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The Effect of Creative Problem Solving Learning Models on Problem Solving Ability in Learning Motivation and Student Self-Efficacy View

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ABSTRACT: This study aims to determine; 1) the effect of using creative problem-solving learning models on mathematical problem-solving abilities, 2) the influence of learning motivation on mathematical problem-solving abilities, 3) the influence of students' self-efficacy on mathematical problem-solving abilities, 4) interactions between creative problem-solving learning models with students' learning motivation towards mathematical problem-solving abilities, 5) interaction between creative problem-solving learning models with self-efficacy on mathematical problem-solving abilities, 6) interactions between learning motivation and self-efficacy on mathematical problem-solving abilities and 7) interactions between models learning creative problem solving, learning motivation and self-efficacy together on mathematical problem-solving abilities. The method used in this research is an experimental research method. A sample of 70 students was taken using the cluster random sampling technique. The data analysis used was the three-way Anava technique and the follow-up test used a multiple comparison test. The results showed that: 1) creative problem-solving learning models more effectively influence problem-solving abilities than conventional learning models, 2) high learning motivation is more effective in influencing mathematical problem-solving abilities than moderate learning motivation and low learning motivation, 3) high self-efficacy more effective in influencing mathematical problem-solving abilities than moderate self-efficacy and low self-efficacy, 4) there is no effect of differences in learning models with learning motivation on mathematical problem-solving abilities, 5) there is no difference between learning models and self-efficacy on solving abilities problem, 6) high learning motivation with moderate self-efficacy most effectively affects mathematical problem-solving abilities, 7). Creative problem-solving learning model, high learning motivation with moderate self-efficacy most effectively affect mathematical problem-solving abilities.

KEYWORDS: Creative Problem Solving Learning Model, Learning Motivation, Self-efficacy

INTRODUCTION

Mathematics is a science that students can use to solve problems in everyday life, each confirming the role of meditation from constructs (Putra, et al. 2020). The main objective of learning mathematics is to develop students' abilities in solving complex mathematical problems (Fernandez, et al. 1994). According to Mauladaniyati, et al. (2020), the problem-solving ability is the focus of education, this is stated by Ananiadou and Claro (2009), the problem-solving ability is a key competency of the twenty-first century. According to Branca (1980), the main objective of school students is to improve students' problem-solving skills.

However, based on preliminary data that researchers got at SMP N 21 Tanjung Jabung Timur, it shows that the students' mathematical problem-solving abilities are still low. Students cannot understand the information provided and do not know the problem of the question so that students cannot find a solution to the problem, even students cannot distinguish the problem given from the example described by the teacher. This is because in teaching and learning activities the teacher does not accustom students to practicing creative thinking (Partayasa, et al. 2020).

There are two main procedural steps in problem-solving: 1) converting problems into mathematical sentences, and computation operations involved in mathematical sentences (Qin, et al. 1995). The steps that can be used to measure aspects of problem-solving abilities are: (1) Understanding the problem (understanding the problem); (2) Develop a plan (strategic planning); (3) Implementing the plan (implementing the strategy); (4) Check again (looking back) (Polya 1973).

According to Hobri et al. (2020), it is necessary to combine learning models to be able to improve the problem-solving abilities of students, where the teacher is no longer a learning center but a facilitator. He continued, the teacher must be able to

facilitate students so that in teaching and learning activities students can be active and think. According to Muslich (2007), the Creative Problem Solving (CPS) learning model is a learning model that is considered suitable to be able to improve students' problem-solving abilities, because this model focuses on problem-solving skills followed by strengthening skills.

Purwati's research (2015) shows that the mathematical problem-solving abilities of students with the Creative Problem Solving (CPS) model are better than the mathematical problem-solving skills of students with ordinary learning. CPS can improve students' creative thinking skills. Partayasa et al., (2020) show that the mathematics problem-solving abilities of students whose learning uses the CPS learning model are better than students who take conventional learning.

The application of creative problem-solving learning models must not ignore the psychological aspects of students (Partayasa, et al. 2020). In this case the learning motivation and self-efficacy of students. Motivation determines the extent of the choice, involvement, effort, and persistence of students (Dornyei and Ushioda 2011). Research by Márquez and Abundez (2015), shows motivation is one of the factors that positively affect learning. Motivation can encourage and encourage students in carrying out problem-solving actions (Utami, et al., 2017). Meanwhile, self-efficacy is also one that influences children's lives regarding aspects of self-knowledge (Maryam 2013). SE refers to an individual's belief that they can succeed with any task at hand (Bandura 1977). A person's SE generally affects their cognitive behavior (Wilde and Hsu 2019) and is strongly related to a person's ability to achieve educational goals in an academic context (Elias and Macdonald 2007). People who have low SE will easily give up on tasks that are challenging problems, while people with high SE will try harder to solve the problems given (Schunk 1989). In the research of Zhou et al. (2020) the level of self-efficacy has a relationship with students' mathematical problem-solving abilities. Research by Salazar and Hayward (2018), states that self-efficacy in problem-solving is also a predictor of the expected value of students. The findings of Kim, et al. (2019) support the importance of self-efficacy in increasing individual creativity. In the CPS learning model that was originally formulated by Alex Osborn and Sidney Parnes in the 1940s. Osborn emphasizes the deliberate development of creative talent, especially in the field of education. He believes that everyone can be creative through teaching and learning processes (Santoso and Ariani 2016). In the context of learning, the teacher is tasked with providing subject matter or discussion topics that can stimulate students to think creatively (Huda, 2015). Based on this description, the focus of this study is to show the effect of the Creative Problem Solving (CPS) learning model on problem-solving ability in terms of learning motivation and student self-efficacy.

METHODS

This study uses a quantitative approach with the research method of true experiment design, posttest-only control design (Sugiyono 2014). The populations in this study were students of SMP N 21 Tanjung Jabung Timur. The research sample was selected by cluster random sampling of 2 classes, consisting of 1 experimental class that was treated in the form of the use of the creative problem-solving learning model as many as 37 students and 1 control class who were not given treatment as many as 33 students. This research was conducted in February - March 2021. The instrument used to measure problem-solving abilities was the post-test test. And the instrument used to measure the level of learning motivation and self-efficacy of students in the form of a questionnaire. The learning motivation questionnaire used was adapted from the MSLQ (Motivated Strategies for Learning Questionnaires) (Pintrich et al. 1991) on a motivation scale containing 3 indicators, namely: 1) intrinsic goal orientation, 2) extrinsic goal orientation and 3) effective components. The learning motivation questionnaire consists of 24 questions with a minimum score of 0 and a maximum score of 168. The Self-efficacy questionnaire contains 3 indicators, namely: 1) level, 2) generality, and 3) strength (Bandura 1997). The Self-efficacy questionnaire consists of 27 questions with a minimum score of 0 and a maximum score of 108. Before the instrument is used, it is first tested to meet 3 specifications, namely 1) The validity of the construction uses expert opinion, 2) The validity of the item is done by testing the calculated instrument using the product-moment formula, 3) the reliability test is calculated using the Alpha Cronbach formula. For the post-test instrument, the problem-solving ability has calculated the level of difficulty and the power difference test.

Analysis of quantitative data first carried out an assumption test consisting of a data normality test conducted by the Shapiro-Wilk test, and the homogeneity test of variance using the Bartlet test. After it is stated that the distribution is normal and the data variance is homogeneous, then it is followed by hypothesis testing using a 3-way analysis of variance with a significance level of 5%, the significance criterion is if $F_{count} > F_{table}$ it can be interpreted as significant and if $F_{count} < F$ then it can be interpreted as insignificant. and continued with further tests using the Scheffe test. The hypothesis of this study is:

Ha1: There is an effect of applying creative problem-solving learning capital with conventional learning models on students' problem-solving abilities

Ho1: There is no effect of applying creative problem-solving learning capital with conventional learning models on students' mathematical problem-solving abilities

Ha2: There is an effect of high learning motivation, moderate learning motivation, and low learning motivation on students' mathematical problem-solving abilities

Ho2: There is no influence of high learning motivation, moderate learning motivation, and low learning motivation on students' mathematical problem-solving abilities

Ha3: There is an effect of high Self Efficacy, moderate Self Efficacy, and low Self Efficacy on students' mathematical problem-solving abilities

Ho3: There is no effect of high Self Efficacy, moderate Self Efficacy, and low Self Efficacy on students' mathematical problem-solving abilities

Ha4: There is an interaction between creative problem-solving learning models with conventional learning models with high learning motivation, moderate learning motivation, and low learning motivation on students' mathematical problem-solving abilities

Ho4: There is no interaction between creative problem-solving learning models with conventional learning models with high learning motivation, moderate learning motivation, and low learning motivation on students' mathematical problem-solving abilities

Ha5: There is an interaction between creative problem-solving learning models with conventional learning models with high Self Efficacy, moderate Self Efficacy, and low Self Efficacy on students' mathematical problem-solving abilities

Ho5: There is no interaction between creative problem-solving learning models with conventional learning models with high Self Efficacy, moderate Self Efficacy, and low Self Efficacy on students' mathematical problem-solving abilities

Ha6: There is an interaction between high learning motivation, moderate learning motivation, and low learning motivation with high Self Efficacy, moderate Self Efficacy, and low Self Efficacy on students' mathematical problem-solving abilities

Ho6: There is no interaction between high learning motivation, moderate learning motivation, and low learning motivation with high Self Efficacy, moderate Self Efficacy, and low Self Efficacy on students' mathematical problem-solving abilities

Ha7: There is an interaction between the application of creative problem-solving learning models with conventional learning models, high learning motivation, moderate learning motivation, and low learning motivation with high Self Efficacy, moderate Self Efficacy, and low Self Efficacy on students' mathematical problem-solving abilities

Ho7: There is no interaction between the application of creative problem-solving learning models with conventional learning models, high learning motivation, moderate learning motivation, and low learning motivation with high Self Efficacy, moderate Self Efficacy, and low Self Efficacy on students' mathematical problem-solving abilities

RESULT

As previously stated, this research aims to answer several problems systematically. To answer this problem, several hypothesis testing tests were carried out using a 3-way analysis of variance with a significance level of 5% and continued with further tests using the Scheffe test. The test results are as follows:

Table 1. Tests of Between-Subjects Effects

Dependent Variable: Problem Solving Ability Test

Source	Type I Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1211.646[a]	17	71.273	14.161	.000	.822
Intercept	19622.629	1	19622.629	3898.660	.000	.987
Learning model	203.060	1	203.060	40.344	.000	.437
Motivation to learn	642.717	2	321.358	63.848	.000	.711
Self-Efficacy	189.335	2	94.668	18.809	.000	.420
Learning model * Motivation to learn	20.978	2	10.489	2.084	.135	.074
Learning model * Self-Efficacy	23.680	2	11.840	2.352	.105	.083
Motivation to learn * Self-Efficacy	69.812	4	17.453	3.468	.014	.211
Learning model * Motivation to learn * Self-Efficacy	62.064	4	15.516	3.083	.024	.192
Error	261.725	52	5.033			
Total	21096.000	70				
Corrected Total	1473.371	69				

a. R Squared = .822 (Adjusted R Squared = .764)

Based on the results of the three-way ANOVA test as in Table 1 above, it can be understood that:

1. The results of the three-way ANOVA test on the first hypothesis indicate that the F_{count} value is 40.34 and the F_{table} value at the 0.05 level with dbk = 1: dbd = 17 is 4.45. When compared to the price F_{count} is greater than F_{table}. Thus Ho1 is rejected Ha1 is accepted. So it can be concluded that there are differences in mathematical problem-solving abilities between students who follow the CPS learning model and students who take conventional learning. The creative problem-solving learning model obtained a mean value of 17.97 higher than the mean acquisition of the conventional learning model of 15.15. So it can be concluded that the creative problem-solving learning model is more effective than the conventional learning model in influencing mathematical problem-solving abilities.

Creative problem solving (CPS) is a student-centered approach to problem-solving skills and abilities (Pepkin 2004). The final goal that is more important in the future of the CPS model is to enable students to improve their ability to face real problems and challenges successfully and creatively because, in the application of CPS, students are involved in facing opportunities and challenges (Treffinger and Isaksen 2005). Zulyadaini's research (2017) shows that there is an effect of applying creative problem-solving learning models on students' mathematical problem-solving abilities.

2. The results of the three-way ANOVA test in the second hypothesis show that the F_{count} value is 60.85 and the F_{table} value at the 0.05 level with dbk = 2: dbd = 17 is 4.11. When compared to the price F_{count} is greater than F_{table}. Thus Ho2 is rejected Ha2 is accepted. So it can be concluded that there are differences in mathematical problem-solving abilities between students who have high learning motivation, moderate learning motivation, and low learning motivation. Because Ho2 was rejected, a further test was carried out using the Scheffe method. The Scheffe test results can be seen in Table 2 below:

Table 2. Multiple Comparisons

Dependent Variable: Scheffe Problem Solving Ability Test Results

(I) Learning Motivation	(J) Learning Motivation	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
High Learning Motivation	Moderate Learning Motivation	4.30*	.644	.000	2.68	5.92
	Low Learning Motivation	8.06*	.684	.000	6.33	9.78
Moderate Learning Motivation	High Learning Motivation	-4.30*	.644	.000	-5.92	-2.68
	Low Learning Motivation	3.76*	.653	.000	2.11	5.40
Low Learning Motivation	High Learning Motivation	-8.06*	.684	.000	-9.78	-6.33
	Moderate Learning Motivation	-3.76*	.653	.000	-5.40	-2.11

Based on observed means.

The error term is Mean Square (Error) = 5.033.

*. The mean difference is significant at the,05 levels.

From table 2 it can be seen that high learning motivation is more effective in influencing problem-solving abilities than moderate learning motivation and low learning motivation. Students who have good learning achievement if have good learning motivation (Riswanto and Aryani 2017). Learning motivation is one of the factors that influence and support learning achievement (Lee et al. 2014; Puklek and Zupančič 2009). Previous research has shown a significant influence between learning motivation and math problem-solving abilities (Fatimah et al. 2019; Pohan, Asmin, and Menanti 2020).

3. The results of the three-way ANOVA test in the third hypothesis indicate that the F_{count} value is 18.81 and the F_{table} value at the 0.05 level with dbk = 2: dbd = 17 is 4.11. When compared to the price F_{count} is greater than F_{table}. Thus Ho4 rejected Ha accepted. So it can be concluded that there are differences in mathematical problem-solving abilities between students who have high self-efficacy, moderate self-efficacy, and low self-efficacy. Because Ho2 was rejected, a further test was carried out using the Scheffe method. The Scheffe test results can be seen in Table 3 below:

Table 3. Multiple Comparisons

Dependent Variable: Scheffe Problem Solving Ability Test Results

(I) *Self-efficacy*	(J) *Self-efficacy*	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
High Self-Efficacy	*Moderate Self-Efficacy*	1.13	.629	.212	-.46	2.71
	Low Self-Efficacy	4.72*	.689	.000	2.99	6.46
Moderate Self-Efficacy	*High Self-Efficacy*	-1.13	.629	.212	-2.71	.46
	Low Self-Efficacy	3.60*	.672	.000	1.90	5.29
Low Self-Efficacy	*High Self-Efficacy*	-4.72*	.689	.000	-6.46	-2.99
	Moderate Self-Efficacy	-3.60*	.672	.000	-5.29	-1.90

Based on observed means.

The error term is Mean Square (Error) = 5.033.

*. The mean difference is significant at the 0,05 level.

Referring to the test results in table 3, it can be seen that high self-efficacy is more effective in influencing problem-solving abilities than moderate self-efficacy and low self-efficacy.

According to social cognitive theory, student self-efficacy will affect emotional arousal, thinking, choice behavior, and performance in carrying out tasks (Hackett and Betz 2020). Because self-efficacy greatly affects the academic achievement of students (Sparks 2014) and is an important factor for student academic achievement (Honicke and Broadbent 2016; Skaalvik, et al., 2015). In particular, self-efficacy can significantly affect learning outcomes in certain subjects, such as algebra, geometry, and complex mathematics (Neuville, Frenay, and Bourgeois 2007; Pajares and Miller 1997).

4. The results of the three-way ANOVA test on the fourth hypothesis indicate that the F_{count} value is 2.08 and the F_{table} value at the 0.05 level with dbk = 2: dbd = 17 is 4.11. When compared to the price F_{count} is smaller than F_{table}. Thus Ho4 is accepted Ha4 is rejected. So it can be concluded that there is no difference in mathematical problem-solving abilities between students who follow the CPS learning model with high learning motivation, moderate learning motivation, or low learning motivation and students who take conventional learning with high learning motivation, moderate learning motivation, or low learning motivation.

5. The results of the three-way ANOVA test on the fifth hypothesis indicate that the F_{count} value is 2.35 and the F_{table} value at the 0.05 level with dbk = 2: dbd = 17 is 4.11. When compared to the price F_{count} is smaller than F_{table}. Thus Ho5 is accepted Ha5 is rejected. So it can be concluded that there is no difference in mathematical problem-solving abilities between students who follow the CPS learning model with high self-efficacy, moderate self-efficacy, or low self-efficacy and students who take conventional learning with high self-efficacy, self-efficacy. Moderate or low self-efficacy.

6. The results of the three-way ANOVA test on the sixth hypothesis show that the F_{count} value is 3.47 and the F_{table} value at the 0.05 level with dbk = 4: dbd = 17 is 2.96. When compared to the price F_{count} is smaller than F_{table}. Thus Ho6 rejected Ha6 accepted. So it can be concluded that there are differences in mathematical problem-solving abilities between students who have high learning motivation with high self-efficacy, medium self-efficacy or low self-efficacy, students who have medium learning motivation with high self-efficacy, self-efficacy moderate or low self-efficacy, and students who have low learning motivation with high self-efficacy, medium self-efficacy or low self-efficacy. Because Ho6 was rejected, a further test was carried out using the Scheffe method. The Scheffe test results can be seen in Table 4 below:

Table 4. Problem Solving Ability Test Results

Scheffe[a,b,c]

Motivasi**Self-efficacy*	N	Subset				
		1	2	3	4	5
B3C3	7	8.86				
B2C3	6		14.00			

B3C2	7		14.43	14.43		
B3C1	7		15.00	15.00		
B2C2	13		16.23	16.23	16.23	
B2C1	8			18.88	18.88	18.88
B1C3	6			19.17	19.17	19.17
B1C1	9				20.78	20.78
B1C2	7					22.29
Sig.		1.000	.881	.057	.080	.400

Means for groups in homogeneous subsets are displayed.
Based on observed means.
The error term is Mean Square (Error) = 5.033.
a. Uses Harmonic Mean Sample Size = 7.390.
b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.
c. Alpha = ,05.

Based on table 4, it can be seen that high learning motivation and moderate self-efficacy are the most effective in influencing problem-solving abilities. Self-efficacy and learning motivation affect student learning achievement. High self-efficacy can help students solve math problems well because it raises greater motivation and attention to solve problems, increases effort, and greater persistence in facing difficulties (Pajares and Kranzler 1995). Previous research has shown that there is an effect of self-efficacy and learning motivation (Farihah and Rakasiwi 2020; Tuty Sariwulan 2019; Brown 2010)

7. The results of the three-way ANOVA test on the seventh hypothesis indicate that the F_{count} value is 3.08 and the F_{table} value at the 0.05 level with dbk = 4: dbd = 17 is 2.96. When compared to the price F_{count} is smaller than F_{table}. Thus Ho7 rejected Ha7 accepted. So it can be concluded that there are differences in mathematical problem-solving abilities between students who follow the CPS learning model who has high learning motivation with high self-efficacy, medium self-efficacy or low self-efficacy, students who have moderate learning motivation, self-efficacy high, medium self-efficacy or low self-efficacy and students who have low learning motivation with high self-efficacy, moderate self-efficacy or low self-efficacy with students who follow conventional learning models who have high learning motivation with self- high efficacy, medium self-efficacy or low self-efficacy, students who have medium learning motivation, high self-efficacy, medium self-efficacy or low self-efficacy and students who have low learning motivation with high self-efficacy, Moderate self-efficacy or low self-efficacy.

Table 5. Problem Solving Ability Test Results

Scheffe[a,b,c]

Interaction	N	Subset				
		1	2	3	4	5
A2B3C3	4	6.75				
A2B2C3	3	11.33	11.33			
A1B3C3	3	11.67	11.67	11.67		
A2B3C1	4	13.00	13.00	13.00	13.00	
A2B3C2	4	14.25	14.25	14.25	14.25	
A1B3C2	3	14.67	14.67	14.67	14.67	14.67
A2B2C2	5	15.20	15.20	15.20	15.20	15.20
A2B2C1	3	15.33	15.33	15.33	15.33	15.33
A1B2C3	3		16.67	16.67	16.67	16.67
A1B2C2	8		16.88	16.88	16.88	16.88
A1B1C3	3		17.67	17.67	17.67	17.67
A1B3C1	3		17.67	17.67	17.67	17.67
A2B1C1	4		19.50	19.50	19.50	19.50
A2B1C2	3		20.33	20.33	20.33	20.33
A2B1C3	3			20.67	20.67	20.67
A1B2C1	5				21.00	21.00
A1B1C1	5				21.80	21.80
A1B1C2	4					23.75
Sig.		.111	.070	.070	.088	.064

Means for groups in homogeneous subsets are displayed.
Based on observed means.
The error term is Mean Square (Error) = 5.033.
a. Uses Harmonic Mean Sample Size = 3.618.
b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.
c. Alpha = ,05.

From table 5 it can be concluded that the Creative Problem Solving Learning Model with high learning motivation and moderate self-efficacy most effectively affects problem-solving abilities.
Self-efficacy, learning motivation, and learning strategies significantly increase learning achievement (Yusuf 2011). Factors that affect self-efficacy and problem-solving abilities are how teachers teach and student learning motivation (Hutasoit, et al. 2017)

CONCLUSION

Based on the statistical test and discussion above, the application of creative problem-solving learning models affects students' problem-solving abilities. Learning motivation and self-efficacy are also factors that affect students' mathematical problem-solving abilities. Thus it can be said that the creative problem-solving learning model can be used as an alternative learning model that can be applied in the learning process, or can be concluded that:

1) Creative problem-solving learning models more effectively influence problem-solving abilities than conventional learning models,
2) High learning motivation is more effective in influencing mathematical problem-solving abilities than moderate learning motivation and low learning motivation,
3) High self-efficacy more effective in influencing mathematical problem-solving abilities than moderate self-efficacy and low self-efficacy,
4) There is no effect of differences in learning models with learning motivation on mathematical problem-solving abilities,
5) There is no difference between learning models and self-efficacy on solving abilities problem,
6) High learning motivation with moderate self-efficacy most effectively affects mathematical problem-solving abilities,
7). Creative problem-solving learning model, high learning motivation with moderate self-efficacy most effectively affect mathematical problem-solving abilities.

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