq 0.7$ , which means an increase in creative thinking abilities of students learning mathematical Treffinger in the medium category.

### 3.3. Mathematical creative thinking skills reviewed from student motivation to learn

Mathematics creative thinking ability test results and interview results are analyzed by noting the indicators of mathematical creative thinking capabilities that include: (1) Fluency, refers to the ability of students to give answers to diverse problems and correct. Some of the answers to the problem is said to vary, if the answers seem different and follow a certain pattern; (2) flexibility, refers to the ability of students to solve problems in a variety of different ways. Students solve problems in the way the settlement later in the way of solving the other. Students are expected to explain the way of solving the problem; (3) Novelty in problem solving refers to the ability of students to answer the problem with some of the answers vary but is true or one answer is "unusual" by individuals (students) in the level of knowledge. Some say the answer is different, it looks different when the answer and do not follow a certain pattern.

The results of post-test analysis and the ability to think creatively mathematically derived interview recap of the entire subject achievement indicators presented in Table 4.

**Table 4.** Summary of Analysis Results Mathematically Creative Thinking Ability

Level Motivation to learn	Code	Indicator		
		Flexibility	Fluency	Novelty
High	E-01	√	√	√
	E-21	√	√	√
Moderate	E-10	-	√	-
	E-25	-	√	√
Low	E-11	-	√	-
	E-13	-	√	-

#### 3.3.1. Mathematical creative thinking skills reviewed from the motivation to learning high

Based on the study through questionnaires of motivation to learn, there are 6 students that fall into the category of having high learning motivation. Researchers took two research subjects of 6 students who have high motivation to learn as a sample for analyzing the mathematical creative thinking abilities. Both subjects are able to complete all the items the ability to think creatively mathematically well according to indicators that have been set.

Results of the analysis showed that subjects with a high motivation to learn is able to meet all the indicators of mathematical creative thinking abilities, in this case that fluency, flexibility, and novelty. Students with high learning motivation to resolve the matter properly. At the time of solving problems involving the indicators of flexibility, students with high learning motivation can provide more than one way of solving the problem. In indicator fluency, students with high learning motivation can deliver more than two answers, and students are able to explain the workmanship smoothly. At the time of solving the novelty indicator, students with high learning motivation can work on the problems with the completion of a unique with his own thinking. Therefore, students with high learning motivation can achieve all indicators that the creative abilities with optimal flexibility, fluency, and novelty. This is in line with Eftafiyana et al. (2018) that the higher the students' ability to think creatively mathematically, the higher also learning motivation of the students.

### 3.3.2. *Mathematical creative thinking skills reviewed from the motivation to learning moderate*

Based on the study through questionnaires of motivation to learn, there are 22 students who fall into the category have moderate learning motivation. Researchers took two subjects research of 22 students who have moderate learning motivation as a sample for analyzing the mathematical creative thinking abilities. Both subjects are almost completed all items creative thinking abilities correspond mathematically well defined indicators that have been fairly well.

Students with moderate learning motivation to actually understand all the questions given and can answer correctly. On the matter of the flexibility indicator of student motivation to learn about the trial was able to answer correctly, but only able to provide one way of settlement. While the indicator fluency and novelty students were able to answer correctly. Problem indicators fluency students were able to provide more than two answers correctly. And be able to explain how to get the answer to smooth and detailed. While the novelty indicator, students with learning motivation is being able to work on the problems with a unique settlement with his own thinking. Thus, students with moderate learning motivation has the ability to think creatively mathematically quite good. Students are motivated to learn hearings have fluency indicators and novelty or just have fluency.

### 3.3.3. *Mathematical creative thinking skills reviewed from the motivation to learning low*

Based on the study through questionnaires of motivation to learn, there are four students who fall into the category has a low learning motivation. Researchers took 2 of 4 students study subjects who have a low learning motivation such as a sample for analyzing the mathematical creative thinking abilities. Both subjects are almost completed all items creative thinking abilities correspond mathematically well defined indicators that have been unfavorable.

From the analysis of the job and interview the research subjects were learning motivation category, students were only able to solve problems with creative thinking abilities fluency indicators. At the time of resolving problems with indicators of flexibility, students with low learning motivation is actually capable of doing the question correctly. However, students were only able to give one way of settlement. At the time of solving the novelty indicator, students with low learning motivation of students have not been able to work on the problems with the completion of a unique with his own thinking. Thus, students with low motivation had difficulty in solving mathematical creative thinking abilities. Because students with low motivation can only solve problems with fluency indicators. Based on the analysis of the ability test results mathematical creative thinking and interview results for each category of learning motivation, ability mathematical creative thinking of students with motivation higher learning is better than ability mathematical creative thinking of students with motivation moderate learning and low motivation to learn. While the ability to think mathematically creative students with moderate learning motivation are almost equal to the average of each ability indicator mathematical creative thinking of students with motivation low learning. This is in line with research Ermistri (2017) says that there is significant relationship between learning motivation by mathematical creative thinking in class students VII strong and positive..

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## 4. Conclusion

Based on the results of research and discussion on mathematical creative thinking abilities of students in terms of learning motivation in learning model Treffinger be concluded as follows. (1) the ability to think creatively mathematical seventh grade students of Junior High School 3 Semarang in terms of learning motivation in learning model Treffinger achieve mastery learning, (2) ability to think creatively mathematical seventh grade students of Junior High School 3 Semarang on learning Treffinger increased with an index gain of 0,64 so that the increase in medium category, (3) a description of the ability to think creatively mathematical class VII Junior High School 3 Semarang in terms of learning motivation in Treffinger learning model with indicators flexibility, fluency, and novelty.

Students with high learning motivation is able to meet all the indicators of mathematical creative thinking abilities, in this case that fluency, flexibility, novelty. At the time of solving problems involving the indicators of flexibility, students with high learning motivation can provide more than one way of solving the problem. In indicator fluency, students with high learning motivation can deliver more than two answers, and students are able to explain the workmanship smoothly. At the time of solving the

novelty indicator, students with high learning motivation can work on the problems with the completion of a unique with his own thinking.

Students with learning motivation was simply fulfilling an indicator of creative mathematical thinking skills, in this case that fluency and novelty or simply fluency. Has not been able to meet the indicators of flexibility. On the matter of the flexibility indicator of student motivation to learn about the trial was able to answer correctly, but only able to provide one way of settlement. While the indicator fluency and novelty students were able to answer correctly. Problem indicators fluency students were able to provide more than two answers correctly. And be able to explain how to get the answer to smooth and detailed. In indicator novelty, student motivation to learn is being able to work on the problems with the completion of a unique with his own thinking.

Students with learning motivation was simply fulfilling an indicator of creative mathematical thinking skills, in this case that fluency. Has not been able to meet the indicators of flexibility and novelty. At the time of resolving problems with indicators of flexibility, students with low learning motivation is actually capable of doing the question correctly. However, students were only able to give one way of settlement. At the time of solving the novelty indicator, students with low learning motivation of students have not been able to work on the problems with the completion of a unique with his own thinking.

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