Focus **ACT**ion **O**f **R**esearch **M**athematic
Volume 6, No. 02, Desember, 2023
Page 57-70

ISSN: 2655-3511 (print)
ISSN: 2656-307X (online)
DOI:10.30762/f_m.v6i2.1365

The Influence of Student Creativity on Students' Ability to Solve HOTS Type Questions

Muhammad Ikmal Faizien[1], Yusuf Fuad,[2] A'yunin Sofro[3]
[1,2,3] program Studi S2 Pendidikan Matematika, Universitas Negeri Surabaya, Surabaya, Indonesia
* *Corresponding author. Graha Permata A-22 RT 46 RW 10, 61262, Sidoarjo, Indonesia*
E-mail: *ikmalfaizien@gmail.com* [1)]
yusuffuad@unesa.ac.id [2)]
ayuninsofro@unesa.ac.id [3)]

Keywords

Pengaruh, Kreativitas, Ssoal tipe HOTS

Influence, Creativity, HOTS type questions

ABSTRACT

Penelitian ini bertujuan untuk mengetahui pengaruh kreativitas siswa terhadap kemampuan siswa dalam menyelesaikan soal tipe HOTS. Penelitian ini menggunakan jenis penelitian deskriptif kuantitaif. Subjek penelitan sebanyak 35 siswa kelas VII A. Instrumen penelitian terdiri dari tes kreativitas dan tes HOTS. Uji coba instrumen dilakukan kepada sebanyak 35 siswa kelas VII B yang bukan subjek penelitian untuk mengetehaui karateristik butir soal meliputi (1) pembuktian validitas menggunakan korelasi *product moment*, (2) estimasi reabilitas menggunakan *Cronbanch Alpha*, (3) tingkat kesukaran dan (4) daya pembeda menggunakan hasil dari nilai koefisien. Teknik analis data menggunakan dua tahapan yaitu uji asumsi dan uji hipotesis. Uji asumsi meliputi uji normalitas dan uji linearitas serta uji hipotesis meliputi analisis korelasi dan regresi linear sederhana. Hasil penelitian menunjukkan bahwa terdapat pengaruh yang signifikan kreativitas siswa terhadap kemampuan siswa dalam menyelesaikan soal tipe HOTS yang dijelaskan pada persamaan regresi $\hat{y} = 26{,}232 + 0{,}370x$. Kemampuan siswa dalam menyelesaikan soal tipe HOTS dipengrahui oleh kreativitas siswa sebesar 54,9% sedangkan sisanya yaitu 45,1% dipengaruhi oleh variabel lain yang tidak dilakukan kajian lebih lanjut pada model regresi ini.

The purpose of this study is to figure out how students' creativity affects their capacity to answer problems of the HOTS variety. Quantitative descriptive research is used in this study. Thirty-five kids in class VIIA served as the research subjects. The research tools included the HOTS and creativity tests. Instrument trials were carried out on 35 class VII B students who were not research subjects to determine the characteristics of the test items including (1) proving validity using product moment correlation, (2) estimating reliability using Cronbanch Alpha, (3) level of difficulty and (4) power. The differentiator uses the results of the coefficient values. The data analysis technique uses two stages, namely assumption testing and hypothesis testing. Assumption tests include normality tests and linearity tests and hypothesis tests include correlation analysis and

simple linear regression. The study's findings demonstrate a strong correlation between student creativity and their ability for solving questions of the HOTS variety, as indicated by the regression equation y=26.232+0.370x. Students' creativity influences their ability to answer questions of the HOTS type by 54.9%, whereas other characteristics that were not further investigated in this regression model influence the remaining 45.1% of students.

INTRODUCTION

The transformation of education in the 21st century era in the fields of science and technology is developing very rapidly (Trilling and Fadel, 2009). Learning activities must provide new innovations in order to realize good quality education. By creating innovative learning, it is hoped that students will have various skills that are needed today. Having various skills can make it easier for students to solve problems and be able to face future demands (Badjeber & Purwaningrum, 2018).

Mathematics learning is a subject that to this day always provides innovation and renewal (Sulistyawati, 2016). Mathematics is one of the basic sciences which is important for its application in everyday life in various other scientific fields and technological developments. Mathematics is also a branch of science that must be studied by every individual, especially every student at school because mathematics is studied at every level of education from elementary to high school (Kusaeri & Ridho, 2019). Mathematics not only facilitates students to develop computing skills but also develops skills in reasoning, modeling, representation, and problem solving. (Jannah et al., 2022)

Twenty first century mathematics learning emphasizes the importance of developing 4C skills including creativity, critical thinking, collaboration, and communication (Trilling and Fadel, 2009). The school's current goal is to support the development of 4C skills in student-centred learning (Asyhar, 2023). The results obtained will later help in solving problems in real life independently. One of the 4C

skills that needs to be developed is creativity

Students who have creativity are able to solve real problems flexibly, because students are able to find several alternative solutions. Students who have creativity can also understand failure and difficulties, these failures will be used as opportunities to learn from their mistakes, then be able to develop, implement and communicate several new ideas to deal with these difficulties (Griffin et al., 2012). So it can be said that the individual skill that students need to have is creativity.

Each student has different creativity. Creativity is a complex thought and can be expressed through linguistic intelligence, musical intelligence, mathematical intelligence, spatial intelligence, kinesthetics intelligence, naturalist intelligence, interpersonal intelligence, and intrapersonal intelligence (Bornstein & Gardner, 1986). Munandar (1999) defines creativity as the result of an individual's interaction with their environment, the ability to create something new that is a combination based on data, information that has been previously obtained based on experience or knowledge gained from life in the family, community and school environment. Student creativity will emerge if someone can think creatively.

The ability to think creatively is one of the Higher Order Thinking Skills (HOTS) (McMahon, 2009; Tan & Siti Hajar, 2015). Conklin (2011) states that the two components of HOTS include critical and creative thinking abilities. HOTS is defined as skills in analysing a problem, evaluating each process carried out by connecting the concepts obtained, and finding or creating new ideas from the results of the evaluation (Anderson & Krathwohl, 2001; Faridah et al., 2018).

If connected as a whole, creativity is related to creative thinking, while creative thinking is found in one part of HOTS. So it is suspected that creativity and HOTS are also related. The purpose of this research is to determine whether there is a significant influence of student creativity on students' ability to solve HOTS type questions. It is hoped that the research results can provide quantitative information regarding the influence of student creativity on HOTS and provide opportunities for further research related to qualitative evidence, namely student creativity in the form of answers or solutions in solving HOTS questions.

METHODS

This research uses quantitative descriptive research. Quantitative descriptive research was used to study and see the relationship between student creativity and students' ability to solve HOTS type questions. The research population was all class VII students at SMPN 3 Krian. The selection of the research population was based on the material used, namely integers, where this material is one of the subjects taught to class VII students. From the determined population, the research sample was then selected using purposive sampling. The purpose of using this technique is to determine the research sample based on consideration of one class that has the best average academic score among all class VII. The basis for considering class selection is based on the best average academic score because the questions that will be given are non-routine questions that require skills that are not just about remembering but skills that meet the HOTS indicators. So, in order to get maximum and valid data, class selection is based on the considerations mentioned earlier. SMPN 3 Krian has grouped students who have the highest academic scores among other students into one class. Class VII A is the class with the highest average academic score among the other classes. So class VII A was selected as the research sample. A total of 35 students from class VII A were given two test instruments, namely the creativity test instrument and the HOTS test.

In this study, two variables were used, namely the independent variable as student creativity and the dependent variable as student ability in solving HOTS type questions. The research instruments used were a creativity test consisting of two questions and a HOTS test consisting of three questions, where all the questions were in the form of descriptions with the material being integers. Both instruments were validated by two lecturers and one teacher who had been teaching for more than five years. Two people were selected from the Mathematics Education Study Program, Surabaya State University and one mathematics teacher from Amanatul Ummah Middle School, Surabaya. The validation procedure by experts uses assessment standards that refer to the validation sheet that has been created.

Before the instrument was used, an analysis of the characteristics of the test items was carried out on students who were not research subjects as many as 35 students from class VII B. Analysis of the characteristics of the test items included

proving validity, estimating reliability, level of difficulty, and distinguishing power. Proving validity uses product moment correlation, if the value of r_count>r_table then it is said to be valid (Sugiyono, 2015) while the reliability estimate uses Cronbach Alpha, if the value is sig>0.06 then it is said to be reliable (Sujarweni, 2014). Based on the level of difficulty and differentiating power of the questions, first look for each coefficient value. Next, the coefficient value is interpreted based on the following criteria:

Table 1.
Interpretation of Difficulty Level and Differential Power

	Interval	Criteria
DL	0	Very Difficult
	$0 < p \leq 0{,}3$	Difficult
	$0{,}3 < p \leq 0{,}7$	Moderate
	$0{,}7 < p < 1$	Easy
	1	Very Easy
DP	$D \leq 0{,}00$	Very Bad
	$0 < D \leq 0{,}2$	Bad
	$0{,}2 < D \leq 0{,}4$	Sufficient
	$0{,}4 < D \leq 0{,}7$	Good
	$0{,}7 < D \leq 1$	Very Good

Source: Arikunto (2015:225)

Data collection starts from providing research instruments, namely creativity test instruments and HOTS tests. The creativity instrument is used to obtain data on student creativity, while information on the ability of learners for answering questions of the HOTS type is gathered using the HOTS test instrument. To test the research hypothesis, quantitative analysis was done after the data was collected. The research's hypothesis is that students' creativity has a significant impact on their capacity to answer questions of the HOTS variety. The data analysis technique employs two steps, namely assumption testing and hypothesis testing, to address the study hypothesis.

There are tests for linearity and normalcy in the assumption test. Examining residual values from the regression equation, the normality test determines whether or not the data is regularly distributed. The normalcy of the residual values indicates the quality of the regression model.

In the assumption test, there are normality and linearity tests. Examining residual values from the regression

equation, the normality test determines whether or not the data is normally distributed. If the residual values follow a normal distribution, the regression model is considered to be good. Use the Kolmogorov-Smirnov test to determine this; if the significance value is greater than 0.05, the research data is normally distributed. When there is a linear relationship between two variables, the linearity test is employed. There is a significant linear association if the Deviation from Linearity score is more than 0.05.

In hypothesis testing, the analysis carried out is simple correlation and regression analysis. The students' creativity is the independent variable and the ability of students to solve HOTS-style questions is the dependent variable, correlation analysis is used to determine whether or not there is a linear relationship between the two. A significant relationship is found if the significance value is less than 0.05. The nature of the association between students' creativity, and their ability for answering problems of the HOTS kind was examined using simple regression analysis. The linear regression equation model can be described as:

$$\hat{y} = \beta_0 + \beta_1 x$$

Note:

$\hat{y}$: Students' ability in solving HOTS question (independent variable)

β_0 : Constant

β_1 : Regression Coefficient

x : Students' Creativity (dependent variable)

Following the determination of the regression coefficient value, a t test analysis is performed. The significance of constants for each independent variable on the dependent variable is tested using the T test technique. Students' creativity has a substantial impact on their ability to solve HOTS type questions if the significance value is less than 0.05. The F test is used to evaluate the hypothesis after obtaining the regression equation. The regression equation's ability to predict or foresee the magnitude of the dependent variable depending on the independent variable is tested using the F test. Hypothesis testing is carried out where if the significance is <0.05 then there is a significant influence on student creativity. on students' ability to solve HOTS type questions. Next, to determine whether the residuals are normally distributed, a residual test is performed. In order to use the t test and F test statistics, this is necessary. The

conclusions drawn from the statistics of the t test and F test are invalid if this test is not conducted. If the residuals are known to be normally distributed, the regression model is considered to be good. To detect normally distributed residuals by observing the scatter plot.

RESULT AND DISCUSSION

Analysis of Question Item Characteristics

For each research instrument, an analysis of the characteristics of the question items is carried out. Following are the recapitulation results.

Table 2.
Recapitulation Of The Results Of The Analysis Of The Characteristics Of The Questions

No	Validity Proofing			Reliability Estimation					
	r test	*r table*	interpretation	$p\ value$	Interpretation	TK	Category	DP	Category
Creativity Test Instrument									
1	0,965	0,3338	Valid	0,927	Reliabel	0,37	Moderate	0,23	Sufficient
2	0,966	0,3338	Valid			0,38	Moderate	0,21	Sufficient
HOTS Test Instrument									
1.	0,991	0,3338	Valid			0,30	Difficult	0,21	Sufficient
2.	0,984	0,3338	Valid	0,984	Reliabel	0,33	Moderate	0.29	Sufficient
3.	0,992	0,3338	Valid			0,30	Difficult	0,21	Sufficient

Table 2 shows that the validity of all the items on the creativity test and HOTS test instruments is valid, the reliability estimates show reliability, the level of difficulty of the questions in the lowest category is moderate and the highest is difficult, and the differentiating power of the questions is in the sufficient category.

Test Assumptions

By examining the sig value >0.05, the normality test determines whether or not the research data is normally distributed. The following is the Kolmogorov-Smirnov test output from SPSS:

Table 3.
Normality Test Results Using Kolmogorov-Smirnov

One-Sample Kolmogorov-Smirnov Tes		
		Unstandardized Residual
N		35
Normal Parameters[a.b]	Mean	0,0000000
	Std. Deviation	2,81066471
Most Extreme Differences	Absolute	0,138
	Positive	0,138

	Negative	$-0,135$
Tes Statistic		$0,138$
Asym. Sig. (2-tailed)		$0,090^{c}$

a. Test distribution is Normal
b. Calculated from data
c. Liliefors Significance Correction

The data from the HOTS and creativity tests are normally distributed, as Table 3 demonstrates, because the significance value is 0.09>0.05.

The linearity test is used to determine whether the research data used has a significant linear relationship by looking at the Deviation from Linearity value >0.05. The following is the linearity test output from SPSS.

Table 4.
Linearity Test Results

Anova Table

			Sum of Squares	df	Mean Square	F	Sig.
Tes HOTS*Tes Kreativitas	Between Groups	(Combined)	449,543	7	64,220	11,923	0,000
		Linearity	326,377	1	326,377	60,595	0,000
		Deviation from Linearity	123,166	6	20,528	3,811	0,070
	Within Groups		145,429	27	5,386		
	Total		594,971	34			

Because the Deviation from Linearity score in Table 4 is 0.07>0.05, it is evident that there is a considerable linear relationship between students' creativity and their ability to answer typical HOTS type problems.

Hypothesis testing

To ascertain whether or if there is a linear relationship between students' creativity and their ability for answering questions of the HOTS kind, correlation analysis is employed. The following is the correlation test output from SPSS.

Table 5.
Correlation test results

Correlations

		Tes Kreativitas	Tes HOTS
Tes Kreativitas	Pearson Correlation	1	$0,741^{**}$

	Sig. (2-tailed)		0,000
	N	35	35
Tes HOTS	Pearson Correlation	0,741**	1
	Sig. (2-tailed)	0,000	
	N	35	35

** Correlation is significant at the 0,01 level (2-tailde)

The r value in Table 5 is 0.741. The favourable results shown by the r value indicate a positive correlation between students' creativity and their ability to answer questions of the HOTS kind. The high correlation between students' creativity and their ability for solving HOTS-style problems is indicated by the substantial r value of 0.741.

The next step was to conduct a hypothesis test to determine whether student creativity and their capacity for solving problems of the HOTS kind were significantly correlated. There is a significant correlation between students' creativity and their ability to answer questions of the HOTS type if the significance value is less than 0.05. Because the significance value in Table 5 is 0.00<0.05, it is evident that there is a significant correlation between students' creativity and their ability for solving HOTS-style problems.

The nature of the correlation between students' creativity and their ability for answering questions of the HOTS kind was explained using simple regression analysis. This is the result of an easy regression test that was run with SPSS.

Table 6.
Simple Regression Test Results

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	26,232	2,665		9,844	0,000
	Tes Kreativitas	0,370	0,058	0,741	6,332	0,000

a. Dependent Variable: Tes HOTS

Table 6 shows the regression constant value of 26.232 and the regression coefficient of 0.370. So, the regression equation is Yˆ=26.232+0.370x.

Next, hypothesis testing will be carried out using the t test and F test. The t test is used to test the significance of the constant for each student creativity variable which will influence the dependent variable on students' ability to solve HOTS type questions. The F and t tests will be used for hypothesis testing. The dependent variable on students' capacity to answer HOTS-style questions depends on their creativity, and the t test is utilized to determine the significance of each constant for each student creative variable.

Table 6 demonstrates that, with a significance value of 0.00<0.05, creativity among students significantly influences their ability to solve HOTS-style questions. After that, a F test is conducted. When solving HOTS-style problems based on the student creative variable, the F test is utilized to determine if the regression equation can be used to forecast or predict the magnitude of the student ability variable. The SPSS output that was utilized for the F test is as follows.

Table 7.
F Test Results

Anova[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	326,377	1	326,377	40,099	$0{,}000^{b}$
	Residual	268,594	33	8,139		
	Total		34			

a. Dependent Variable: Tes HOTS
b. Predictors: (Constant), Tes Kreativitas

With a significance value of 0.00<0.05, Table 7 demonstrates that student creativity has a significant impact on students' ability to answer HOTS-style problems. Additionally, the amount of the coefficient of determination, or R Square, can be used to determine the extent to which student creativity influences students' capacity to answer HOTS-style questions. The result of SPSS R Square looks like this.

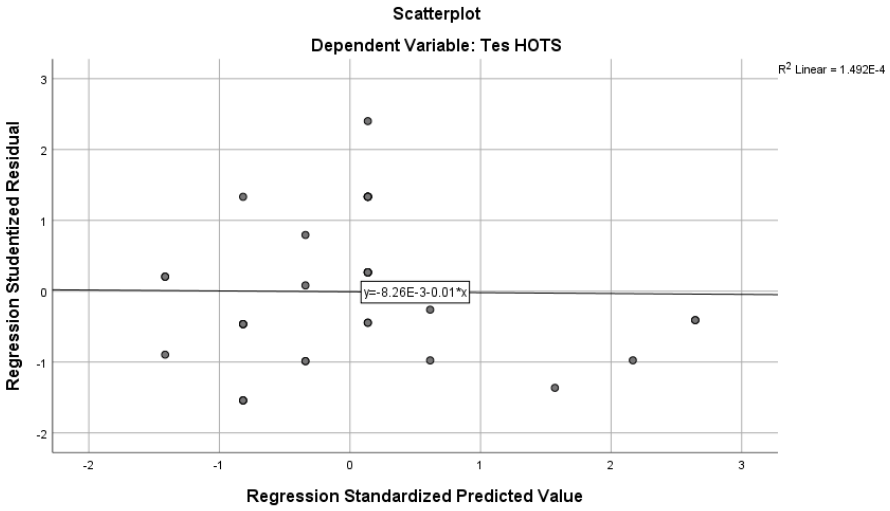
Table 8.
Coefficient of Determination Results

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	$0{,}741^{a}$	0,549	0,535	2,853

a. Predictors: (Constant), Tes Kreativitas

Table 8 indicates that the value of the coefficient of determination is 0.549. This result indicates that, when it comes to answering HOTS-style questions, the student creativity variable can affect the student ability variable by 0.549, or 54.9%. In the meantime, additional variables that were not explored further in this regression model had an impact on 45.1%. To determine if the residuals are normally distributed, the residual test is used. In order to use the t test and F test statistics, this is necessary. The conclusions drawn from the statistics of the t test and F test are invalid if this test is not conducted. If the residuals of a regression model are known to be normally distributed, the model is considered excellent. To detect normally distributed residuals by observing the following scatter plot



Gambar 1. ***Scatter plot of residuals***

Based on the scatter plot above, it shows that the residual distribution pattern is along the x-axis and falls along the horizontal so that the points spread on the regression line are close to zero and the prediction model and the actual value have a small difference. This shows that the residual analysis is normally distributed. So, it can be concluded that the results of the t test and F test are valid.

The study's findings indicate that there is a major impact on students' capacity for creativity and abilities for answering questions of the HOTS kind.

Previous research results stated that students who have creative thinking abilities can solve HOTS mathematics questions (Muttaqin et al., 2021).

Creativity is a person's ability to create something new starting from an idea or create a real work where the work is a new work or can also be obtained from a combination with existing things, which is relatively different from what has existed before. Creativity is often associated with creative products. As stated by Garaigordobil & Berrueco (2011), creativity is the ability to create, to produce something that has never existed or is something new. In the problem-solving process, Dewi & Machromah (2022) define creativity as an individual's ability to provide answers smoothly, correctly, and using new methods.

Fluency, flexibility, and originality on each answer sheet demonstrate the students' creativity in responding to HOTS-style questions (Silver, 1997). Fluency refers to the student's capacity to supply multiple solutions to a given problem, while flexibility is the ability to provide multiple solutions to a problem simultaneously. The capacity to solve a problem with an answer that differs from that of other students is known as novelty. (Siswono & Budayasa, 2006).

Students' creativity has a 54.9% magnitude of influence on their ability to solve issues of the HOTS kind; the remaining 45.1% is influenced by other factors. This other variable may be critical thinking. Critical thinking and creative thinking are part of HOTS (Conklin, 2011; McMahon, 2009; Tan & Siti Hajar, 2015). If the indicators for each HOTS are described, the analyzing and evaluating indicators are related to students' critical thinking abilities, while the creating indicators are related to students' creative thinking abilities.

CONCLUSION

According to the research findings, student creativity has a major impact on their capacity for solving problems of the HOTS type, which is explained by the regression equation. $\hat{y}=26.232+0.370x$. The magnitude of the influence of creativity on students' ability to solve HOTS type questions can be seen from the coefficient of determination value which shows 0.549 or 54.9%. Meanwhile, the remaining 45.1% is influenced by other variables that were not studied further in this regression model. This research is still quantitative

research. For further research, qualitative evidence can be carried out, namely the diversity of creativity produced by students in the form of ideas, strategies and answers in solving HOTS type questions.

REFERENCES

Anderson, L. W., & Krathwohl, D. R. (2001). A Taxonomy for Learning, Teaching, and Assessing. In *Longman New York*.

Badjeber, R., & Purwaningrum, J. P. (2018). PENGEMBANGAN HIGHER ORDER THINKING SKILLS DALAM PEMBELAJARAN MATEMATIKA DI SMP. *Guru Tua : Jurnal Pendidikan Dan Pembelajaran*, *1*(1). https://doi.org/10.31970/gurutua.v1i1.

Bornstein, M. H., & Gardner, H. (1986). Frames of Mind: The Theory of Multiple Intelligences. *Journal of Aesthetic Education*, *20*(2). https://doi.org/10.2307/3332707

Conklin, W. (2011). *Higher-order thinking skills to develop 21st century learners*. Teacher Created Materials.

Dewi, A., & Machromah, I. U. (2022). Kemampuan Berpikir Kreatif Siswa dalam Menyelesaikan Soal HOTS Ditinjau dari Kemampuan Awal Matematika. *Jurnal Math Educator Nusantara: Wahana Publikasi Karya Tulis Ilmiah Di Bidang Pendidikan Matematika*, *8*(2). https://doi.org/10.29407/jmen.v8i2.17779

Faridah, R., Siswono, T. Y. E., & Rahaju, E. B. (2018). *Developing Higher Order Thinking Skill (HOTS) Mathematic Problem Using That Quiz Application*. https://doi.org/10.2991/miseic-18.2018.41

Garaigordobil, M., & Berrueco, L. (2011). Effects of a Play Program on Creative Thinking of Preschool Children. *The Spanish Journal of Psychology*, *14*(2). https://doi.org/10.5209/rev_sjop.2011.v14.n2.9

Griffin, P., McGaw, B., & Care, E. (2012). Assessment and teaching of 21st century skills. In *Assessment and teaching of 21st century skills* (Vol. 9789400723245). https://doi.org/10.1007/978-94-007-2324-5

Kusaeri, K., & Ridho, A. (2019). Learning outcome of mathematics and science: Features of Indonesian madrasah students. *Jurnal Penelitian Dan Evaluasi Pendidikan*, *23*(1). https://doi.org/10.21831/pep.v23i1.24881

McMahon, G. (2009). Critical thinking and ICT integration in a Western Australian secondary school. *Educational Technology and Society*.

Munandar, U. (1999). Kreativitas dan Keberbakatan. In *Kreativitas dan Keberbakatan* (Vol. 2017, Issue 1).

Muttaqin, H., Susanto, Hobri, & Tohir, M. (2021). Students' creative thinking skills in solving mathematics higher order thinking skills (HOTS) problems based on online trading arithmetic. *Journal of Physics: Conference Series*, *1832*(1). https://doi.org/10.1088/1742-6596/1832/1/012036

Silver, E. A. (1997). Fostering creativity through instruction rich in mathematical problem solving and problem posing. *Zentralblatt Für Didaktik Der Mathematik*, *29*(3). https://doi.org/10.1007/s11858-997-0003-x

Siswono, T. Y. E., & Budayasa, I. K. (2006). Implementasi Teori Tentang Tingkat Berpikir Kreatif dalam Matematika. *Seminar Konferensi Nasional Matematika XIII Dan Konggres Himpunan Matematika Indonesia Di Jurusan Matematika FMIPA Universitas Negeri Semarang*.

Sulistyawati, S. (2016). PENGEMBANGAN DESAIN PEMBELAJARAN INQUIRY MENINGKATKAN MOTIVASI DAN PRESTASI BELAJAR MATEMATIKA MATERI LUAS DAN VOLUME BENDA PUTAR. *JIPM (Jurnal Ilmiah Pendidikan Matematika)*, *5*(1). https://doi.org/10.25273/jipm.v5i1.856

Tan, S. Y., & Siti Hajar, H. (2015). Effective Teaching of Higher-Order Thinking (Hot) in Education. *The Online Journal of Distance Education and E-Learning (TOJDEL)*.

Trilling and Fadel. (2009). 21st century skills: learning for life in our times. Jossey Bass: USA. *Journal of Chemical Information and Modeling*, *53*(9).