The influence of learning motivation on high school students' mathematical creative thinking ability

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Abstract: This research aims to investigate the impact of learning motivation on students' mathematical creativity. Employing correlational research techniques with a quantitative approach, the study focuses on the entire Class X population at MIPA Rajagaluh High School. The purposive sampling method was applied to select 30 students from Class X MIPA 6. Research tools included tests on creative thinking and surveys to gauge students' enthusiasm for learning. Data analysis involved correlation, linearity, and normalcy tests. The results revealed a noteworthy correlation between learning motivation and enhancing students' mathematical creative thinking skills. Learning motivation has a statistically significant influence on mathematical creative thinking abilities. These results underscore the importance of cultivating and sustaining students' learning motivation. It is recommended that teachers actively provide encouragement and guidance to nurture robust learning motivation among students.

Keywords: Creative thinking ability; High school students; Learning motivation


INTRODUCTION

One of the skills that might help pupils succeed is the ability to think creatively, together with a cognitive component (Dilla et al., 2018). The learning outcomes that follow can be used to gauge a student's success; those who are able to think creatively are better able to comprehend issues and come up with creative solutions (Supardi, 2012). According to (Andiyana et al., 2018) the ability to think creatively is the ability to generate or find fresh ideas that are distinctive, unexpected, original, and produce definite and specific consequences. Students can respond to mathematics difficulties in this situation by utilizing their own words, approaches, and concepts.

Students who are able to create something new already have the ability to think creatively, such as the characteristics of creative thinking stated (Munandar, 2014). Specifically, demonstrating traits of fluency, flexibility, inventiveness, and elaboration. Fluency refers to a student's capacity to offer a variety of pertinent solutions to a given issue. Students that are flexible are able to approach challenges in a variety of ways while still coming up with the right solution. The ability of kids to use their own language to address problems is a sign of authenticity. Students are able to communicate ideas clearly and in detail, which is referred to as detail (elaboration).

Creative thinking becomes a provision for students in the future to solve problems (Nursilawati et al., 2020). The ability to think creatively is a fundamental skill that everyone must have when facing technological challenges (Mawaddah et al., 2015). The ability to think...
creatively needs to be instilled from an early age because in this era of development the prosperity and glory of society and the country depend on the ability to think creatively in the form of new ideas, new discoveries and new technology (Munandar, 2014). In line with (Ghufron, N., & Rini, 2014) creative thinking has an important role in life for human progress in various ways, including development and new discoveries in the fields of science and technology, as well as in all fields of human endeavor. So, the ability to think creatively is needed to develop humans in the fields of science and technology, and to face problems in life with various alternative solutions. Through the creative thinking process, students learn to find innovative answers and can solve problems in various ways (Putri et al., 2019). Students who have the ability to think creatively can construct ideas in solving mathematical problems and students can draw conclusions from a mathematical problem through non-routine steps.

The importance of creative thinking turns out to be inconsistent with the reality on the ground. TIMSS (Trends in International Mathematics and Science Study) in 1999, 2003, 2007, 2011, 2015 noted that the level of creative thinking ability of Indonesian students is relatively low, because only 2% of Indonesian students can work on high and advanced questions that require the same ability. think creatively in solving it (Hasanah et al., 2019). Based on research results, Ginting (2019) states that students' mathematical creative thinking abilities are still low, this can happen because many people think mathematics is a boring, scary subject, only has a single answer for every problem and can only be understood by some people. Learning mathematics is learning that is avoided by students, so that it has an impact on students' mathematical creative thinking abilities which are less than optimal (Liberna, 2022). One of the low creative thinking abilities of students is a lack of motivation within students. By providing motivation to students in the mathematics learning process, students will be encouraged, moved and directed in learning activities. (Novita Sari, 2020). The low level of motivation for students to learn causes students to be less active in participating in lessons and hinders students' creative thinking abilities (Eftafiyana et al., 2018).

Motivation is one of the most important things to improve creative thinking skills, with the motivation that students have, it will make students more enthusiastic about looking for ideas when they face a problem (Anditiasari et al., 2021). Learning motivation is the overall driving force within students which gives rise to learning activities, which ensures the continuity of learning activities, and which provides direction to learning activities, so that the goals desired by the learning subject can be achieved (Nugraha et al., 2021). The characteristics of motivation that exist in students include: (1) there is encouragement and need for student learning (Akmalia et al., 2023), (2) Showing attention and interest in the tasks given, namely students always do the tasks given by the teacher (Nafiah & Munawir, 2022); (3) Perseverance in facing tasks, that is, students can do the task until it is finished (Davidovitch & Dorot, 2023); (4) Tenacious in facing difficulties, that is, students do not give up easily (Tarigan et al., 2023); (5) There is passion and desire to succeed (Yessenamanova et al., 2022).

Creative thinking abilities need to be developed in mathematics learning (Nursamira et al., 2023). Creative thinking is very necessary because it is used as an important element to determine students' understanding of the material and becomes a provision for students to have good thinking patterns. In line with the opinion of (Purnami et al., 2022) the purpose of creative thinking is to make decisions, to solve various problems and to create new ideas.

Much research has been conducted on the influence of motivation on creative thinking abilities before. The results of research (Ermiestri, 2017) state that there is a significant influence on learning motivation on junior high school students' creative thinking abilities. The results of research (Eftafiyana et al., 2018) state that there is an influence on learning motivation on senior high school students' mathematical creative thinking abilities. The results of research (Rahmawati et al., 2021) state that there is a significant influence on learning motivation on MTs students' creative thinking abilities. According to a number of earlier studies, learning motivation has an impact on students' mathematics creative thinking skills. As opposed to other studies that investigated learning motivation in junior high schools and discovered that it
significantly influenced the capacity for creative thought. This study will look at how high school students in one of the Majalengka Regency's schools use their drive to think creatively. This study examined how learning motivation affected the mathematics creative thinking skills of high school pupils.

**METHOD**

This research is quantitative research with correlational research methods. This research was conducted to analyze whether or not there was an influence of student learning motivation as the independent variable X on mathematical creative thinking abilities. This research design is illustrated in Figure 1.

![Figure 1. Research design](image)

Information about Figure 1, X : Student learning motivation; Y : Ability to think creatively mathematically; → : Influence.

This research was carried out at SMAN 1 Rajagaluh in the even semester of the 2022/2023 academic year with a population of all class X students at SMAN 1 Rajagaluh. The sampling technique used was *purposive sampling* by determining the sample based on certain considerations. According to the mathematics teacher, all class X students have the same mathematical characteristics and abilities. New classes were not formed but used existing classes, so the sample for this research was class X MIPA 6 with a total of 30 people. This class was chosen because the learning material that will be presented has never been accepted in this class. The learning motivation variable instrument is a *Likert scale* with 26 statement items equipped with 4 answer choices, namely SS (Strongly Agree), S (Agree), TS (Disagree), STS (Strongly Disagree). Each answer has a score of 1-4. The variable instrument for mathematical creative thinking ability is a test in the form of a description of 7 questions. The instrument used has previously been tested for validity, reliability, difficulty index and differentiability of questions. The research data obtained was then tested for analytical prerequisites, including a normality test and linearity test, then a correlation test was carried out to see the effect of learning motivation on students' mathematical creative thinking abilities. Statistical Hypothesis: $H_0 : \mu_1 = \mu_2$ : There is no influence of student learning motivation on ability students' creative mathematical thinking.$H_1 : \mu_1 \neq \mu_2$ : There is an influence of student learning motivation on ability students' creative mathematical thinking.

**RESULTS AND DISCUSSION**

Results

Research data processing was carried out with the help of the SPSS 16.0 program. The results of data processing and descriptive statistical analysis are described in Table 1.

<table>
<thead>
<tr>
<th>Table 1. Descriptive Statistics</th>
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<td></td>
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<tr>
<td>Creative Thinking Ability</td>
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<tr>
<td>Motivation to learn</td>
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</table>

Based on Table 1, the results of the test of creative thinking ability given to 30 respondents yielded a mean value of 79.70 and the results of the questionnaire on learning motivation yielded a mean of 80.40, with a maximum value of 92 for learning motivation and a maximum value of 93 for creative thinking ability. According to the research, student learning motivation and mathematics creative thinking skills are generally good and exhibit high numbers.

The normality test is used to examine whether or not the data collected by researchers is representative of a population with a normally distributed population. If testing is done using
non-parametric statistics, this is done as a requirement. The instrument used by researchers is SPSS 16.0. Table 2 summarizes the outcomes of the normalcy test on the two variables.

<table>
<thead>
<tr>
<th>Table 2. Normality Test</th>
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<tr>
<td><strong>Kolmogorov-Smirnov</strong></td>
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<td><strong>Statistics</strong></td>
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<tr>
<td>Motivation to learn</td>
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<tr>
<td>Creative Thinking Ability</td>
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</table>

Based on Table 2, it is found that each sig value is > 0.05 so that the variables of learning motivation and mathematical creative thinking ability are normally distributed. The linearity test is carried out to find out, to prove that the relationship between the variables studied has a linear relationship. The linearity test hypothesis in this research is:

\[ H_0 : \mu_1 = \mu_2 : \text{There is no linear relationship between student learning motivation and students' mathematical creative thinking abilities} \]

\[ H_1 : \mu_1 \neq \mu_2 : \text{There is a linear relationship between student learning motivation and students' mathematical creative thinking abilities} \]

To determine the influence of learning motivation variables on mathematical creative thinking abilities, it was carried out using SPSS 16.0, the \( H_0 \) criterion was accepted if the Sig. < 0.05 and \( H_0 \) is rejected if sig. >0.05. Results _ Linearity testing for the simple regression model can be seen in Table 3.

<table>
<thead>
<tr>
<th>Table 3. Linearity test</th>
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<tr>
<td><strong>ANOVA Table</strong></td>
</tr>
<tr>
<td><strong>Sum of Squares</strong></td>
</tr>
<tr>
<td>Motivation to learn * Creative thinking ability Between Groups Deviation from Linearity</td>
</tr>
</tbody>
</table>

In Table 3 of the linearity test results, it is known that the Sig.Deviation Form Linearity value is 0.174. Sig value. 0.585 > 0.05 means that \( H_0 \) is rejected, meaning that there is a linear relationship between the learning motivation variable and the student's mathematical creative thinking ability variable, thus students who have high learning motivation will have high mathematical creative thinking ability. Based on the description above, it can be concluded that all prerequisite tests have been fulfilled. Next, a hypothesis test was carried out using the correlation test which can be seen in Table 4.

<table>
<thead>
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<th>Table 4. Correlation test</th>
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<tr>
<td><strong>N</strong></td>
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<tr>
<td>Learning Motivation on Creative Thinking Ability</td>
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</table>

In Table 4 it is known that the significance value is 0.000 < 0.05, this shows that learning motivation is correlated or related to students' mathematical creative thinking abilities, so \( H_0 \) is rejected. Regression analysis is a further analysis of the correlation test to test the extent of the influence of learning motivation on students' mathematical creative thinking abilities.

<table>
<thead>
<tr>
<th>Table 5. Model Summary</th>
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<tr>
<td><strong>Model</strong></td>
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<tr>
<td>1</td>
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</table>
Based on Table 5, we get $R^2$ is 55.1% which shows that learning motivation influences students’ creative mathematical thinking abilities while the remaining 48.9% is influenced by other factors outside learning motivation.

**Table 6. ANOVA**

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>1474,799</td>
<td>1</td>
<td>1474,799</td>
<td>34,324</td>
<td>.000</td>
</tr>
</tbody>
</table>

Based on Table 6, the significance value is 0.000. < 0.05, this shows that learning motivation has a significant positive influence on students' mathematical creative thinking abilities.

**Table 7. Coefficients**

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
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<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
</tr>
<tr>
<td>1</td>
<td>(Constant)</td>
<td>2.067</td>
</tr>
<tr>
<td></td>
<td>Motivation to learn</td>
<td>1.028</td>
</tr>
</tbody>
</table>

Based on Table 7, the equation $Y = 2.067 + 1.028x$ with the student learning motivation coefficient having a positive value. The regression coefficient $x$ is 1.028, stating that for every additional 1 motivation value, the creative thinking value increases by 1.028, thus there is an influence between learning motivation and students' creative mathematical thinking.

**Discussion**

Based on the outcomes of the data processing, it is evident that learning motivation affects students’ innovative mathematical thinking. Creative thinking abilities and learning motivation are inversely correlated. This study demonstrates the link between learning motivation and creative thinking skills, demonstrating that students with high levels of learning motivation also have high levels of creativity. Students that can think creatively, on the other hand, will be very motivated to learn. According to (Pratiwi, 2021) students with the capacity for creative thought would have high intrinsic motivation for learning and strong drive, self-confidence, and high thinking abilities.

The association between learning motivation and ability is favorable, therefore students who are highly motivated to learn actively encourage themselves to improve their capacity for original thought. When working on problems in the field, students who are very motivated to learn are able to do it quickly, in a variety of ways, and using their own techniques. They are also able to work on questions thoroughly. The regression test's findings indicate that learning motivation has a favorable impact on one's capacity for creative thought. These findings demonstrate that a student's capacity for mathematical creativity increases with their level of learning enthusiasm. Students that are highly motivated will be eager to study, which will enable them to meet all the criteria for creative thinking abilities.

Students who have motivation to learn will be encouraged, moved and directed in the learning process and students will not easily give up in solving problems. Motivation to learn is basically someone who has the desire and drive to learn in order to be successful in learning (Rahmawati et.al, 2021). Students who have good learning motivation and knowledge will be able to solve problems creatively. In line with Munandar, (2014) states that creative thinking is supported by students’ intelligence, cognitive and learning motivation. Students who think creatively will do something because of internal encouragement which will make students proactive so that their minds are able to develop (Hassoubah, 2004). Students who have the ability to think creatively can solve problems with various alternative solutions.
The results of the student motivation questionnaire in learning mathematics with an average score of 80.40 are relatively high. The results of the student learning motivation questionnaire contained in each indicator are: (1) There is encouragement and need to learn, the average value is 84% in the high category, students show an attitude of always paying attention when the teacher explains and asks if they don't understand and take notes on the material. delivered (2) Shows interest in the assignments given, the score is 80% in the high category, students try to spend time at home studying (3) Diligently facing the assignments the score is 79% in the high category, it can be seen that the students try to do the assignments given teacher and has the initiative to fill in questions that have not been done (4) Resilient in facing difficulties, the score is 78% in the high category, shown by students trying to work on questions that are considered difficult and always being enthusiastic in mathematics lessons (5) the desire and desire to succeed the average score the average is 82% in the high category, this can be seen when students try to learn as well as possible in mathematics lessons.

Students' scores on the mathematical creative thinking ability test with an average score of 79.57 are relatively high. The results of the mathematical creative thinking ability test contained in the indicators: (1) The average fluency is 76% in the high category, some students are able to work on questions smoothly by writing down ideas that are relevant to the problem and the answers produced are correct (2) The average flexibility is 75% in the high category, some students are able to work on questions by providing alternative solutions in more than one way and produce answers that have the correct value (3) The average originality is 82% in the very high category for the majority of students are able to work on questions in different ways using their own methods and students are able to understand and explain the methods they use and have correct scores (4) the average elaboration is 80% in the very high category and 83% in the very high category, the majority of students have been able to work on questions in detail and with correct marks. This high average value of learning motivation is in line with a significant positive influence on creative thinking abilities.

Students who are persistent in facing difficulties during the learning process always work on the questions given by the teacher and try to find answers to questions that are considered difficult. In practice, some students are able to go through problems without any difficulty, and the answers they come up with are accurate and detailed, demonstrating strong fluency skills. Since students who are tenacious in the face of challenges may try repeatedly to work on topics that are seen as tough, students have high flexibility abilities, or the ability to deliver answers in more than one way. This is in accordance with (Novianti et al., 2020) students' persistence can be seen from their learning motivation, to get better results students will try and be persistent in learning something. Students who have the drive and need to learn and show interest in the assignments given by the teacher have enthusiasm for learning, do practice questions and discuss with their group friends and try to do things in their own way so that students have high originality abilities. This is in accordance with the opinion (Amir, 2010) that working together in groups to find solutions to problems can be used to link curiosity. Students who have the desire to succeed have the enthusiasm to learn mathematics and try to do the problems as well as possible. The reality in the field is that students are able to work on questions carefully and in detail so that students have high elaboration abilities. Students are able to have the ability to think creatively because during the learning process students follow it well and students actively look for alternative solutions to problems independently.

In the test, students' mathematical creative thinking abilities are classified as high, and their learning motivation scores are relatively high. In accordance with the results of student learning tests, most students were able to solve the questions well. So, it can be said that students with high learning motivation have high creative thinking abilities.

CONCLUSION
This research aims to determine the effect of learning motivation on mathematical creative thinking abilities. Based on the research results, there is an influence of learning motivation on
mathematical creative thinking abilities. Learning motivation has a statistically significant influence on mathematical creative thinking abilities. Students who have high learning motivation can solve mathematical problems creatively with various alternative solutions. Students who have good learning motivation will likely have good creative thinking abilities and vice versa, students who have less motivation will have low creative thinking abilities. Based on the research results, it is hoped that teachers will provide encouragement and guidance so that students have good learning motivation. Apart from that, more practice is needed on creative thinking skills so that students' mathematical creative thinking abilities will be better.

Declaration

Author Contribution: ER: Conceptualization, Writing - Original Draft, Methodology, Editing and Visualization, Writing - Review & Editing, and Formal analysis; NK and IN: Writing - Review & Editing, Formal analysis, Validation and Supervision.

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