**Original Research Article**

**Mediating Effect of Student Motivation on the Relationship between Perceived Teacher Support and** **Creative Thinking Skills in Mathematics**

.

**ABSTRACT**

|  |
| --- |
| This study examined whether student motivation mediates the relationship between perceived teacher support and creative thinking skills in mathematics among Filipino secondary students. A quantitative, descriptive-correlational design with mediation analysis was employed. The study involved 274 Grade 10 students from four public secondary schools in New Corella District, Division of Davao del Norte, selected through stratified random sampling. Data were collected using the Mathematics Motivation Questionnaire, Questionnaire for Perceived Teacher Support, and a researcher-developed Creative Thinking Skills in Mathematics test. Statistical analyses included descriptive statistics, Pearson correlations, and mediation analysis. Results revealed high levels of student motivation (M = 3.45), perceived teacher support (M = 3.99), and creative thinking skills in mathematics (M = 65.37). Significant positive correlations were found between perceived teacher support and creative thinking skills (r = 0.737, *P* < .05), perceived teacher support and student motivation (r = 0.831, *P* < .05), and student motivation and creative thinking skills (r = 0.598, *P* < .05). However, mediation analysis indicated that student motivation did not significantly mediate the relationship between perceived teacher support and creative thinking skills (indirect effect = -0.58, *P* = .53). The direct effect of perceived teacher support on creative thinking skills remained significant (β = 0.78, *P* < .05). The findings suggest that teacher support directly influences mathematical creative thinking rather than operating through motivational pathways. This indicates that supportive teaching practices may foster creativity through direct instructional methods, classroom climate, or modeling behaviors rather than by enhancing student motivation. Results highlight the importance of teacher professional development focused on creativity-fostering pedagogies and suggest that future research should examine alternative mediating variables in the teacher support-creativity relationship. |

*Keywords: Perceived teacher support, student motivation, creative thinking skills in mathematics, descriptive-correlational designs, mediation analysis, Davao del Norte, Philippines*

**1. INTRODUCTION**

Creative thinking skills in mathematics are among the skills that 21st-century learners must develop and adopt as they help them generate ideas, innovate, and introduce novel solutions to any mathematical problem. However, schools rarely prioritize developing these skills, despite their acknowledged benefits for both society and individuals, as well as for personal achievement (Veno, 2023; Lucas, 2022). Also, for some reason, students used to focus on what is common and adapt what is already known, which discourages creative thinking skills in mathematics to develop and foster. Lacking creative thinking skills will lead students to struggle to generate arithmetic ideas, solving complex mathematics problems, or adapt to new challenges (Karunarathne & Calma, 2024). Thus, this limitation can hinder their ability to excel in the Math subject that requires original thought. Despite these recognized benefits, several barriers prevent schools from prioritizing creative thinking development. These include traditional assessment methods that favor convergent thinking, time constraints within standardized curricula, and limited teacher training in creativity-fostering pedagogies. Additionally, institutional pressure to meet standardized test scores often overshadows creative skill development.

The limitation is evident in international assessments. For instance, research from the Trends in International Mathematics and Science Study (TIMSS) in Indonesia reveals that mathematical creative thinking skills among students are inadequate, with only 2% of them being able to solve math problems which shows how difficult it is for other students to think creatively (Sari et al., 2023). In Malaysia, the Organization for Economic Co-operation and Development (OECD, 2024) reported that students’ mathematics performance is distinctively associated with creative thinking skills. Also, the 25-point mathematical creative thinking skills score of Malaysian students was relatively lower than the average score of the OECD, which is 33.

Similarly, international assessments reveal comparable challenges in other regions. The Program for International Student Assessment (PISA) reported that Filipino students ranked second to last in creative thinking skills in mathematics among 64 countries and economies (Braid, 2024). Specifically, when controlling for average mathematics scores, Filipino learners demonstrated the largest overall deficiencies in mathematical creative thinking, scoring at least three points less than predicted (OECD, 2024). In the Province of Laguna, a report by Andrade and Pasia (2020) revealed that a group of university students has a moderate level of fluency and flexibility in mathematics, but has a low level in terms of originality. In addition, a group of high school students in Iloilo province obtained a moderately low level of mathematical creativity in terms of fluency, flexibility, and originality (Bales & Estomo, 2022).

These international trends are reflected in local contexts as well. In the Division of Davao del Norte, a study conducted by Torquedo and Doronio (2024) in one of the public secondary schools in the New Corella District showed that the mean academic score of 105 students in mathematics is 26.08, which shows 65% class proficiency only. The researchers revealed that this low average in summative assessment shows that their poor performance is attributed to their lack of creative thinking skills in Math, interest, and suitable resources. Thus, students' comparatively low to moderate levels of mathematical creative thinking skills should worry educators and the school since these are necessary for innovation and the generation of new ideas (Fernandez et al., 2024).

Given these documented deficiencies in mathematical creative thinking, researchers have investigated potential contributing factors. Many researchers have confirmed the association of creative thinking in mathematics with other factors, which include perceived teacher support and student motivation. The perceived teacher support has been recognized to influence the mathematical creative thinking of students in educational settings (Liu et al., 2021; Zhang et al., 2020; McLure et al., 2024). Other literature also shows the relationship between students’ motivation and creative thinking skills in Math (Goulet-Pelletier et al., 2023; Manoy & Sari, 2021; Almulla, 2023). As both factors have proven to influence creative thinking skills in Math, several studies also confirmed the relationship between perceived teacher support and student motivation (An et al., 2022; Affuso et al., 2023; Chiu et al., 2023).

Although much research has been carried out in various settings that link the variables, the researcher has not come across a study that investigates the mediating effect of student motivation on the relationship between perceived teacher support and creative thinking skills in mathematics. Thus, the researcher was encouraged to conduct this study to fill the gap in the literature covering these subjects, specifically in the local context. Based on the presented scenarios, there is an urgent need to conduct a study considering the current state and existence of the problem. This research gap is particularly significant for several reasons. First, understanding the mediating role of motivation could inform targeted interventions that leverage teacher support to enhance student creativity. Second, identifying the mechanisms through which teacher support influences creative thinking could guide professional development programs. Finally, examining these relationships in the Filipino context addresses the cultural specificity of educational motivation and creativity development.

**1.1 Objectives**

This research aimed to investigate the mediating effect of student motivation on the relationship between perceived teacher support and creative thinking skills in mathematics.

Specifically, it sought the following research questions:

1. What is the level of student motivation in terms of:

1.1. intrinsic value;

1.2. self-regulation;

1.3. self-efficacy;

1.4. utility value; and

1.5. test anxiety?

2. What is the level of perceived teacher support of students in terms of:

2.1. emotional support; and

2.2. instrumental support?

3. What is the level of creative thinking skills in mathematics in terms of:

3.1. fluency;

3.2. flexibility;

3.3. authenticity; and

3.4. elaboration?

4. Is there a significant relationship between:

4.1. perceived teacher support and creative thinking skills in mathematics;

4.2. perceived teacher support and student motivation; and

4.3. student motivation and creative thinking skills in mathematics?

5. Does student motivation mediate the relationship between perceived teacher support and creative thinking skills in mathematics?

**1.2 Conceptual Framework**

As shown in Figure 1, perceived teacher support, student motivation, and creative thinking skills in mathematics are the variables involved in the study. It is hypothesized that perceived teacher support – emotional and instrumental support – influenced the student motivation – intrinsic value, self-regulation, self-efficacy, utility value, and test anxiety, which may affect the students’ creative thinking skills in mathematics – fluency, flexibility, authenticity, and elaboration. Furthermore, it is hypothesized in this study that perceived teacher support has a significant relationship with creative thinking skills in mathematics. In this proposed model, student motivation serves as a mediating variable explaining the relationship between perceived teacher support and creative thinking skills in mathematics.

Dependent Variable

Independent Variable

Mediating Variable

**PERCEIVED TEACHER SUPPORT**

* Emotional Support
* Instrumental Support

**STUDENT MOTIVATION**

* Intrinsic Value
* Self-regulation
* Self-Efficacy
* Utility Value
* Test Anxiety

**CREATIVE THINKING SKILLS IN MATHEMATICS**

* Fluency
* Flexibility
* Authenticity
* Elaboration

Figure 1. The Conceptual Paradigm of the Study

**Figure 1. The Conceptual Paradigm of the Study**

**Figure 1. The Conceptual Paradigm of the Study**

**Figure 1. The Conceptual Paradigm of the Study**

**Figure 1. The Conceptual Paradigm of the Study**

**Figure 1. The Conceptual Paradigm of the Study**

**1.3 Theoretical Framework**

This research is anchored on the Componential Theory of Creativity (Amabile, 1983) and Self-Determination Theory (Ryan & Deci, 1985). Amabile’s componential theory of creativity supports the link between perceived teacher support and students’ creative thinking skills in mathematics. As explained, the creative thinking skills in mathematics may be triggered by the support provided by the teachers to generate, innovate, and produce novel ideas and math problem solutions (Amabile, 1983). Meaning to say, that perceived teacher support plays a crucial role in influencing the students’ creative thinking skills in mathematics (Zhong et al., 2024; Qureshi et al., 2021). Also, various researchers emphasize the importance of perceived teacher support towards risk-taking in fostering creative thinking skills in mathematics (Tang & Sternberg, 2020; Runco, 2018; Simonton, 2017; Kadyirov et al., 2024; Zhang et al., 2020).

In addition, self-determination theory explained that in the learning environment, perceived teacher support acts as a great contributor in fostering the motivation of the students (Skinner et al., 2008). The crucial idea of self-determination theory is that every time the students are well-supported, they tend to be motivated in both actions and choices or “self-determined” (Ryan & Deci, 2020). When Math teachers provide support, students feel more in charge of their learning, boosting motivation (Parrish, 2022). In the componential theory of creativity, Amabile (1983) highlights the student motivation that influences creative thinking skills in mathematics. She added that student motivation implies undertaking challenging problem-solving situations because these are interesting, involving, exciting, or satisfying. In addition, creative thinking skills in mathematics become evident when students approach tasks with curiosity and intrinsic interest (Scott-Barrett et al., 2023; Mahama et al., 2023).

**2. MATERIALS AND METHODS**

**2.1 Research Design**

This quantitative study employed a descriptive and correlational design with mediation analysis. Quantitative research involves systematically collecting and analyzing numerical data. The result of a quantitative approach can predict patterns, analyze causal relationships, and make generalizations from the results of a population (Bhandari, 2023). This study employed a quantitative approach since the goal is to gather measurable data that can be analyzed to draw conclusions and patterns objectively. Descriptive approach was also utilized to describe and measure the level of perceived teacher support, student motivation, and creative thinking skills of the students in mathematics. In addition, a correlational design was used to test the strengths of the relationships among the variables to each other without manipulation.

**2.2 Research Instrument**

This study utilized two questionnaires and a researcher-made test. Mathematics Motivation Questionnaire was adapted to measure the mediating variable. This survey is composed of 5 constructs: intrinsic value with 3 statements, self-regulation with 4 statements, self-efficacy with 4 statements, utility value with 4 statements, and test anxiety with 4 statements (Fiorella et al., 2021). To measure the independent variable, Federici and Skaalvik’s (2014) 13-item questionnaire for perceived teacher support was adapted. In addition, the instrument for quantifying the creative thinking skills in mathematics was a researcher-made test. The test is composed of 12 test questions: 3 questions for fluency, 3 for flexibility, 3 for authenticity, and 3 for elaboration focusing on sequences, polynomials, and circles. All tools underwent pilot testing and validated by experts of the field.

**2.3 Respondents of the Study**

The randomly selected Grade 10 students for the School Year 2024-2025 were the target respondents of this study. These students were officially enrolled from four public secondary schools of the New Corella District, Division of Davao del Norte. Using the Raosoft Sample Size Calculator with a 0.05 margin of error and 95% confidence level, the total number of samples taken from these schools was 274 students out of 945. The researcher employed stratified random sampling to identify the number of respondents per school. The chosen schools are the top 4 schools among the 6 that have the highest population. In this study, the 4 schools served as the strata, and the sections were the sub-strata. Using the ratio and proportion distribution, the number of respondents taken from School A is 187, School B is 41, School C is 34, and School D is 12. The selection of the respondents continued using the interval until the intended number in a specific group was met.

**2.4 Data Gathering**

Before conducting the study, approval from the Research Ethics Committee was acquired. Upon approval, the researcher asked the Dean of the Graduate School for an endorsement letter to conduct the study. After securing an endorsement, the researcher went to the Schools Division Superintendent (SDS) to whom the target respondents belong. The endorsement from the Graduate School was given to the SDS. After that, another letter with the same intention was addressed to the school heads. The approval of the school principals marks the start for the researcher to reach the advisers, parents, students, and gatekeepers for the list of students, conduct orientation, and seek consent.

The researcher had a gatekeeper in each school to have access to the data of the students and to ensure randomization among the respondents. Considering data privacy, gatekeepers were informed about the confidentiality and non-disclosure agreement, hence they signed the form respecting the privacy and ethical considerations of the study. After that, the list of the Grade 10 students was requested from the gatekeeper and taken for selection. The researcher randomly selected the respondents using a stratified and systematic random sampling. After identifying the samples, their attention was called to conduct an orientation about the study.

Securing parental consent and informed assent form was one of the considerations of the researcher before conducting the study, since the target respondents were minors and under the age of 18. It was also the nature of this study to ensure that all forms were signed as proof of verification of respondents’ voluntary participation. After securing their consent, the researcher set a date for the conduct of the study. The researcher also ensured that the venues where the study was conducted were well-ventilated and free from any distractions. After the allotted time, the test and survey questionnaires were retrieved immediately from the respondents for checking, collating, and processing of data. Once all the responses were retrieved, the researcher accurately collated and tallied all the data. After that, the data from the survey questionnaires were sent to the official graduate school statistician for analysis and results. Lastly, the researcher then interpreted it for the formulation of the result and discussions.

**2.5 Statistical Analysis**

The following statistical tools were used to carefully and accurately analyze and interpret the data in a way that is consistent with the study’s objectives.

**2.5.1 Mean**

This tool measures the level of the variables involved in the study with respect to their indicators. In this study, this statistical tool measures perceived teacher support, student motivation, and creative thinking skills in mathematics.

**2.5.2 Standard Deviation**

This tool was utilized to determine how widely spread the responses of variables and indicators are based on their mean.

**2.5.3 Pearson r**

This was utilized to measure the strength of the relationship between the level of teacher support and creative thinking skills in mathematics; the level of teacher support and student motivation; and the level of student motivation and creative thinking skills in mathematics.

**2.5.4 Mediation Analysis**

This tool was used to determine if student motivation influences the relationship between perceived teacher support and creative thinking skills in mathematics.

**3. RESULTS AND DISCUSSION**

**3.1 Level of Student Motivation**

Table 1 presents the level of student motivation. Since intrinsic value, self-regulation, self-efficacy, and utility value represent positive attributes, the test anxiety was reversely scored to maintain consistency and clearer interpretations of the results. As shown in the table, utility value has the highest mean of 3.52 and a standard deviation of 0.77, with a descriptive equivalent of high, followed by self-regulation with a mean of 3.51 and a standard deviation of 0.75, which is described as high. On the other hand, the self-efficacy obtained the lowest mean of 3.27 and a standard deviation of 0.76, with a descriptive equivalent of moderate.

As a whole, the level of student motivation is described as high, supported by the overall mean of 3.45. This means that student motivation is manifested by the students. The standard deviation of 0.56 (SD<1.00) indicates that respondents provided similar answers, resulting in responses that are tightly grouped around the average. This implies that student motivation levels vary depending on specific indicators when learning Math, but when these are viewed together, the responses present a more balanced rather than extremely high or low motivation.

**Table 1. Level of Student Motivation**

|  |  |  |  |
| --- | --- | --- | --- |
| Indicators | SD | Mean | Descriptive Equivalent |
| Intrinsic Value | 0.90 | 3.48 | High |
| Self-Regulation | 0.75 | 3.51 | High |
| Self-Efficacy | 0.76 | 3.27 | Moderate |
| Utility Value | 0.77 | 3.52 | High |
| Test Anxiety | 0.76 | 3.48 | High |
| Overall Mean | 0.56 | 3.45 | High |

The findings confirm the claim of Ryan and Deci (2020), who stated that students displayed characteristics of high motivation, especially in the field of Mathematics. They are making efforts to reach their potential and self-fulfillment and accomplish tasks that are challenging. Also, Diseth et al. (2020) supported that the motivation is from one’s own initiative that gives enjoyment to uplift themselves when facing academic hurdles. Meaning, motivated learners will continue and are more likely to complete the mathematical tasks given to them despite the struggles and challenges they face during the process (Gopalan et al., 2017).

**3.2 Level of Perceived Teacher Support**

Table 2 presents a summary on the level of perceived teacher support. As shown in the table, emotional support has a mean of 4.05 and a standard deviation of 0.67, with a descriptive equivalent of high. This indicates that there is a strong and consistent perception of emotional support among the respondents. Moreover, the instrumental support obtained a mean of 3.94 and a standard deviation of 0.71, with a descriptive equivalent of high. This means that most of the respondents receive a high level of instrumental support, indicating shared perceptions of tangible assistance. As a whole, the level of perceived teacher support is described as high, supported by the overall mean of 3.99. This means that perceived teacher support is evident among the students. The standard deviation of 0.61 (SD<1.00) indicates that responses have a low level of dispersion, with most concentrated near the mean.

**Table 2. Level of Perceived Teacher Support**

|  |  |  |  |
| --- | --- | --- | --- |
| Indicators | SD | Mean | Descriptive Equivalent |
| Emotional Support | 0.67 | 4.05 | High |
| Instrumental Support | 0.71 | 3.94 | High |
| Overall Mean | 0.61 | 3.99 | High |
|  |  |  |  |

These claims are guided by the findings of Ren et al. (2022), who claimed that the basis of perceived teacher support is the evaluation of students on the attitudes and treatment of their Math teachers when at school and during discussions. Also, Huang et al. (2022) supported that perceived teacher support could provide and strengthen the relationship between students and teachers, which will drive strong social interaction and mathematical skills of the students. Most students are content with the teacher support they received, which directly affects their participation in class, motivation to study, skill improvement, academic achievement, and personal development. The intimacy and commitment between the teacher and students are developed when teacher support is emphasized (Granziera et al., 2022; Zeng et al., 2022).

**3.3 Level of Creative Thinking Skills in Mathematics**

Table 3 depicts the summary of the level of creative thinking skills in mathematics. The level of creative thinking skills in mathematics in terms of authenticity obtained the highest mean of 66.27 and a standard deviation of 16.55, with a descriptive equivalent of high, which is interpreted as very good. The level of creative thinking skills in mathematics in terms of fluency acquired a mean of 65.27 and a standard deviation of 16.42, with a descriptive equivalent of high, which is interpreted as very good. On the other hand, the lowest mean among the indicators of creative thinking skills in mathematics is the elaboration, which earned a mean of 64.75 and a standard deviation of 17.72, with a descriptive equivalent of high, which is interpreted as very good.

In general, the level of creative thinking skills of the students in mathematics has an overall mean of 65.37, with a descriptive equivalent of high, which means very good. The standard deviation of 9.16 indicates there is a moderate spread in the students' creative thinking skill scores in mathematics, meaning that while the overall mean is 65.37, individual student scores varied noticeably, some scoring significantly above or below the average, indicating diverse levels of creative thinking ability among the students

**Table 3. Level of Creative Thinking Skills in Mathematics**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Indicators |  | SD | Mean | Descriptive Equivalent |
| Fluency |  | 16.42 | 65.27 | High |
| Flexibility |  | 16.76 | 65.18 | High |
| Authenticity |  | 16.55 | 66.27 | High |
| Elaboration |  | 17.72 | 64.75 | High |
| Overall Mean |  | 9.16 | 65.37 | High |

These findings are supported by the study of Tabach and Friedlander (2017), who stated that high creative thinking skills help students to understand concepts, especially during the mathematics learning process. They added that students possessing a high level of creative thinking skills in mathematics will be able to apply flexible learning, where they do not stick to what the teachers teach. Anas et al. (2023) added that based on their analysis with their students, 50% of the students had high mathematical creative thinking skills. This indicates the importance of developing these skills among students to be able to compare, criticize, and examine data or information for the student to be fluent, authentic, and flexible. Moreover, Lasari et al. (2023) claim that students having a high level of creative thinking skills tend to increase their math achievement, can understand easily, and solve problems in the 21st century.

**3.4 Significance of the Relationship between the Variables**

Table 4 shows the relationship between variables: perceived teacher support and creative thinking skills in mathematics, perceived teacher support and student motivation, and student motivation and creative thinking skills in mathematics. As viewed from the table, perceived teacher support significantly correlates with the creative thinking skills in mathematics of the students (*P* = .00). The r-value of 0.737 implies that perceived teacher support and creative thinking skills show a strong positive relationship. Therefore, the null hypothesis is rejected. The significantly strong relationship of perceived teacher support and creative thinking skills in mathematics implies that if students are well-supported by their teachers, they are more likely to actively show creativity in learning Mathematics.

These findings are in line with the claim of Zhang et al. (2020), who stated that perceived teacher support has a significant relationship with math creative thinking skills. This statement is also supported by Orakci and Durnali (2023), who claimed that the two variables showed a positive relationship. There were also researchers, such as Du et al. (2019) and Gao et al. (2020), who were able to directly find out the relationship between perceived teacher support and creative thinking skills of the students in mathematics, as long as opportunity and resources are provided.

**Table 4. Significance of the Relationship between the Variables**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Variables Correlated |  | r | p-value | Decision on Ho | Decision on Relationship |
| Perceived Teacher Support & Creative Thinking Skills in Mathematics |  | 0.737 | .00 | Rejected | Significant |
| Perceived Teacher Support & Student Motivation |  | 0.831 | .00 | Rejected | Significant |
| Student Motivation & Creative Thinking Skills in Mathematics |  | 0.598 | .00 | Rejected | Significant |

Moreover, it can be seen from the table that perceived teacher support significantly correlates with student motivation (*P* = .00). The r-value of 0.831 indicates that perceived teacher support and student motivation exhibit a very strong positive relationship. Thus, the null hypothesis is rejected. The very strong relationship between perceived teacher support and student motivation explains that if the Math teachers are approachable, encouraging, and offer meaningful feedback about their learning, students are likely to boost their confidence and motivation. The finding shows a strong importance of the student-teacher relationship, especially in creating a conducive learning environment. The result corroborates the significant findings of Oppermann and Lazarides (2021), who stated that there is a positive correlation between perceived teacher support and motivation in the mathematics setting. The closeness between teacher and students, which includes warm and good relationships, is significantly related to the motivational attitudes of the students (Zee et al., 2021).

Furthermore, it can be drawn from the table that student motivation significantly correlates with creative thinking skills in mathematics (*P* = .00). The r-value of 0.598 explains that student motivation and creative thinking skills show a moderate positive relationship. The moderate relationship between student motivation and creative thinking skills in mathematics implies that the students who are motivated are more likely to explore ideas, generate novel solutions, or innovate approaches in mathematics setting. The findings supported the claim of Sipin and Paglinawan (2024), who stated that student motivation has a significant positive correlation with creative thinking skills in mathematics learning. They also emphasized that as student become more creative in math, their motivation in learning also tend to increase. In addition, Fischer et al. (2019) supported that in mathematical creative thinking skills, student motivation is considered a pivotal factor because the absence of this will hinder an individual from engaging and persisting in creativity-related tasks. Motivation is one of the determinants that influence mathematics creativity (Yesuf et al., 2024).

**3.5 Path and Mediation Estimates**

Table 5 shows the path and mediation estimates of the hypothesized mediation of student motivation on the relationship between perceived teacher support and creative thinking skills in mathematics. The data were analyzed in order to ensure that the basic assumptions of mediation analysis were met. The results were found to satisfy the assumption of normality and the assumption of multicollinearity; thus, the data are normally distributed.

Furthermore, it was hypothesized that perceived teacher support positively predicts the creative thinking skills in mathematics. Moreover, it was hypothesized that student motivation mediates such a relationship. To test these hypotheses, a sequence of regression analyses was performed. In Table 5, Path “a” points to the path from perceived teacher support to student motivation, Path “b” represents the path from student motivation to creative thinking skills, while “ c’ ” means the direct effect from perceived teacher support to creative thinking skills when student motivation is controlled in the study. The indirect effect is the path that represents the portion of the relationship between perceived teacher support and creative thinking skills in mathematics that is transmitted through student motivation. Furthermore, the path depicting the total effect is represented by Path “c”, where the indirect effect and the direct effect are put together.

Based on Table 5, the results revealed that, in Path “a”, perceived teacher support positively predicts student motivation, with a significant estimated effect of 0.76 (β = .83, z = 24.76, *P* = .05). Meanwhile, in Path “b”, student motivation negatively predicts creative thinking skills in mathematics, with a non-significant estimated effect of -0.76 (β = - .05, z = -0.63, *P* = 0.53). In Path c’ or the direct effect, the result revealed that perceived teacher support positively predicts creative thinking skills in mathematics, with a significant estimated effect of 11.57 (β = .78, z = 10.56, *P* = .00). In the indirect effect, the estimated effect of perceived teacher support through student motivation on creative thinking skills is -0.58 (β = .04, z = -0.63, *P* = .53), which was not significant. Furthermore, the total effect of perceived teacher support on students' creative thinking skills in mathematics is significantly positive, with an estimated effect of 11.0 (β = .74, z = 18.01, *P* = .00).

**Table 5. Path and Mediation Estimates**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Paths/Types** | **Estimate** | **SE** | **95% C.I (a)** | | ***β*** | **z** | **p** |
| **Lower** | **Upper** |
| Path a | 0.76 | 0.03 | 0.70 | 0.82 | .83 | 24.76 | .00 |
| Path b | -0.76 | 1.20 | -2.96 | 1.29 | -.05 | -0.63 | .53 |
| Direct/ Path c’ | 11.57 | 1.10 | 9.78 | 13.49 | .78 | 10.56 | .00 |
| Indirect | -0.58 | 0.91 | -2.22 | 1.02 | -.04 | -0.63 | .53 |
| Total (c) | 11.00 | 0.61 | 9.85 | 12.17 | .74 | 18.01 | .00 |

As presented above, the direct effect of perceived teacher support on creative thinking skills in mathematics is statistically significant and has a positive effect when the student motivation is controlled. However, the indirect effect of perceived teacher support on creative thinking skills through student motivation is not statistically significant. Since the indirect effect is not significant, it suggests that the student motivation is not acting as a significant pathway between perceived teacher support and creative thinking skills in mathematics. In addition, considering the result that the total effect is significant, it indicates that perceived teacher support significantly predicts creative thinking skills, even without the inclusion of student motivation. This means, the student motivation, as the hypothesized mediator in this study, did not mediate the relationship between perceived teacher support and creative thinking skills in mathematics. Thus, the null hypothesis was not rejected.

These findings are contrary to the findings of Liu et al. (2021), who confirm that student motivation has a partial mediation effect on the relationship between perceived teacher support and creative thinking skills in mathematics. They added that when a student perceived more teacher support, he or she will have higher motivation and then will trigger a high level of creativity. Moreover, Du et al. (2019) added that student motivation has positively mediated the relationship between creativity-fostering teacher behavior and creative achievement of the students.

**4. CONCLUSIONS AND RECOMMENDATIONS**

**4.1 Conclusions**

The following are drawn conclusions based on the findings and in relation to the research questions:

1. The student motivation is manifested.
2. The perceived teacher support of the students is evident.
3. The creative thinking skills in mathematics of the students are very good.
4. There is a strong positive and statistically significant relationship between perceived teacher support and creative thinking skills in mathematics. There is a very strong positive and statistically significant relationship between perceived teacher support and student motivation. There is a moderate positive and statistically significant relationship between student motivation and creative thinking skills in mathematics.
5. The student motivation did not significantly mediate the relationship between perceived teacher support and creative thinking skills in mathematics.

**4.2 Recommendations**

After careful analysis of the key findings and conclusions, the following recommendations were drawn to address issues, improve the current practices, and suggest future researches:

1. Students are highly encouraged to actively engage in exploratory learning practices and always connect math concepts in real-life scenarios to not just rely on correct answers, but also deepen their understanding and solve complex problems in a unique or novel way. Meaning, they should project math as an effective and powerful tool for innovation and practical application, fueled by motivation and teacher support. Having the mindset of being curious and continuously challenging themselves to think differently should be practiced and maintained by the students.
2. Teachers are encouraged to create a supportive and conducive learning environment for the students to think critically and creatively, especially in mathematics discussions. In addition, teachers should also consider boosting the self-efficacy of the students by nurturing positive feedback, deeper engagement, and prioritizing opportunities for successful Math performances. Also, they should provide assistance to boost diverse perspectives and help the students to think outside the box and connect abstract math concepts to real-life applications. By offering constructive feedback, the logical reasoning and potential creativity of the students will grow and cultivate. Thus, teachers must consider and promote risk-taking, flexibility, curiosity, and originality by incorporating technology-based and process-based learning in their pedagogy.
3. The Department of Education and the school administrators should forge policies and programs that foster student motivation and creative thinking skills in relation to Mathematics. A comprehensive curriculum reform focusing on innovation and math creativity for the students and professional development for the teachers must be improved for the learners to become functional literate citizens and for the teachers to establish school cultures that give importance to motivation and creative thinking skills in mathematics. Furthermore, investing in the teachers by giving them sufficient resources, time, and mentorship programs will drive them to innovative teaching practices that strengthen quality and student learning experiences.
4. Future researchers may consider other alternative variables aside from motivation as a mediator. Consider other factors such as psychological aspects, classroom strategies, or school climate that might play a more pivotal role in the relationship between perceived teacher support and creative thinking skills in mathematics. Future studies may apply a different research design or approach to expand conceptual frameworks about the variables. In addition, the researcher recommends investigating the possibility of student motivation as a moderator rather than a mediator.

**ETHICAL APPROVAL**

This study was conducted with utmost precautions to guarantee that the standard procedures were followed, especially when citing related works of literature, interacting with the target respondents, and securing their rights and identity. Thus, this study seriously and strictly adheres to the 10 dimensions of ethical considerations, namely social value, informed consent, vulnerability of the research respondents, risks, benefits and safety, privacy and confidentiality, justice, transparency, qualification of the researcher, adequacy of facilities, and community involvement. In addition, ensuring the diverse aspects of ethics in research is a top priority of this study, as it was submitted to the SMCTI Research Ethics Committee (SMCTI-REC).

**REFERENCES**

Affuso, G., Zannone, A., Esposito, C. (2023)*.* The effects of teacher support, parental monitoring, motivation and self-efficacy on academic performance over time. *Eur J Psychol Educ* 38, 1–23 (2023). <https://doi.org/10.1007/s10212-021-00594-6>

Almulla, M. A. (2023). Constructivism learning theory: A paradigm for students’ critical thinking, creativity, and problem solving to affect academic performance in higher education. *Cogent Education*, *10*(1). https://doi.org/10.1080/2331186X.2023.2172929

Amabile, T. M. (1983). Social psychology of creativity: A componential conceptualization. *Journal of Personality and Social Psychology*, 45, 997-1013. https://doi.org/10.1037/0022-3514.45.2.357

An, F., Yu, J., & Xi, L. (2022). Relationship between perceived teacher support and learning engagement among adolescents: Mediation role of technology acceptance and learning motivation. *Frontiers in Psychology, Sec. Educational Psychology*, *Vol. 13*. https://doi.org/10.3389/fpsyg.2022.992464

Anas, M., Harum, A., & Rusmayadi (2023). Factors influencing students’ creative thinking skills in mathematics. *Journal of Educational Science and Technology Volume 9* Number 1, =page 86-94 p-ISSN:2460-1497 and e-ISSN: 2477-3840. DOI: https://doi.org/10.26858/est.v9i1.38752

Andrade, R. & Pasia, A. (2020). Mathematical creativity of pre-service teachers in solving non-routine problems in state university in Laguna. *Universal Journal of Educational Research, 8*(10), 4555 - 4567. DOI: 10.13189/ujer.2020.081024. https://www.hrpub.org/journals/article\_info.php?aid=9803

Bales, M. & Estomo, R. (2022). Mathematical creativity, mathematics self-efficacy, and mathematics problem-solving performance of high school students in different curricular programs. *International Journal of Research Publication and Reviews*. 286-294. 10.55248/gengpi.2022.3.9.6.

Bhandari, P. (2023). An introduction to quantitative research. *Scribbr*, https://www.scribbr.com/methodology/quantitative-research/

Braid, F.R. (2024, June 29). *PISA and Creative Thinking*. *Manila Bulletin.* https://mb.com.ph/2024/6/28/pisa-and-creative-thinking

Chiu, T. K. F., Moorhouse, B. L., Chai, C. S., & Ismailov, M. (2023). Teacher support and student motivation to learn with Artificial Intelligence (AI) based chatbot. *Interactive Learning Environments, Advanced online publication*. https://doi.org/10.1080/10494820.2023.2172044

Diseth, A., Mathisen, F. K. S., & Samdal, O. (2020). A comparison of intrinsic and extrinsic motivation among lower and upper secondary school students. *Educ. Psychol*. 40, 961–980. doi: 10.1080/01443410.2020.1778640

Du, Y. L., Xie, L. Y., Zhong, J. A., Zou, H., Law, R., & Yan, X. B. (2019). Creativity fostering teacher behavior on student creative achievement: mediation of intrinsic motivation and moderation of openness to experience. *Sch. Psychol*. Int. 40, 525–542. doi: 10.1177/0143034319868271

Federici, R., & Skaalvik, E. (2014). Students’ perceptions of emotional and instrumental teacher support: relations with motivational and emotional responses. *International Education Studies; Vol. 7, No. 1*.  http://dx.doi.org/10.5539/ies.v7n1p21

Fernandez, S.M., Madelo, P.K., Suico, R.A.L., Cane, J.F., Magsayo, J., Capuyan, M., Siew, N.M. & Acut, D. (2024). Thinking what no one else has thought: Investigating the scientific creativity of primary school students in a science class. *Center for Educational Policy Studies Journal*. https://www.cepsj.si/index.php/cepsj/article/download/1514/720

Fiorella, L., Yoon, S.Y., & Atit, K. (2021). Validation of the mathematics motivation questionnaire (MMQ) for secondary school students. *IJ STEM Ed* **8**, 52 (2021). https://doi.org/10.1186/s40594-021-00307-x

Fischer, C., Malycha, C. P., & Schafmann, E. (2019). The influence of intrinsic motivation and synergistic extrinsic motivators on creativity and innovation. *Frontiers in Psychology,* *10*(FEB), 1–15. https://doi.org/10.3389/fpsyg.2019.00137

Gao, Q., Chen, P., Zhou, Z., & Jiang, J. (2020). The impact of school climate on trait creativity in primary school students: the mediating role of achievement motivation and proactive personality. *Asia Pacific J*. Educat. 40, 330–343. doi: 10.1080/02188791.2019.1707644

Gopalan, V., Bakar, J. A. A., Zulkifli, A. N., Alwi, A., & Mat, R. C. (2017). A review of the motivation theories in learning. In AIP Conference Proceedings, 1891(1), 020043. AIP Publishing LLC. https://doi.org/10.1063/1.5005376

Goulet-Pelletier, J.C., Gaudreau, P., & Cousineau, D. (2023). Do students motivated to learn have better creative abilities? *Learning and Individual Differences*, Volume 106, 102327, ISSN 1041-6080. https://doi.org/10.1016/j.lindif.2023.102327.

Granziera, H., Liem, G. A. D., Chong, W. H., Martin, A. J., Collie, R. J., Bishop, M., & Tynan, L. (2022). The role of teachers’ instrumental and emotional support in students’ academic buoyancy, engagement, and academic skills: a study of high school and elementary school students in different national contexts. *Learning and Instruction*, 80, Article 101619.

Huang, J., Sang, G., and Chao, T. (2022). Self-Worth as a mediator and moderator between teacher-student relationships and student engagement in rural schools. *Front. Psychol*. 12:777937. doi: 10.3389/fpsyg.2021.777937

Kadyirov, T., Oo, T. Z., Kadyjrova, L., & Józsa, K. (2024). Effects of motivation on creativity in the art and design education. *Cogent Education*, *11*(1). <https://doi.org/10.1080/2331186X.2024.2350322>

Karunarathne, W., & Calma, A. (2023). Assessing mathematical creative thinking skills in higher education: deficits and improvements. *Studies in Higher Education*, *49*(1), 157–177. https://doi.org/10.1080/03075079.2023.2225532

Lasari, R.N., Fadly, W., Nuranisak, P.F., & Karenina, A. (2023). The Effectiveness of Radec Learning on Critical Thinking and Creative Thinking in the Era of Super Smart Society 5.0. ASSEHR 746, pp. 127–137. https://doi.org/10.2991/978-2-38476-060-2\_13

Liu, X., Gong, S.Y., Zhang, H.P., Yu, Q.L., & Zhou, Z.J. (2021). Perceived teacher support and creative self-efficacy in Math: The mediating roles of autonomous motivation and achievement emotions in Chinese junior high school students. *Thinking Skills and Creativity*, Volume 39, 100752, ISSN 1871-1871. https://doi.org/10.1016/j.tsc.2020.100752.

Lucas, B. (2022). Creative thinking in schools across the world: A snapshot of progress in 2022. London: Global Institute of Creative Thinking. https://www.oecd.org/content/dam/oecd/en/about/projects/edu/teaching,-learning-and-assessing-creative-and-critical-thinking-skills/ces-2022/CES%202022%20brochure.pdf

Mahama, I., Yusuf Dramanu, B., & Asamoah-Gyimah, K. (2023). Predictive abilities of curiosity, creativity, and motivation on mathematics performance of high school students in Ghana. *Education Research International*, 2023, 1–10. https://doi.org/10.1155/2023/4626945

Manoy, J. T. & Sari, A.P. (2021). Students’ creative thinking in Math based on motivation to learn during online learning, *E3S Web Conf*. 328 06010. DOI: 10.1051/e3sconf/202132806010

McLure, F., Won, M., & Treagust, D. F. (2024). Math teachers’ understanding of creative thinking and how to foster it as mandated by the Australian curriculum. *Journal of Science Teacher Education*, 35(5), 524–543. https://doi.org/10.1080/1046560X.2024.2313882

Oppermann, E., & Lazarides, R. (2021). Elementary school teachers’ self-efficacy, student-perceived support, and students’ mathematics interest. *Teaching and Teacher Education,* *103*, 103351. https://doi.org/10.1016/j.tate.2021.103351

Orakci, Ş. and Durnali, M. (2023). The mediating effects of metacognition and creative thinking in Math on the relationship between teachers’ autonomy support and teachers’ self-efficacy. *Psychology in the Schools* 60: 162–81.

Organization for Economic Co-operation and Development (2024). *PISA Results 2022 (Volume III) - Factsheets: Philippines.* https://www.oecd.org/en/publications/pisa-results-2022-volume-iii-factsheets\_041a90f1-en/philippines\_68d369a7-en.html

Organization for Economic Co-operation and Development (OECD, 2024). *PISA Results 2022 (Volume III) - Factsheets: Indonesia*. https://www.oecd.org/en/publications/pisa-results-2022-volume-iii-factsheets\_041a90f1-en/indonesia\_a7090b49-en.html

Organization for Economic Co-operation and Development (OECD, 2024). *PISA Results 2022 (Volume III) - Factsheets: Malaysia*. https://www.oecd.org/en/publications/pisa-results-2022-volume-iii-factsheets\_041a90f1-en/malaysia\_4aa2f8e4-en.html

Parrish, N. (2022). To increase student engagement, focus on motivation. *Edutopia*. https://www.edutopia.org/article/to-increase-student-engagement-focus-on-motivation/

Qureshi, J.A., Pasha, M.A., Soomro, S.H. (2021). Analysis of classroom social environment relating to student and teacher perception in Math. 58. 5807-5820. https://doi.org/10.17762/pae.v58i1.3487

Ren, X., Jing, B., Li, H., & Wu, C. (2022). The impact of perceived teacher support on Chinese junior high school students’ academic self-efficacy: The mediating roles of achievement goals and academic emotions. *Sec. Educational Psychology*. Volume 13. https://doi.org/10.3389/fpsyg.2022.1028722

Runco, M. A. (2018). *Creativity and education*. In J. C. Kaufman & R. J. Sternberg (Eds.), *The Cambridge handbook of creativity* (2nd ed., pp. 431–450). Cambridge University Press.

Ryan, R. M. & Deci, E.L. (2020). Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices, and future directions. *Contemporary Educational Psychology*. 61. 101860. 10.1016/j.cedpsych.2020.101860.

Ryan, R. M. & Deci, E.L. (1985). Intrinsic motivation and self-determination in human behavior. *Berlin: Springer Science & Business Media*. https://doi.org/10.1007/978-1-4899-2271-7

Sari, M. I., Pambudi, M. R., Gudu, B. O., &Tholibon, D. A. (2023). Effectiveness of Problem-Based Learning Model on Creative Thinking in Senior High School. *Jambura Geo Education Journal,* 4(2), 179–186. https://doi.org/10.34312/jgej.v4i2.21806

Scott-Barrett, J., Johnston, S.K., Denton-Calabrese, T., McGrane, J., & Hopfenbeck, T. (2023). Nurturing curiosity and creativity in primary school classrooms. *Teaching and Teacher Education*, Volume 135, 104356. https://doi.org/10.1016/j.tate.2023.104356

Simonton, D. K. (2017). Giftedness and creativity in the classroom. *High Ability Studies*, 28(1), 5–23.

Sipin, K. & Paglinawan, J. (2024). Mathematics creativity and motivation in learning of senior high school students using Quipper. International Journal of All Research Education & Scientific Methods. ISSN (O) - 2582-1008, Vol. 6 Issue. 6. https://www.researchgate.net/publication/387295815\_MATHEMATICS\_CREATIVITY\_AND\_MOTIVATION\_IN\_LEARNING\_OF\_SENIOR\_HIGH\_SCHOOL\_STUDENTS\_USING\_QUIPPER

Skinner, E., Furrer, C., Marchand, G., and Kindermann, T. (2008). Engagement and disaffection in the classroom: Part of a larger motivational dynamic? *Journal of Educational Psychology*, 100(4), 765-781. doi: 10.1037/a0012840

Tabach, M., & Friedlander, A. (2017). Algebraic procedures and creative thinking. ZDM - Mathematics Education, 49(1), 53–63. https://doi.org/10.1007/s11858-016-0803-y

Tang, X., & Sternberg, R. J. (2020). Teachers’ attitudes toward creativity and their relationship to student creativity. *Thinking Skills and Creativity*, 35, 100645.

Torquedo, G. & Doronio, R. (2024). The influence of student motivation and classroom setting on students' academic performance in mathematics. IJARIIE-ISSN(O)-2395-4396. Vol-10 Issue-4. https://ijariie.com/AdminUploadPdf/THE\_INFLUENCE\_OF\_STUDENT\_MOTIVATION\_AND\_CLASSROOM\_SETTING\_ON\_STUDENTS\_\_ACADEMIC\_PERFORMANCE\_IN\_MATHEMATICS\_ijariie24555.pdf?srsltid=AfmBOooIBTybKqUu8Tzvgumb089k9IptCtUP3dCcerP2GJFm0mFXDwho

Veno, E. (2023). Why is creativity important in education? *Prisma*. Retrieved on November 18, 2024 from https://www.joinprisma.com/blog/why-is-creativity-important-in-education

Yesuf, Y.M., Getahun, D.A. & Debas, A.T. (2024). Determinants of employees’ creativity: modeling the mediating role of organizational motivation to innovate. *J Innov Entrep* 13, 8. https://doi.org/10.1186/s13731-024-00364-w

Zee, M., Rudasill, K. M., & Bosman, R. J. (2021). A cross-lagged study of students’ motivation, academic achievement, and relationships with teachers from kindergarten to 6th grade. *Journal of Educational Psychology,* *113*(6), 1208–1226. https://doi.org/10.1037/edu0000574

Zeng, L. H., Hao, Y., Hong, J. C., & Ye, J. N. (2022). The relationship between teacher support and bullying in schools: the mediating role of emotional self-efficacy. *Current Psychology,* 1-10. https://doi.org/10.1007/s12144-022-04052-4

Zhang, H. Sun, C., Liu, X., Gong, S., Yu, Q., & Zhou, Z. (2020). Boys benefit more from teacher support: Effects of perceived teacher support on primary students’ creative thinking, *Thinking Skills and Creativity*, Volume 37, 100680, ISSN 1871-1871. https://doi.org/10.1016/j.tsc.2020.100680.

Zhong, X., Qu, K., & Zhang, D. (2024). Examining influencing factors of teacher education students’ creativity in Chongqing Municipality. *Cogent Education*, 11(1). https://doi.org/10.1080/2331186X.2024.2351268