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Mathematical Creative Thinking Ability: Its Relation to Study Independence and Self-Concept

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Abstract. This study constitutes a quantitative research endeavor aimed at examining the influence of self-directed learning and self-concept on mathematical creative thinking ability. A questionnaire was used as the measuring tool during the data gathering process. The questionnaire was employed to gather data on self-directed learning and self-concept, while tests were utilized to collect data on mathematical creative thinking ability. Questionnaires were used as the assessment tool for data collecting. The questionnaire was utilized to capture data on self-directed learning and self-concept, while tests were employed to gather data on mathematical creative thinking ability. Data analysis utilized both descriptive and inferential statistics. Descriptive statistics were employed to ascertain the mean, median, mode, and standard deviation. The research findings indicate that the levels of self-directed learning, self-concept, and creative mathematical thinking abilities among elementary school students in the Malili district fall within the moderate category. There exists an influence of self-directed learning on students' creative mathematical thinking abilities. Additionally, there is an influence of self-concept on students' creative mathematical thinking abilities. Furthermore, self-directed learning and self-concept impact students' math creativity. Conclusion: there is a significant influence of both self-directed learning and self-concept on mathematical thinking abilities, both partially and collectively.

Keywords: independent study; self-concept; creative thinking; mathematics.

INTRODUCTION

Creative thinking in learning mathematics is crucial for enhancing students' abilities to comprehend and solve mathematical problems in a more innovative and effective manner. Continuously applying critical and creative thinking strategies can develop more meaningful concepts and higher-order thinking skills (Sumarni & Kadarwati, 2020). Although there is some research exploring the relationship between creative thinking skills in mathematics and learning independence, there is still a lack of in-depth understanding of how these factors influence each other specifically in the context of mathematics learning.Thus, creative thinking

can impact various factors. Creative thinking influences academic achievements in both high schools and universities (N. E. A. Nasution, Al Muhdhar, Sari, & Balqis, 2023) (Hidayatulloh, Muslim, Rahmadyanti, Ismayati, & Kusumawati, 2020). Recognizing the significance of creative thinking, its enhancement is necessary. Several methods to enhance creative thinking are evident in the following research findings. Critical and creative thinking skills are developed through the implementation of various learning method strategies (Valentová & Brečka, 2020). The development of e-learning PjBL-STEM instructional tools yields significant improvements in both creative thinking and self-regulation (Hasibuan, Sari, Syahputra, & Nahadi, 2022). Varied models of creativity, whether generative or evaluative, and diverse interactions can stimulate creative thinking abilities (Sowden, Pringle, & Gabora, 2015).

Problem-based and project-based learning relevant to daily life, considering advancements in science and technology, are deemed capable of fostering students' creative thinking abilities as preparation for the workforce (Madyani, Yamtinah, Utomo, Saputro, & Mahardiani, 2020). Blended learning strategy OE-C proves most effective in empowering creative thinking skills compared to open-ended, collaborative, and lecture methods (Titikusumawati, Sa'dijah, As'ari, & Susanto, 2020).

Metacognition holds the most significant influence on mathematical creative thinking abilities compared to other components (Munahefi, Kartono, Waluya, & Dwijanto, 2022). Creative thinking skills can be fostered through journal writing programs (Şenel & Bağçeci, 2019). Project briefs are more effective in enhancing students' creative thinking abilities as they create an enjoyable learning environment that encourages active student participation (Habibi, Mundilarto, et al., 2020). Problem-based learning methods can enhance critical and creative thinking abilities (Kardoyo, Nurkhin, Muhsin, & Pramusinto, 2020). Innovative programs are utilized for training creative thinking skills through learning (ED41201) (Chantarasombat & Sombatsakulkit, 2021).

The Phet simulation has positive implications for enhancing CrTS in concepts (Habibi, Jumadi, & Mundilarto, 2020). There is an increase in students' creative thinking abilities through cooperative learning, specifically the Jigsaw type (Nurmalia, Halim, & Syahrun, 2020). Several factors are related to creative thinking abilities. There is a strong correlation between critical thinking and creative thinking skills in improving students' cognitive learning outcomes..(Siburian, Corebima, Ibrohim, & Saptasari, 2019**).** Indicators of creative thinking are linked to problem-solving abilities (Hilmi, Juandi, & Usdiyana, 2021**).** The use of the ESI experimental tool can elucidate the brain component functions in periodic decision-making, including creative thinking (Madore, Thakral, Beaty, Addis, & Schacter, 2019). Self-efficacy is related to creative thinking (Mashitoh, Sukestiyarno, & Wardono, 2021).

Learning independence is crucial in academic pursuits as it fosters the cultivation of critical and creative thinking skills among students. Additionally, it instills the ethos of lifelong learning, characterized by intrinsic motivation, diversified learning approaches, and adeptness in overcoming educational hurdles. There exists a positive correlation between learning independence and mathematical learning outcomes, emphasizing the substantial contribution of learning autonomy to mathematical achievement (N. Nasution, Rahayu, Yazid, & Amalia, 2018). There is an influence of learning independence on mathematical learning outcomes (Suhendri, 2015). Elevating learning autonomy necessitates a concurrent enhancement in both learning creativity and motivation (Isnawati & Samian, 2017).

Efforts to instill and foster learning independence require intrinsic motivation within students, a desire to learn autonomously, a sense of responsibility, and confidence in their ability to tackle learning material effectively. Enhancing learning independence can be facilitated by access to facilities such as learning media, internet connectivity, and financial resources. To promote learning independence, effective instructional models and resources should be employed, enabling students to become more accustomed to self-directed learning (Patimah & Sumartini, 2022).

The enhancement of students' learning independence aims to master desired competencies, thus achieving learning objectives in both knowledge and skills (Indah & Farida, 2021). A conducive learning environment can foster and enhance learning independence, facilitating the attainment of mathematical

learning objectives (Rahayu & Aini, 2021). High levels of learning independence are imperative in the learning process, as students with a high degree of autonomy can make positive decisions to overcome challenges both within and outside the school environment, thereby cultivating self-confidence in completing tasks assigned by teachers (N. Nasution et al., 2018). Self-confidence is closely linked to learning independence. This implies that if students have high self-confidence, it can enhance their learning independence (Tahar & Enceng, 2006). Therefore, it is preferable for teachers to pay attention to students' independence in the mathematics learning process, as independence in learning mathematics enables students to meet teachers' expectations (Nurfadilah & Lukman Hakim, 2019). The higher the learning independence of a learner, the more likely they are to achieve high learning outcomes (Tahar & Enceng, 2006).

The development of self-concept is a crucial endeavor for students. Those with a positive self-concept tend to exhibit strong self-confidence and feel capable of facing challenges. The development of self-concept is a collective responsibility shared among teachers, parents, and the surrounding environment. If the development of creativity and positive self-concept in children progresses optimally, it will give rise to a creative generation (Sari, S, & Irdamurni, 2020). Several factors that contribute to the formation of negative self-concept in individuals include parents, peers, and society (Oktaria & Pardede, 2008).

Children with negative self-concept typically exhibit certain behaviors. They often feel incapable or unworthy, have low self-esteem, and tend to self-criticize. They may also become highly sensitive to criticism and failure, often feeling insecure or unhappy. Several factors that contribute to the formation of negative self-concept in individuals include parents, peers, and society (Oktaria & Pardede, 2008).

Self-concept has implications for several factors. Self-concept and self-confidence collectively influence mathematical critical thinking abilities (Rohmat & Lestari, 2019). Understanding the changes in self-concept over time requires in-depth study. Changes in self-concept are associated with age and gender (Widiarti, 2017). Self-concept is also related to bullying behavior; the higher the student's self-concept, the lower the incidence of bullying behavior (Saifullah, 2015). Academic self-concept mediates the relationship between several aspects and achievement, and how teachers address and evaluate pluralism and culture plays a crucial role in reinforcing adolescents' self-concept and self-esteem (Oczlon, Bardach, & Lüftenegger, 2021). Self-concept has a causal dominance on student achievement (Bolus & Shavelson, 1982). Regarding learning, project-based methods can enhance the self-concept of early childhood (Simanjuntak, 2022).

METHOD

This study employs a quantitative approach utilizing a survey methodology. The survey utilized questionnaire data as its primary source, collected via a Likert scale featuring questions derived from the instrument rubric. The study focused on assessing the creative thinking abilities of mathematics students in the Malilli sub-district. Participants were purposively selected, taking into account the characteristics of the population in Neolaka. (Rais, Hartoto, & Aryani, 2022).

This study was conducted within the school infrastructure located in the Malilli sub-district of East Luwu Regency. The study population comprised sixth-grade elementary school students in the Malili district. The sample size for this study constituted 30% of the total population. According to Arikunto (2006), when dealing with a population of less than one hundred, it is advisable to include all subjects in the research. However, if the number of subjects is substantial, a sample size ranging between 10-15% or 15-25% or more can be considered. In accordance with this recommendation, the author opted for a sample size of at least 30% of the population. Details of the successfully identified sample are provided in the table 1.

The data collection methods employed in this study consisted of two main approaches: (1) the administration of a questionnaire aimed at gathering information on respondents' levels of learning independence and self-concept, and (2) the utilization of an assessment tool to evaluate students' mathematical creative thinking abilities.

The instrument utilized for data collection was a closed questionnaire sheet, characterized by pre-established response options from which respondents selected their answers. The

questionnaire measurements employed a multilevel scale. Each item within the instrument featured graded scale responses in textual format, in the table 2.

Table 1. Research Sample

Name School	Amount Student
SD Country 221 Malilli	49
Public Elementary School 233 Ussu	15
SD Country 238 Mallaulu	58
Public Elementary School 222 Red stone	1
SD Country 220 bowl	7
SD Country 232 Wulus	28
SD Country 237 Atue	24
Public Elementary School 228 Lagaroang	34
Public Elementary School 231 Lakawali	50
Public Elementary School 225 Karebbe	19

Table 2. Scoring Guidelines

Alternative Answer	Score for Statement	
	Positive	Negative
Very Agree (SS)	4	1
Agree (S)	3	2
Don't agree (TS)	2	3
Very No Agree (STS)	1	4

Based on the findings of this study, the collected data from respondents were subjected to statistical analysis. The analytical techniques encompassed a range of statistical methods, commencing with descriptive statistics to determine key metrics such as the mean score, median, mode, standard deviation, and frequency distribution of the collected data.

Analysis Statistics Descriptive. The data concerning Self-directed Learning and Self-regulation were subsequently categorized into three distinct groups, namely high, moderate, and low, employing the following formula.

Table 3. The categorization of independent study and self-concept.

Criteria	Category
$X > (Mean + SD)$	Tall
$(Mean - SD) < X \leq (Mean + SD)$	Medium
$X < (Mean - SD)$	Low

The data regarding the ability to think creatively in mathematics are further classified into four categories: not creative, somewhat creative, creative, and highly creative, as guided by the table provided below.

Table 4. The categorization of creative mathematical thinking ability.

Percentage Mark	Category
01% − 34%	Less Creative
35% − 64%	Creative Enough
65% − 80%	Creative
81% − 100%	Very creative

Statistical Inference Analysis. The null hypothesis is the opposite of the alternative hypothesis, where if the statistical test results reject the null hypothesis, it means the alternative hypothesis is accepted, and vice versa. In this study, hypothesis testing employs a significance level of 0.05, indicating a 5% risk of error in drawing conclusions from the total truth, leaving a 95% level of confidence in the achieved truth. Consistent with the summarized problem formulation, the analysis techniques used are product moment analysis and double correlation analysis.

Subsequently, the analysis employed to test the hypotheses involves simple correlation analysis and multiple correlation techniques. However, before conducting the analysis, preliminary tests are carried out. Firstly, the requirements test, namely the tests for data normality and data linearity.

RESULTS AND DISCUSSION

Result

Data concerning independent study and self-perception were collected via question-naires, whereas information regarding students' creative thinking skills was acquired through testing. Subsequently, the gathered data were tabulated for examination using both descriptive

statistics and inferential statistics. The analysis of the study's findings is presented in the subsequent section below.

1. Descriptive Statistical Analysis Results

a. Description of Student Independence Study in Malili Subdistrict, East Luwu Regency.

The data on student independence study in Malili Subdistrict, East Luwu Regency, is presented in the table 5.

Table 5. Descriptive Statistical Analysis of Student Independence Study

Statistics	Mark
Means	91.78
Median	87.00
Variances	204.92
std. Deviation	14.31
Minimum	72
Maximum	117
Range	45

The data on student independence study in Malili Subdistrict, East Luwu Regency, is subsequently classified into three levels: high, medium, and low. The outcomes of this categorization regarding student learning independence are depicted in the table 6.

Table 6. Categories of Student Learning Independence in Malili Subdistrict

Study Independence Categories	Amount
Tall	86
Currently	166
Low	33

b. Description of Student Self-Drafting in Malili Subdistrict, East Luwu Regency.

Data on Student Self-Drafting in Malili Subdistrict, East Luwu Regency, is presented in the table 7.

Table 7. Analysis Statistics Self-Concept Descriptive

Statistics	Amount
Mean	89,49
Median	81.00
Variance	199.70
Std. Deviation	14.132
Minimum	72
Maximum	118
Range	46

The data on student self-drafting in Malili Subdistrict, East Luwu Regency, is further categorized based on current level into tall and low. The results of categorizing student self-drafting are presented in the table below.

Table 8 Categories of Student Self-Drafting in Malili District

Study Independence Categories	Amount
Tall	86
Currently	177
Low	22

c. Description of Mathematical Creative Thinking Ability Among Students in Malili Subdistrict, East Luwu Regency

The data on students' mathematical creative thinking ability in Malili District, East Luwu Regency, is presented in the table 9.

Table 9. Descriptive Statistical Analysis of Mathematical Creative Thinking Ability

Statistics	Mark
Means	60,52
Median	57.00
Variances	322.72
Std. Deviation	17.96
Minimum	30
Maximum	100
Range	70

The data on students' mathematical creative thinking ability in Malili District, East Luwu Regency, is subsequently categorized into four levels: Not enough Creative, Enough Creative, Creative, and Very Creative. The results of categorizing students' mathematical creative thinking ability are presented in the table 10.

Table 10. The Category of Students' Mathematical Creative Thinking Ability in the Sub-district

Creative category	Amount Students
Not enough Creative	17
Creative Enough	167
Creative	38
Very creative	63

The table above indicates that among students in the Malili Subdistrict, 17 students fall into the "not enough creative" category, 167 students fall into the "creative enough" category, 38 students fall into the "creative" category, and 22 students fall into the "very creative" category

in terms of Mathematical Creative Thinking Ability. This suggests that the majority of students in the Malili District demonstrate a level of Mathematical Creative Thinking Ability categorized as "creative enough".

The results of the analysis for the first hypothesis are presented in the table below. The normality test is conducted on the residuals from the model, which will be tested. The results of the normality test are presented in the table 11.

Table 11. Normality Test for Residuals of Hypothesis 1

Statistic	Significance		
	Statistic	**df**	**Sig.**
Unstandardized Residual	.084	285	0.204

Based on the test results above, it can be observed that the significance value is 0.204, thereby leading to the conclusion that the residual data for hypothesis 1 follows a normal distribution.

Linearity test was conducted to examine the linear relationship between independent study variables and mathematical creative thinking ability variables. The results of the linearity test are presented in the table 12.

Table 12 Test of Linearity for Hypothesis 1

Statistic		Sig.
Creative Thinking Ability *Independent Learning	Deviation from Linearity	0.292

Based on the table, it can be concluded that there is a significant linear relationship between Independent Learning (X_1) and Mathematical Creative Thinking Ability (Y).

Test of Heteroscedasticity. The results of the test are presented in the table 13.

Table 13. Results of Heteroaskedasticity Test for Hypothesis 1

Model	UnstandardizedCoefficients		Standardized Coefficients	Sig.
	B	**std. Error**	**Betas**	
(Constant)	15,592	1,254		.000
Independence_Learn	-.123	013	-.475	.000

Based on the output above, it is evident that the significance value for the independent learning variable is 0.000, which is smaller than 0.05. Therefore, it is concluded that there are symptoms of heteroscedasticity in the regression model. However, this analysis can proceed despite these symptoms.

Test of Simple Linear Regression. The results of the simple linear regression test for hypothesis 1 are presented in the table 14.

Table 14 Model Summary

R	R Square	Significance adjusted R Square	std. Error of the Estimates
.948 [a]	.899	.899	5,721

The Model Summary table for Hypothesis 1 indicates that the R value is 0.948, suggesting a strong relationship between the two research variables. The R Square, or coefficient of determination ($\mathbf{R^2}$), demonstrates the goodness of fit of the regression model created by the relationship between Independent Learning (X_1) and Mathematical Creative Thinking Ability (Y). The obtained coefficient of determination is 0.899 × 100% = 89.9%. This indicates that the Independent Learning variable (X_1) contributes significantly, accounting for 89.9% of the variance in Mathematical Creative Thinking Ability (Y).

Table 15. ANOVA Table for Testing Hypothesis 1

Model		Sum ofSquares	df	Means Square	F	Sig.
1	Regression	82390951	1	82390951	2517390	.000 [b]
	residual	9262228	283	32,729		
	Total	91653.179	284			

a. dependent Variable: Creative_Thinking Ability
b. Predictors: (Constant), Independence_Learn

Based on the results of the ANOVA test for hypothesis 1, it is observed that the significance value is 0.001, which is less than or equal to 0.05. This suggests that the regression model generated can be used to predict the Mathematical Creative Thinking Ability variable (*Y*).

Table 16. Results of the Simple Linear Regression Test for Hypothesis 1

Model	UnstandardizedCoefficients		standardized Coefficients	t	Sig.
	B	std. Error	Betas		
(Constant)	-48.69	2.20		-22.10	0.01
Independence_Learning	1.19	0.02	.95	50.17	0.01

Furthermore, the constant value in the table is observed to be -48.69, with the coefficient (B) for Independent Learning being 1.19. Thus, the regression equation created is:
$Y = -48{,}69 + 1{,}19X1$

In the table above, the t-value is also noted to be 50.17 with a significance level of 0.01, which is less than or equal to 0.05. This implies that the null hypothesis (H_0) is rejected. Therefore, it can be concluded that there is an influence of Independent Learning on the Mathematical Creative Thinking Ability of elementary school students in Malili District, East Luwu Regency.

Normality test was conducted on the residuals from the model under test.

Table 17. Normality Test Residuals for Hypothesis 2

Statistics	Significance		
	Statistics	df	Sig.
Unstandardized Residual	.991	285	0.88

Based on the test results above, it can be observed that the significance value is 0.088, thereby leading to the conclusion that the residual data for Hypothesis 2 follows a normal distribution.

A linearity test was conducted to examine whether there is a linear relationship between the self-concept variable and the mathematical creative thinking ability variable of the students. The results of the linearity test are presented in the table below.

Table 18. Linearity Test Results for Hypothesis 2

Statistics		Sig.
Creative_Thinking_Ability * Self concept	Deviation from Linearity	0.147

Based on the table, it can be inferred that the deviation from linearity is 0.147, which is greater than or equal to 0.05. Thus, it can be concluded that there is a significant linear relationship between the self-concept (X_2) and the Mathematical Creative Thinking Ability (*Y*).

The results of the heteroscedasticity test are presented in the table 19.

Table 19. Results Heteroaskedasticity Test for Hypothesis 2

Model	UnstandardizedCoefficients		Standardized Coefficients	Sig.
	B	std. Error	Betas	
(Constant)	13,398	1879		.000
Self Concept	-.077	.021	-.215	.000

Based on the output, it is observed that the significance value for the self-concept variable is 0.000, which is smaller than 0.05. Therefore, it is concluded that there are symptoms of heteroscedasticity in the regression model. However, further analysis can still proceed despite these symptoms.

The simple linear regression test was conducted to determine the extent of the influence of the Self-Concept variable on the Mathematical Creative Thinking Ability of students in Malili District, East Luwu Regency. The results of the simple linear regression test for Hypothesis 2 are presented in the table 20.

Table 20. Model Summary

R	R Square	adjusted R Square	std. Error of the Estimates
.888 [a]	.788	.788	8.279

Predictor (Constant). The Model Summary table for Hypothesis 2 indicates that the R value is 0.888, signifying a strong relationship between the two research variables. The R Square or Coefficient of Determination (KD), demonstrates the goodness of fit of the regression model created from the relationship between Self-Concept (X_2) and Mathematical Creative Thinking Ability (Y). The obtained coefficient of determination value is 0.788 × 100% = 78.8%. This indicates that the independent variable Self-Concept (X_2) contributes significantly, accounting for 78.8% of the variance in Mathematical Creative Thinking Ability (Y).

Table 21 ANOVA Table for Testing Hypothesis 1

Model		sum of Squares	df	Means Square	F	Sig.
1	Regression	72257.177	1	72257.177	1054,278	.000 [b]
	residual	19396.002	283	68,537		
	Total	91653.179	284			

a. dependent Variable: Creative_Thinking Ability
b. Predictors: (Constant), Independence_Learn

Based on the results of the ANOVA test for Hypothesis 2, it is observed that the significance value is 0.001, which is less than or equal to 0.05. This implies that the regression model generated can be used to predict the Mathematical Creative Thinking Ability variable (Y).

Table 22 Result of Simple Linear Regression Test for Hypothesis 2

Model	UnstandardizedCoefficients		S tandardized Coefficients	t	Sig.
	B	std. Error	Betas		
(Constant)	-40.50	3.15		-12.86	.00
Self concept	1.13	.035	.89	32.47	.01

From the table, it can be observed that the constant value in column b is -40.50, and the coefficient (B) for the Self-Concept variable is 1.12. Thus, the regression equation created is: $Y = -40{,}500 + 1{,}13X_1$

Furthermore, the t-value is noted to be 32.47 in the table, with a significance level of $0.01 \leq 0.05$, indicating that the null hypothesis (H_0) is rejected. Therefore, it can be concluded that there is an influence of Self-Concept on the Mathematical Creative Thinking Ability of students in the Malili District, East Luwu Regency.

Hypothesis 3. Prior to testing the hypothesis, a prerequisite analysis test was conducted, consisting of tests for normality, linearity, multicollinearity, and heteroscedasticity. The results of the analysis for the third hypothesis are presented below. Test A normality test was conducted on the residuals from the model to be tested.

Table 23. Normality Test for Residuals of Hypothesis 3

Statistics	Significance		
	Statistics	df	Sig.
Unstandardized Residual	.977	2850.129	

Based on the test results above, it is observed that the significance value is 0.129, indicating that the residual data for Hypothesis 3 follows a normal distribution.

A linearity test was conducted to examine whether there is a linear relationship between the independent study variable and Self-Concept variable with the Mathematical Creative Thinking Ability variable of students. The results of the linearity test are presented in the table 24.

Table 24 Linearity Test for Hypothesis 3

Statistics		**Sig.**
Creative_Thinking_Ability *Self concept	Deviation from Linearity	0.147
Creative_Thinking_Ability * Independence_Learn	Deviation from Linearity	0.292

Based on the table 24, it is evident that the deviation from linearity is 0.292, which is greater than or equal to 0.05. Thus, it can be concluded that there is a significant linear relationship between Independent Learning (X_1) and Mathematical Creative Thinking Ability (Y). Additionally, based on the table above, it is noted that the deviation from linearity is 0.147, which is greater than or equal to 0.05. Therefore, it can be concluded that there is a significant linear relationship between Self-Concept (X_2) and Mathematical Creative Thinking Ability (Y).

The heteroscedasticity test was conducted to ascertain whether there are any symptoms of heteroscedasticity in the formed regression model. A good model is indicated when heteroscedasticity does not occur. The results of the test are presented in the table 25.

Table 25 Results of Heteroscedasticity Test for Hypothesis 3

Model		**Unstandardized Coefficients**		**Standardized Coefficients**		
		B	**std. Error**	**Betas**	**t**	**Sig.**
1	(Constant)	15,707	1,274		12,329	.000
	Independence_ Learning	-.124	.035	-.078	-.007	.151
	Self concept	-.001	.036	-.002	-.016	.987
a. Dependent Variable: ABS_RES_H3						

Based on the output above, it is observed that the significance value for the Independent Learning variable is 0.151, which is greater than 0.05, and for the Self-Concept variable, it is 0.987, also greater than 0.05. Therefore, it can be concluded that there are no symptoms of heteroscedasticity in the regression model.

The multicollinearity test was conducted to determine whether there is a strong correlation between the independent variables and the dependent variable. A good model is indicated when there are no symptoms of multicollinearity. The results of the test are presented in the table 26.

Table 26. Results of Multicollinearity Test for Hypothesis 3

Model		Collinearity Statistics	
		tolerance	VIF
1	(Constant)		
	Independence_Learning	.147	6,802
	Self concept	.147	6,802

Based on the Multicollinearity Test table above, it can be observed that the tolerance value for the Subjective Well-Being and Self-Awareness variables are 0.147 > 0.1, with a VIF value of 6.802 < 10. This indicates that there are no symptoms of severe multicollinearity in the regression model.

The results of the multiple linear regression test for Hypothesis 3 are presented in the table 27.

Table 27 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.949[a]	.900	.899	5.702

The Model Summary table for Hypothesis 3 shows that the value of R is 0.949, indicating a strong relationship between the study's variables. The R Square, or coefficient of determination ($\mathbf{R}^2$), demonstrates the goodness of fit of the regression model created from the relationship between Independent Learning (X_1) and Self-Concept (X_2) with Mathematical Creative Thinking Ability (Y). The obtained coefficient of determination value is 0.900 × 100% = 90.0%. This indicates that the independent variables, Independent Learning (X_1) and Self-Concept (X_2), together contribute significantly, accounting for 90.00% of the variance in Mathematical Creative Thinking Ability (Y).

Table 28. Result of Simple Linear Regression Test for Hypothesis 3

Model		Unstandardized Coefficients		standardizedCoefficients
		B	std. Error	Betas
1	(Constant)	-49,301	2,225	
	Independence_Learn	1,093	062	.871
	Self concept	.106	062	083

Based on the table, it is observed that the constant value in column B is -49.301, the value of B for Independent Learning is 1.093, and the value of B for Self-Concept is 0.106. Therefore, the regression equation created is: $Y = -49{,}301 + 1{,}093X_1 + 0.106X_2$.

Table 29. ANOVA Table to Test Hypothesis 3

Model	Sum ofSquares	df	Mean Square	F	Sig.
1 Regression	8248440	241242.225		1268,475.000 [b]	
residual	9168729	282	32,513		
Total	91653.179	284			

Dependent Variable: Creative_Thinking_Ability
Predictors: (Constant), Self Concept, Independent_Learning

Based on the results of the ANOVA test for Hypothesis 3 above, it is observed that the significance value is 0.001, which is less than or equal to 0.05. This indicates that there is an influence of Independent Learning and Self-Concept on the Creative Thinking Ability of elementary school students in the Malili District, East Luwu Regency.

Discussion

Description of Independent Learning among School-Based Students in Malili Subdistrict, East Luwu Regency.

School-based students with high levels of independent learning tend to be more self-regulated, self-disciplined, and have a more focused approach to learning. In line with the opinion of(Madore et al., 2019) independent learning demands more than just passive participation in teaching, prompting students to engage in various activities to achieve their study objectives. This suggests that students will learn materials not only from teachers but also from other sources, such as books (Suhendri, 2015).

This study shows that a significant portion of students in the Malili Subdistrict currently exhibit a high level of independent learning. This indicates that school-based students in the Malili District possess good self-confidence and self-control. Students with good self-control tend to enjoy mathematics, grasp the material, exhibit confidence in solving math problems, and believe in achieving good results from their mathematics learning process.

School-based students in the Malili Subdistrict who exhibit high levels of independent learning tend to be more disciplined and responsible. This attitude is characterized by students' ability to manage tasks within appropriate timeframes, demonstrating seriousness in completing tasks. Moreover, they continuously strive to improve their learning methods if they feel that the grades they receive are not satisfactory.

Description of Self-Concept among School-Based Students in Malili Subdistrict, East Luwu Regency.

Internal factors, such as self-concept, significantly influence students' academic performance. Self-concept directly influences a student's self-assessment and evaluation of their capabilities. It determines students' responses to external stimuli and their motivation to achieve success in various aspects of life, including academics, social interactions, and career development (Mashitoh et al., 2021). Students with a positive self-concept exhibit polite and honest behavior and are often recognized by their peers. Conversely, students lacking honesty may engage in unethical behaviors such as avoiding tasks or cheating during exams.

The findings of this study reveal that the majority of elementary school students in Malili District, East Luwu Regency, fall into the "currently" category regarding their self-concept. Particularly during the pandemic, this suggests that students with a positive self-concept tend to be more diligent and enthusiastic about learning mathematics. They understand that success depends not only on themselves but also on the support of their parents (Parnata, Christian, & Son, 2014).

Description of Mathematical Creative Thinking Ability among School-Based Students in Malili Subdistrict, East Luwu Regency.

Creative thinking in mathematics can be fostered through unique and innovative learning activities. Creative activities engage students in mathematical learning, encouraging them to express their creativity(Madore et al., 2019). Especially during the COVID-19 pandemic, teachers are encouraged to promote students' creativity.

Based on research results, the mathematical creative thinking ability of students

in the Malili Subdistrict, East Luwu Regency, is categorized as "quite creative".

Influence of Learning Independence and Self-Concept on the Mathematical Creative Thinking Ability among School-Based Students in Malili Subdistrict, East Luwu Regency.

The government, through its ministries, has issued regulations regarding social distancing and physical distancing to minimize the spread of the coronavirus. All aspects of education are required to ensure that classes continue even though schools are closed. School closures are the most effective mitigation measure to reduce the spread of the epidemic among children. An anticipatory measure taken by the government is home-based learning, often referred to as BDR. Despite the challenges, home-based learning utilizes various support facilities to ensure effective distance learning (Herliandry, Nurhasanah, Splinter, & Kuswanto, 2020).

Based on the research findings, it is known that there is an influence of learning independence and self-concept on the creative mathematical thinking ability of elementary school students in the Malili District, East Luwu Regency. The same results were obtained after partial testing.

The equality indicates that Y, or mathematical creative thinking ability, will be negative if students do not have learning independence. Students will have creative thinking ability in the moderately creative category if the value of X_1 is around 69, meaning students must have a minimum low level of learning independence. Students will have creative thinking ability in the creative category if the value of X_1 is around 94, meaning students must have a minimum moderate level of learning independence. Students will have creative thinking ability in the very creative category if the value of X_1 ranges around 115, indicating students must have a minimum high level of learning independence.

Based on this equation, it can be concluded that students' mathematical creative thinking ability will increase along with the increase in their learning independence. Akhdiyat and Hidayat (2018) state that the positive influence of independent learning on students' creative thinking ability in mathematics, and the higher the learning independence in mathematics possessed by students, the higher their mathematical creative thinking ability will be.

The second Partial Equality found is an equality that demonstrates the relationship between self-concept and students' mathematical creative thinking ability. The equality in question is as follows: Y = -40,500 + 1,13 X_2

The equality indicates that Y, or mathematical creative thinking ability, will be negative if students do not have self-concept. Students will have creative thinking ability in the moderately creative category if the value of X_2 ranges around 65, meaning students must have a minimum low level of self-concept. Students will have creative thinking ability in the creative category if the value of X_2 is around 92, meaning students must have a moderate level of self-concept. Students will have creative thinking ability in the very creative category if the value of X_1 is around 117, meaning students must have a minimum high level of self-concept.

The simultaneous or joint equations derived in this study are as follows: $Y = -49{,}301 + 1{,}093\ X_1 + 0.106\ X_2$

The equation above demonstrates that the coefficients of X_1 and X_2 are positive. This implies that the variables of independent study and self-concept have a positive effect on students' mathematical creative thinking ability. This finding is consistent with the perspective of Pratiwi, Supandi, & Aaron (2021), who argue that independent study influences the creative thinking profile. Additionally, Rahman (2012) revealed that students' self-concept regarding mathematics in Geogebra-assisted learning generally influences creative thinking ability.

CONCLUSIONS AND SUGGESTIONS

There is an influence of self-concept on the ability to think creatively in mathematics. There is an influence of learning independence on the ability to think creatively in mathematics. There is an influence of self-concept and learning independence combined on the ability to think creatively in mathematics.

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