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## Relationship between Self-Confidence and Students' Mathematical Creative Thinking Ability

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### ABSTRACT

Mathematical creative thinking ability and self-confidence are two important interrelated aspects in mathematics learning. Self-confidence plays a role in encouraging students' courage to put forward ideas, try various problem-solving strategies, and persevere when facing difficulties, thus potentially supporting the development of mathematical creative thinking ability. Therefore, a study on the relationship between self-confidence and mathematical creative thinking ability is important to understand the contribution of the affective aspect to the development of students' cognitive abilities. This study used a quantitative approach with a correlational method to analyze the relationship between the two variables. The subjects were eighth-grade students of SMP Negeri 8 Garut who were selected using a purposive sampling technique. Data were collected through a self-confidence questionnaire and a mathematical creative thinking ability test in the form of descriptive questions. The questionnaire and test instruments have undergone validity and reliability tests to ensure the feasibility of measuring each research variable. Based on the results of the descriptive analysis, it is known that the majority of students have self-confidence in the medium category (54%), while mathematical creative thinking ability is in the medium category (38%). Because one of the data is not normally distributed, inferential analysis was conducted using the Spearman correlation test. The results of this test indicate a significant positive relationship between self-confidence and mathematical creative thinking ability, with a correlation coefficient of 0.464 and a significance value of  $0.017 < 0.05$ . Thus, it can be concluded that the higher the student's self-confidence, the better the mathematical creative thinking ability they have. This shows that self-confidence contributes to mathematical creative thinking ability, although it is not the only influencing factor.



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## Introduction

Education is the primary foundation for developing competent, adaptive human resources capable of competing and thriving in the era of globalization and the Industrial Revolution 4.0 (Rozi & Afriansyah, 2022). This confirms that education plays a strategic role in preparing individuals who excel not only academically but also adapt to ongoing social change and technological advancements. Rapidly evolving times require the education system to continuously adapt, both in terms of curriculum, methods, and learning strategies. In this modern era, education is experiencing a paradigm shift, no longer solely oriented towards mastery of material but also towards developing 21st-century skills such as thinking, collaboration, and communication (Revanda et al., 2024). This paradigm shift demonstrates that learning needs to be designed to encourage student engagement and provide space for the development of higher-order thinking skills. Therefore, education is not only a basic need but also a long-term investment in developing a superior and competitive generation. Along with the rapid development of science and technology, updates in the education system have become a necessity so that the learning process can effectively respond to the challenges of the times (Ernitasari et al., 2022).

One educational domain that plays a strategic role in developing higher-order thinking skills is mathematics education (Anditiasari et al., 2021). This relates to the characteristics of mathematics as a basic science that trains students to think systematically, logically, and deeply. Mathematics plays a crucial and strategic role in the advancement of science and technology, both as a means of supporting the application of various disciplines and as a foundation for the development of mathematics itself (Istiqomah & Nurulhaq, 2021; Khoirotunnisa & Irhadtanto, 2020). This strategic role implies that mathematics learning should not only focus on achieving final results, but also on the thought processes experienced by students during the learning process. Furthermore, mathematics serves as a means to train logical, analytical, systematic, critical, and creative thinking skills, as well as supporting communication and problem-solving skills (Gusteti & Neviyarni, 2022). One important competency expected to be developed through mathematics learning is the ability to think mathematically creatively, as this ability supports students in addressing complex problems flexibly, effectively, and innovatively (Anditiasari et al., 2021).

Mathematical creative thinking is an important skill students must possess in mathematics learning. Mathematical creative thinking is defined as the ability to generate new, original, and mathematically relevant ideas (Andiyana et al., 2018). This ability not only reflects mastery of the material but also reflects students' ability to explore, discover, and develop various innovative problem-solving strategies. In the process of solving mathematical problems, creative thinking plays a crucial role because it accustoms students to develop and apply various alternative solutions flexibly and effectively (Sari & Untarti, 2021). Conceptually, mathematical creative thinking encompasses several aspects: fluency in generating numerous ideas, flexibility in using various approaches, originality in creating unique solutions, and elaboration in developing ideas in depth (Dalilan & Sofyan, 2022). These four aspects are important indicators in measuring the extent to which students are able to think creatively in solving problems. Based on several explanations, creative mathematical thinking skills are crucial for equipping students to face global challenges and rapid technological developments. However, the reality on the ground shows that students' creative thinking skills are still lacking. This is in line with research by Sari & Afriansyah, (2022), which shows that students' mathematical creative thinking skills are still relatively low. This finding indicates that the ongoing learning process has not fully provided space for students to develop creative ideas in solving mathematical problems. This statement is supported by the results of the 2022

Programme for International Student Assessment (PISA) survey and the 2019 Trends in International Mathematics and Science Study (TIMSS), which showed low student creativity, because the characteristics of the questions in PISA and TIMSS are contextual, requiring reasoning, argumentation, and creativity in solving the problems (Maryati & Nurkayati, 2021; Masfufah & Afriansyah, 2021; Wathoni & Negara, 2024). These results indicate a gap between the demands of global competence and students' abilities.

One contributing factor is the suboptimal use of learning models and media that support active student engagement. The learning process is still dominated by teachers using one-way methods that provide minimal space for students to explore ideas independently (Wulandari et al., 2021). This learning pattern has the potential to make students passive and less skilled at expressing ideas. As a result, students become passive, less motivated, less confident in expressing their ideas, and experience difficulty understanding and applying mathematical concepts to real life (Firdausi et al., 2018; Huliatusunisa et al., 2019). In addition to the cognitive domain, namely creative thinking skills, the development of affective aspects is also an important part of teaching and learning activities. One affective aspect that plays a significant role in student success is self-confidence, as it reflects an individual's confidence in completing tasks and choosing appropriate, effective, and appropriate solution strategies (Fardani et al., 2021). Self-confidence can be seen as a person's method of evaluating and understanding their self-concept in assessing their abilities and their environment, which is manifested in a responsible attitude, persistence, and a strong commitment to achieving learning goals (Ernitasari et al., 2022). Thus, self-confidence is crucial in the mathematics learning process because it influences learning outcomes, courage in expressing opinions, asking questions, and solving math problems independently.

High self-confidence has a positive impact on students, as it encourages active contribution in the learning process, reduces fear when facing difficulties, and students are more adept at understanding complex mathematical ideas. Aeni et al., (2018) explained that students with high self-confidence are less easily anxious about the challenges of learning mathematics, are more active in participating in learning activities, dare to express opinions, and have a strong learning motivation. However, the reality in the field shows that in the process of learning mathematics, the level of student self-confidence is still relatively low. This condition is evident when students tend to be passive in class, such as hesitant to ask questions, reluctant to give opinions, and feel anxious when asked to present the results of assignments in front of the class (Isyana et al., 2024). This can hinder students' active involvement in learning activities and impact the improvement of their abilities.

Based on the above description, mathematical creative thinking skills and self-confidence are two aspects that play an important role in the mathematics learning process. However, in practice and previous studies, the development of mathematical creative thinking skills is still more focused on the cognitive aspect, while its relationship with the affective aspect, especially students' self-confidence, has not been widely studied in an integrated manner. Therefore, this study was conducted to analyze the relationship between self-confidence and students' mathematical creative thinking skills. The results of this study are expected to provide a more comprehensive understanding of the role of self-confidence in supporting mathematical creative thinking skills and serve as a basis for designing mathematics learning strategies that pay attention to the balance between students' intellectual and emotional aspects.

## Method

### Research Type

This study uses a quantitative approach because it allows for the collection of numerical data that can be statistically analyzed to obtain objective conclusions. The quantitative approach also supports the use of standardized instruments to systematically and measurably measure research variables, and allows for empirical hypothesis testing. The research design used is a quasi-experimental design with a correlational form, which aims to examine the relationship between students' mathematical creative thinking ability (X) and self-confidence (Y).

### Population and Sample

The population in this study was all eighth-grade students at SMP Negeri 8 Garut in the 2025/2026 academic year. This population was chosen because it aligns with the research focus, which is to examine the relationship between mathematical creative thinking skills and students' self-confidence at the junior high school level. Sampling was conducted using purposive sampling, a technique for determining samples based on specific considerations relevant to the research objectives. These considerations included: (1) recommendations from mathematics subject teachers; (2) equivalence of academic ability based on previous mathematics grades; and (3) similarity in the characteristics of the applied learning process. Based on these criteria, one class was selected that was deemed to have characteristics representative of the population. The selected class consisted of 26 students. Therefore, all students in the class served as the research sample, resulting in a total sample size of 26 students.

### Instrument

The research instruments used consisted of two types, namely a self-confidence questionnaire and a mathematical creative thinking ability test. The self-confidence questionnaire was used to determine the level of students' confidence in understanding and completing mathematical material. The self-confidence questionnaire was compiled based on Bachtiar's indicators, covering eight aspects: (1) confidence in one's own abilities, (2) optimistic attitude, (3) objectivity in thinking and acting, (4) responsibility, (5) rational attitude, (6) ability to respond to success and failure, (7) efforts to improve abilities and skills, and (8) appreciation and acceptance in the classroom.

**Table 1. Self-Confidence Instrument**

Item	Statements	Item	Statements
1	I am able to solve math problems with confidence.	16	I feel anxious when taking math tests.
2	I can understand the mathematical concepts taught.	17	I find math too difficult to understand.
3	I believe that effort will pay off in learning mathematics.	18	I give up when I have difficulty solving a problem.
4	I expect to be able to solve math problems well.	19	I have difficulty accepting criticism and suggestions in math lessons.
5	I view mistakes in solving math problems as learning opportunities.	20	I don't do assignments if they aren't due.
6	I complete math assignments within the time allotted.	21	I put off doing assignments that I find too difficult.
7	I research material I don't understand independently.	22	I hope to understand the material immediately without studying.

8	I realize that mastering math requires time and practice.	23	I hope for good grades even if I don't study hard enough.
9	I feel comfortable asking my teacher if there is something I don't understand in math.	24	I feel incapable of understanding the math material being taught.
10	I believe that I can improve my math skills.	25	I feel embarrassed to ask questions if there's something I don't understand in math.
11	I find better ways to solve problems than before.	26	I have difficulty understanding concepts even after they've been explained.
12	I reread my answers to ensure there are no calculation errors.	27	I'm not confident with my answers even after I've worked them out according to the formula.
13	I feel valued when answering questions in class.	28	I lack confidence when I have to work problems in front of the class.
14	I feel happy when given the opportunity to share my method of solving problems.	29	I avoid answering the teacher's questions because I'm afraid.
15	I feel uncertain when working on math problems.	30	I often feel that I will never be good at math.

The questionnaire was structured on a five-point Likert scale, as developed by Rensis Likert, with response options ranging from strongly disagree to strongly agree. The total score obtained by students reflects their level of self-confidence in learning mathematics. The mathematical creative thinking ability test is used to measure the extent to which students are able to solve mathematical problems creatively. The instrument used is a descriptive test based on Torrance's indicators. For example, students are given open-ended questions that allow for various solutions and are asked to explain more than one strategy used. Each question item is equipped with an indicator-based assessment rubric to ensure that the assessment of mathematical creative thinking ability is carried out objectively and in accordance with the theoretical constructs used.

**Table 2. Creative Thinking Ability Test Instrument**

Item	Question	Indicator
1	Given the following sequence of numbers: 2, 4, 8, 16, ... Create as many different number patterns as possible that can be formed using addition, subtraction, multiplication, or division using the first number 2. Explain how you found each pattern.	1) Fluency is measured through students' ability to produce more than one idea or answer that is relevant to a problem, 2)
2	Given the number pattern: 1, 3, 6, 10, 13, ... Determine the formula for the 10th term of this triangular number pattern. Transform the number pattern into a stepwise pattern, while maintaining a similar incremental pattern structure. Explain the process and reasoning.	Flexibility is measured through students' ability to use various different approaches or solution strategies, 3) Originality is measured through students' ability to produce unique or uncommon solutions compared to the majority of students' answers, and 4)
3	Create a new, unfamiliar number pattern (not arithmetic, geometry, Pascal's triangle, etc.). The pattern must consist of at least 5 terms. Explain it fully. The rules for forming the pattern The reason for choosing this pattern How the nth term can be found	Elaboration is measured through students' ability to develop and explain solution steps in detail, sequentially, and systematically.
4	Given the number pattern: 5, 11, 19, 29, 41, ... Find the formula for the nth term ( $U_n$ ) of this pattern. Explain your steps completely and clearly. (For example, using a table)	

## Data Collection

The data collection techniques used in this study were conducted through two methods: a self-confidence questionnaire and a mathematical creative thinking ability test. The self-confidence questionnaire was used to efficiently obtain data or information from respondents regarding students' levels of confidence in learning mathematics, which were filled out independently by students according to their individual conditions and perceptions. Meanwhile, the mathematical creative thinking ability test was used to collect data related to students' abilities to generate creative mathematical ideas, strategies, and solutions. The test was given in the form of descriptive questions and was completed in writing by students within a specified time.

## Data Analysis

Data analysis in this study was conducted on data obtained from the self-confidence questionnaire and the mathematical creative thinking ability test. The initial stage of the analysis was a prerequisite test, namely the normality test, which aims to determine whether the data are normally distributed. The results of the normality test indicated that the data were not normally distributed. Therefore, the analysis of the relationship between self-confidence and students' mathematical creative thinking ability was conducted using an appropriate nonparametric correlation test.

## Research Findings

### Research Results on Students' Mathematical Creative Thinking Abilities

The level of mathematical creative thinking ability of eighth-grade students is classified into three categories: low, medium, and high. The categories of mathematical creative thinking ability are presented in the following [Table 3](#) and [Table 4](#)

**Table 3.** Score Acquisition Category

Criteria	Category
$X \geq 9,83$	Low
$9,83 \leq X < 12,09$	Medium
$X \leq 12,09$	High

**Table 4.** Recapitulation of the Mathematical Creative Thinking Ability Test

TK	fi	%
Low	8	31%
Medium	10	38%
High	8	31%
Total number	26	100%

The majority of eighth-grade students, 10 out of 26 (38%), demonstrated moderate levels of mathematical creative thinking ability. This finding indicates that students' mathematical creative thinking ability is generally moderate, with a relatively balanced distribution.

### Research Results on Student Self-Confidence

Self-confidence levels are divided into three categories: low, medium, and high, which are applied to eighth-grade students. These classifications are shown in the following [Table 5](#) and [Table 6](#)

**Table 5.** Score Acquisition Category

Interval	interpretation
30 - 70	Low
70 - 110	Medium
110 - 150	High

**Table 6.** Self-Confidence Questionnaire Recapitulation

TK	fi	%
Low	3	11%
Medium	14	54%
High	9	35%
Total number	26	100%

The majority of eighth-grade students, 14 out of 26 (54%), fell into the moderate self-confidence category. This finding indicates that students' self-confidence levels generally range from moderate to high.

### Calculation of Both Variables

As a first step in analyzing data from these two variables, the results of descriptive statistics are displayed in Table 7

**Table 7.** Descriptive Statistics

Descriptive Statistics		N	Mean	Std. Deviation
<i>Self-Confidence</i>		26	103,69	12,033
Mathematical Thinking Ability	Creative	26	10,96	2,254

### Normality Test

To determine whether the data from both variables, namely self-confidence and creative thinking ability, were normally distributed, a normality test was performed. If the data were normally distributed, Pearson correlation analysis was used to measure the relationship between the variables. Conversely, if the data were not normally distributed, the Spearman correlation test was used. The Shapiro-Wilk normality test used in this study, using IBM SPSS Statistics 20 software, was used to test self-confidence and mathematical creative thinking ability. The results are presented in Table 8

**Table 8.** Normality Test (Shapiro-Wilk)  
Tests of Normality

		Statistic	Shapiro-Wilk df	Sig.
<i>Self Confidence</i>		0,972	26	0,665
Mathematical Thinking Ability	Creative	0,916	26	0,037

Table 8 shows that the significance value for self-confidence is  $0.665 \geq 0.05$ , indicating a normal distribution of the data. Conversely, the significance value for creative thinking ability is  $0.037 < 0.05$ , indicating a non-normal distribution of the data. Because one of the variables, namely mathematical creative thinking ability, is not normally distributed, it can be assumed that the data, as a whole, does not meet the assumption of normality.

### Spearman Correlation Test

Since at least one variable was not normally distributed, the relationship between the variables was examined using Spearman's rank correlation as a non-parametric approach. This test was selected because the creative thinking scores did not meet the normality assumption.

**Table 9.** Spearman's Correlation between Self-Confidence and Mathematical Creative Thinking Ability

Correlations			Self Confidence	Mathematical Creative Thinking Ability
Spearman's rho	Self Confidence	Correlation Coefficient	1,000	,464*
		Sig. (2-tailed)	.	,017
		N	26	26
	Mathematical Creative Thinking Ability	Correlation Coefficient	,464*	1,000
		Sig. (2-tailed)	,017	.
		N	26	26

Based on Spearman's rho analysis, the significance level was  $0,017 < 0,05$ , making this relationship statistically significant. There was a significant positive correlation between students' self-confidence and mathematical creative thinking skills, with a correlation coefficient of 0,464.

### Discussion

Based on the questionnaire summary results, students' self-confidence levels generally ranged from moderate to high. This indicates that most students have a fairly good level of confidence in learning mathematics. However, some students still require guidance and reinforcement to develop their self-confidence optimally. Students with moderate self-confidence are generally able to follow the learning process well, but are not yet fully confident in expressing opinions or taking risks in solving math problems. Meanwhile, students with high self-confidence tend to show more activeness, courage, and optimal participation in learning activities. This is in line with Bandura (1997), who stated that self-confidence plays a crucial role in shaping students' self-confidence to adapt and succeed in the learning process, especially in mathematics learning, which requires perseverance and the ability to think logically, analytically, and creatively. Meanwhile, test results indicate that students' mathematical creative thinking skills are generally at a moderate level. This indicates that most students are not yet fully able to express their creativity in solving mathematical problems. This limitation is evident in students' suboptimal ability to generate various problem-solving strategies, formulate innovative solutions, and develop alternative ideas in detail and flexibly.

Overall, the results of the study indicate that the mathematical creative thinking skills of eighth-grade students are still at a moderate level and have considerable development opportunities. Aspects that need to be improved include fluency of thinking, flexibility in

selecting various solution approaches, uniqueness of ideas, and the ability to develop ideas in detail. The low proportion of students in the high category is thought to be influenced by the learning process which is still procedural, emphasizing one correct answer, minimal use of open-ended questions, and limited opportunities for students to explore during the learning process. This is in line with research by [Khoirotunnisa & Irhadanto \(2020\)](#), which states that an open approach can stimulate students' creative thinking skills because it provides space for exploration of various alternative solutions. In addition, research by [Ayuningsih et al. \(2025\)](#), shows that the flipped classroom learning model can create a more dynamic, student-centered learning environment and support the development of independence and creative thinking skills.

The results of the descriptive analysis indicate that students generally have moderate self-confidence, with not too extreme variations between students. Meanwhile, students' mathematical creative thinking abilities show that the majority of students have this ability in the moderate category, although there are several students who are included in the low to high categories. Thus, although students' self-confidence is relatively good, this is not fully reflected in their mathematical creative thinking abilities, so that learning strategies are needed that can increase creativity in solving mathematical problems. The results of the normality test using the Shapiro-Wilk test showed that self-confidence had a significance value of  $0,665 \geq 0,05$ , indicating that the data were normally distributed. Meanwhile, the significance value for creative thinking ability was  $0,037 < 0,05$ , indicating that the data were not normally distributed. Because one of the variables did not meet the normality assumption, the analysis of the relationship between the variables was continued using the Spearman correlation test as a non-parametric approach.

The results of the Spearman correlation analysis between self-confidence and students' mathematical creative thinking abilities show that self-confidence and students' mathematical creative thinking abilities have a statistically significant positive correlation. This means that the higher the students' self-confidence, the greater their mathematical creative thinking abilities, although the relationship is in the moderate category. This finding is in line with the results of research conducted by [Trisnawati et al. \(2018\)](#), which revealed that the increase in students' mathematical creative thinking abilities is significantly influenced by self-confidence. Students with high self-confidence tend to have a strong sense of curiosity, thus contributing to the development of their creative thinking abilities. Conversely, low self-confidence can be an obstacle in developing these abilities.

The significant positive relationship between self-confidence and mathematical creative thinking skills indicates that self-confidence plays a crucial role in supporting students' creative thinking processes. Students with high self-confidence tend to be more courageous in expressing ideas, trying various problem-solving strategies, and persisting in giving up when faced with mathematical problems. This encourages students to think flexibly and generate a variety of creative solutions. Therefore, developing self-confidence needs to be an integral part of mathematics learning. Teachers are expected to create a supportive learning environment, including by providing opportunities for students to express their opinions, appreciating every idea that emerges, providing constructive feedback, and encouraging discussion and group work. Therefore, increasing self-confidence can be an important foundation for optimizing students' mathematical creative thinking skills.

## Conclusion

The results of this study indicate a positive and significant relationship between self-confidence and students' mathematical creative thinking abilities. This is evidenced by Spearman's correlation analysis, which produced a correlation coefficient of 0.464 with a significance value of  $0,017 < 0,05$ . This finding indicates that self-confidence is positively correlated with an increase in students' mathematical creative thinking abilities, although the strength of the relationship obtained is in the moderate category. This indicates that mathematical creative thinking abilities are not only influenced by self-confidence, but also by other factors such as learning models, initial abilities, and learning environments. Therefore, further research is recommended to examine other relevant variables, involve a wider sample size, and use different research designs to gain a more comprehensive understanding of the factors that influence students' mathematical creative thinking abilities.

## Conflict of Interest

The author declares no conflict of interest.

## Authors' Contributions

E.R. Developed the theory, methodology, organization, and analysis of the data, as well as the proposed research hypotheses. As research supervisor, I.M. played an active role in discussing the findings and approved the final results. Each author declares that they have read and approved the final draft of this work. The following percentage of overall contributions to the planning, preparation, and editing of this paper are given: E.R.: 50%, and I.M.: 50%.

## Data Availability Statement

The author declares that the data supporting the results of this study will be made available by the corresponding author, [E.R], upon reasonable request.

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