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Analysis of Problem-Solving Ability: The Impact of Lightening the Learning Climate Learning Strategy, and Student Learning Motivation

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Abstract

This study aimed to determine the effect of the "Lightening the Learning Climate" learning strategy on mathematical problem-solving abilities at Madrasah Tsanawiyah Nurul Islam Purwosari. The research method used was quasi-experimental with a non-equivalent control group design. The researchers collected the research data on problem-solving abilities using essay test instruments. This research was conducted on the seventh-grade students of Madrasah Tsanawiyah Nurul Islam Purwosari in West Klumbayan, with a total sample of 60 students who were taken using random cluster sampling. Based on the hypothesis test, it was concluded that the F_{count} value was 11.374, so H_{0A} was rejected. These results prove that "lightening the learning climate" increases students' mathematical problem-solving abilities.

Introduction

Problem-solving is a learning process that employs the strengths and benefits of mathematics to solve problems and a method of locating solutions through problem-solving stages (Netriwati, 2016). The goal of learning mathematics in school is for students to be capable of (1) understanding concepts, (2) mathematical reasoning, (3) problem solving, (4) communicating ideas, and (5) being useful in everyday life (Farida, 2015). Based on these objectives, the problem-solving ability is one of the important abilities to be possessed by students. In the learning process, problem-solving abilities become the core of learning, which is the basic ability of the mathematics learning process (Hidayat & Sariningsih, 2018). Branca emphasizes the significance of problem-solving, stating that problem-solving ability is at the heart of mathematics (Nugroho & Widodo, 2018). According to Irawan et al., "problem-solving ability" is a process skill that students need to understand and master the material in mathematics lessons (Irawan, Suharta & Suparta, 2016). According to Akbar and Nadun, problem-solving is a person's ability to solve a problem by recognizing it and solving it in various ways (Akbar & Nadun, 2015). Research related to problem-solving abilities has been investigated by previous researchers, including Rambe and Afri, with their research showing that students with high and moderate mathematical problem-solving abilities can solve math problems well. In contrast, students with low mathematical problem-solving abilities can only write what is known from the questions given (Rambe & Afri, 2020).

The importance of problem-solving abilities is not in line with the facts in the field, which show that there are still many junior high school students with relatively low problem-solving abilities, as shown by the difficulty of students answering problem-solving ability test questions. Chotimah et al. discovered that the mathematical problem-solving abilities of grade VIII junior high school students in one of the schools using flat shape material were in a low category, with only 43% of problem-solving abilities (Chotimah, Sari & Zaty, 2019). Another study also conducted by Mariam et al. argues that low problem-solving abilities are still relatively low, as seen from how students understand problems, determine models, solve problems, and look back at their work (Mariam & Rohaeti, 2019).

The low ability to solve mathematical problems also occurs at MTs Nurul Islam Purwosari. Based on the pre-research results, the mathematical problem-solving ability test results were obtained with a completeness proportion of only 16.6%. The solution to overcome the low ability to solve these problems requires a learning model influencing this ability. The learning model is closely related to the atmosphere of the learning process; the more appropriate the learning model, the better the learning atmosphere so that the goals can be achieved (Komarudin, Sujadi & Kusmayadin 2014). Improving the process of learning skills in schools can affect the increase in students' mathematical problem-solving abilities (Natsir, Kadir & Samparadja, 2018). The learning process is an important factor in influencing students' abilities with various methods and strategies to create a fun learning atmosphere and be used by students to develop their abilities (Kusuma & Nisa, 2018). A learning strategy that relieves the learning climate fulfills this in learning activities. The selection of appropriate learning models and strategies can help students understand mathematics subject matter and make the teaching and learning process effective and active (Huda, 2014).

Lightening the learning climate learning strategy is proven to be able to improve student learning outcomes (Ziliwu, 2022). According to Aniyah and Santi's research, students' mathematics learning outcomes were better when they used the easing learning climate strategy rather than the expository (Aniyah & Santi, 2017). The MEA learning model, with the strategy of lightening the learning climate, can influence students' mathematical problem-solving abilities (Safitri, Mujib & Nasution, 2021).

Based on several previous studies, it is known that the "lightening the learning climate" strategy can influence learning outcomes or students' mathematical problem-solving abilities. Lightening the learning climate: the learning strategy is active learning interspersed with creative humor related to the subject matter (Zaini, Munthe & Aryani, 2016). The "lightening the learning climate" learning strategy is a class that quickly creates a relaxed, informal learning climate by asking students to use creative humor about the subject matter being taught. This strategy makes students have fun and think (Amorie, 2015). Hartono stated that the strategy of lightening the learning climate could make a class quickly find a relaxed, informal, and not scary learning atmosphere by asking students to make creative humor related to the material. This strategy is very informal, but at the same time, it can invite students to think (Untung, 2017).. So, it can be concluded that the "lightening the learning climate" strategy makes the learning atmosphere relaxed and informal, and not stressful, making students not afraid, not easily bored, not sleepy, and making them active and effective so they don't easily forget material and invite students to think. They are expected to be able to improve students' mathematical problem-solving abilities.

In addition to external factors, namely learning strategies, internal factors can influence students' problem-solving abilities. Learning motivation is the internal factor in question because problem-solving needs were learning motivation (Rahmah, 2020). As research has been conducted by Wulandari et al., who obtained the result that learning motivation contributed to students' mathematical problem-solving abilities (Wulandari, Azhar & Jusra, 2018), Another study conducted by Jayanti and Widyaninggar suggested that learning motivation has a positive influence on problem-solving skills (Jayanti, & Widyaninggar, 2019).

Learning motivation arises or comes from within a person, where the urge or desire to do something appears to achieve the desired goal (Alfarisi, 2018). According to Uno, the essence of learning motivation is a driving force for students to learn so they can carry out behaviors, generally with several supporting indicators or elements. Indicators of learning motivation can be grouped because of: (1) desire and desire to succeed; (2) encouragement and need for learning; (3) hopes and aspirations for the future; (4) appreciation of learning; (5) interesting activities in learning; and (6) a conducive learning environment that allows a student to study well (Uno, 2018).

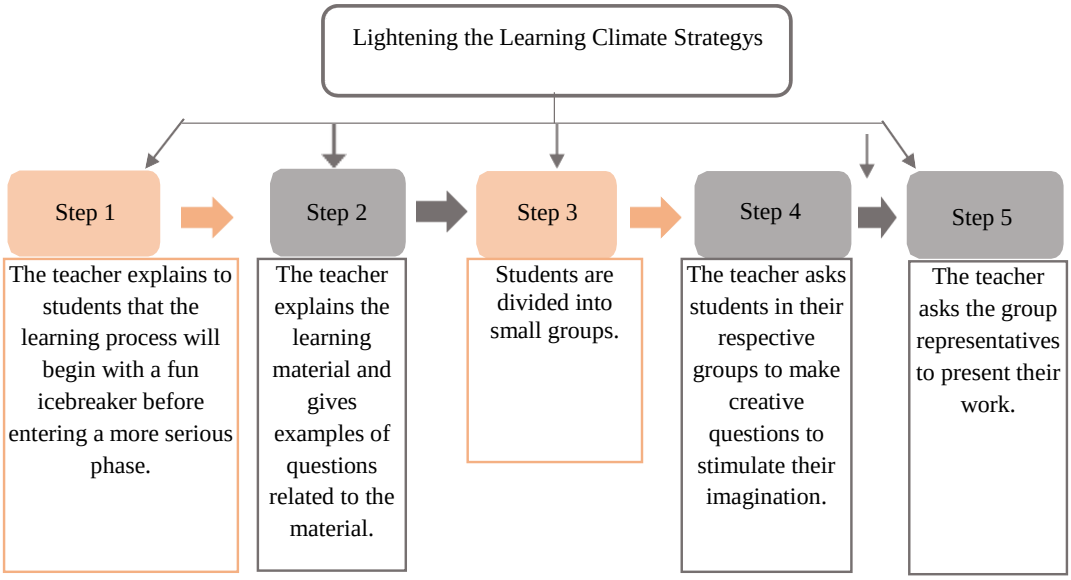
Method

This study employs a quasi-experimental design. This type of research has a control group but is not fully useful for controlling external variables that affect the implementation of experiments (Sugiyono, 2012). The researcher used two randomly selected groups, the experimental class, consisting of students who received the climate learning strategy, and the control class, using the direct learning model. The treatment lasts for four weeks and begins with the initial test in the first week; this test aims to determine the initial profile of students' problem-solving abilities. Then both were given treatment: the experimental group used the "lightening the learning climate" strategy, and the control class used a scientific approach.

The population in this study were students of MTs Nurul Islam Purwosari. The sample was class VII A, with 30 students as the experimental class, and VII B, with 30 students as the control class. The samples were tested for normality and homogeneity using SPSS 25 software with a sig. value > 0.05. Based on the normality test results, the experimental class achieved a significance value of 0.064, and the experimental class achieved a significance value of 0.126. So, both samples are normally distributed, reaching a significance of more than 0.05. Based on the homogeneity test, a significance value of 0.530 is obtained, meaning that the samples come from the same (homogeneous) population.

The research instruments were essay tests to measure students' problem-solving abilities and questionnaires to determine students' learning motivation. Before the test is given, it is first tested to determine the level of validity, reliability, difficulty, and distinguishing power. This instrument is stated to be valid and reliable from the validity and reliability test. In addition, hypothesis testing in this study used the N-Gain test to see the increase in pretest and posttest results and ensure that the increase was the influence of the research variables. An overview of the research steps is presented in Figure 1.

Figure 1. Lightening the Learning Climate Strategys



Result and Discussion

Data collection was obtained from tests in the form of problem-solving ability questions and learning motivation questionnaires given before the implementation of the learning strategy and after the implementation of the learning strategy. The results of students' problem-solving abilities were given during the pretest and posttest, which were used to determine the increase in students' problem-solving abilities through n-gain. In contrast, the learning motivation questionnaire is only given at the beginning of learning to determine each student's learning motivation category. The steps for lightening the learning climate strategy are as follows:

Table 1. Lightening the Learning Climate Strategy Steps

Lightening the Learning Climate	Lightening the Learning Climate Strategy Steps
	The teacher explains to students that the learning process will begin with a fun icebreaker before entering a more serious phase.
	The teacher explains the learning material and gives examples of questions related to the material.
	Students are divided into small groups.

	The teacher asks students in their respective groups to make creative questions to stimulate their imagination.
	The teacher asks the group representatives to present their work.

The table below summarizes the results of the n-gain observed data

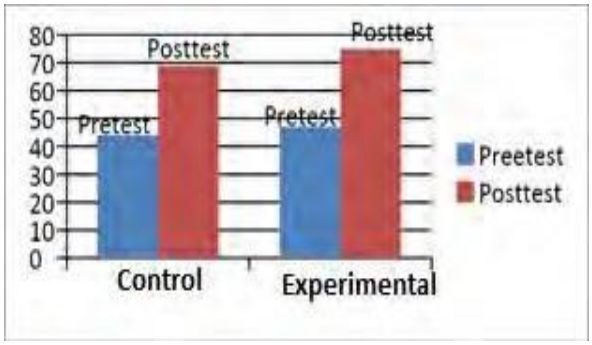
Table 2. Data for Improving Problem-Solving Ability

Statistics

		Experiment	Control
N	Valid	30	30
	Missing	0	0
Mean		.60403	.44130
Median		.56300	.40500
Mode		.165679	.172627
Std. Deviation		.595	.633
Range		.314	.167
Minimum		.909	.800
Maximum		18.121	13.239

Based on the analysis results, it can be said that the increase in problem-solving abilities of students in the experimental class is higher than that of the control class, as seen from the highest, lowest, and central tendency measures (mean, median, and mode). The following is a graph of the increase in pretest and posttest scores:

Figure 2. The result the data



The summary of the data obtained from the learning motivation questionnaire is presented in the following table.

Table 3. Students' Learning Motivation Data

Experiment		Control	
Motivation Learning	Number	Learning Motivation	Number
High	4	High	2
Moderate	24	Moderate	23
Low	2	Low	5
Total	**30**	**Total**	**30**

Four students in the experimental class had high learning motivation, 24 with moderate learning motivation, and two with low learning motivation. While students in the control group demonstrated high learning motivation, only two people demonstrated high learning motivation, 23 demonstrated moderate learning motivation, and 5 demonstrated low learning motivation.

After the research data was collected, the researcher conducted a hypothesis test analysis using a two-way ANOVA test. Still, before that, the researcher first carried out a prerequisite analysis, namely the normality and homogeneity tests.

a. Normality test

The normality test was analyzed using SPSS on problem-solving ability test data and a cognitive style questionnaire by looking at the Sig scores in Kolmogorov-Smirnov, which were carried out in each class to see the normality of the data. The summary of the normality test results is presented in the following table.

Table 4. N-Gain Normality Test for Experimental and Control Classes

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Class	Statistic	df	Sig.	Statistic	df	Sig.
Problem-solving	Experimental	.141	30	.130	.959	30	.285
	Control	.139	30	.146	.951	30	.176

Based on the calculation and analysis results, the sig value in the Kolmogorov Smirnov obtained for the experimental and control classes is greater than = 0.05. From these results, it can be concluded that the study sample came from a normally distributed population.

Table 5. Learning Motivation Normality Test

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Motivation	Statistic	df	Sig.	Statistic	df	Sig.
Problem-Solving	Low	.249	7	.200*	.879	7	.221
	Moderate	.096	47	.200*	.973	47	.331
	High	.279	6	.160	.920	6	.506

The sig values for high, medium, and low learning motivation in Kolmogorov Smirnov were all greater than 0.05 based on the results of calculations and analysis. These findings suggest that the sample has a normal distribution.

b. Homogeneity Test

A homogeneity test analysis was conducted to see whether the variances were identical. The homogeneity test was calculated using SPSS with the Test of Homogeneity of Variance at a significance level of 5%. In contrast, a summary of the homogeneity test results is presented in the following table.

Table 6. Experimental and Control Class N-Gain Homogeneity Test

		Levene Statistic	df1	df2	Sig.
Problem Solving	Based on Mean	.025	1	58	.874
	Based on Median	.025	1	58	.875
	Based on the Median and with adjusted df	.025	1	56.880	.875
	Based on trimmed mean	.031	1	58	.860

Based on the results of calculations and analysis, it was determined that the sig value for the data variance of the experimental and control classes based on the mean was 0.874. These results indicate that the value is greater than the test criteria of 0.05, so it can be concluded that the variances are homogeneous (the same).

Table 7. Learning Motivation Homogeneity Test

		Levene Statistic	df1	df2	Sig.
Problem Solving	Based on Mean	2.217	2	57	.118
	Based on Median	1.864	2	57	.164
	Based on the Median and with adjusted df	1.864	2	51.892	.165
	Based on trimmed mean	2.162	2	57	.124

Based on the calculations and analysis of the sig value, the variance of the low, medium, and high learning motivation is based on a mean of 0.118. These results indicate that the value is greater than the test criteria of 0.05, so it can be concluded that the variances are homogeneous (the same).

c. Hypothesis Test for Problem-Solving Ability Improvement

Hypothesis data were analyzed employing a two-way ANOVA using SPSS. The results of hypothesis testing are presented in the following table.

Table 8. Two-Way Anava Test

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1.055[a]	5	.211	11.374	.000
Intercept	7.725	1	7.725	416.271	.000
Class	.130	1	.130	7.020	.011
Motivation	.519	2	.260	13.993	.000
Class * Motivation	.066	2	.033	1.778	.179
Error	1.002	54	.019		
Total	18.448	60			
Corrected Total	2.057	59			

Based on the results of the two-way analysis of variance on the SPSS output above, it can be concluded:

1) F_A= 11,374 with a significance level of 5% obtained $F_{(0,05:1:54)}$ = 4,020. From these results, it can be seen that $F_A > F_{(0,05:1:54)}$, which means H_{0A} is rejected, so it can be concluded that there

is an effect of problem-solving between students using the lightening the learning climate learning strategy and students using conventional models.

2) $F_{B3,168,}$ = 7, 020 with a 5% significance level obtained, and $F_{(0,05:1:54)}$ = From these results, it can be seen that $F_B > F_{(0,05:1:54)}$ indicating that H_{0B} is rejected, implying that there is an influence of differences in students with low, moderate, and high learning motivation on increasing problem-solving.

3) F_{AB} = 1,778 with a significance level of 5% obtained, and $F_{(0,05:1:54)}$ = 3,168. From these results, it can be seen that $F_{AB} < F_{(0,05:1:54)}$, which means that H_{0AB} is accepted, so it can be concluded that there was no interaction between learning strategies and students' learning motivation toward increasing problem-solving.

d. Multiple Comparison Test

After obtaining the results of the next study, the researcher continued the analysis of the rejected H_0, namely H_{0A} and H_{0B}, intending to see how far the differences were produced in each category. This test analysis was carried out using the SPSS 25.0 application with the Scheffe method. The marginal averages in this analysis are summarized as follows:

Table 9. Marginal Average Summary

Strategies	Learning Motivation			Marginal Average
	Low	Moderate	High	
The Learning Climate	0,558	0,573	0,815	0,648
Direct	0,246	0,453	0,800	0,499
Average Marginal	0,402	0,513	0,808	

The marginal average was used to compare which model or category was better. Based on Table 9, it was found that:

Multiple Comparison Between Columns

The follow-up post-ANOVA test between columns needs to be analyzed because there are three categories of learning motivation: low, medium, and high. Because not all types of learning motivation have the same effect on student problem-solving, the further test calculations were calculated using SPSS, with the following results:

Table 10. Multiple Comparison Test Results between Columns

(I) Motivation	(J) Motivation	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Low	Moderate	-.17924*	.055	.008	-.31817	-.04032
	High	-.47545*	.076	.000	-.66623	-.28467
Moderate	Low	.17924*	.056	.008	.04032	.31817
	High	-.29621*	.059	.000	-.44487	-.14755
High	Low	.47545*	.076	.000	.28467	.66623
	Moderate	.29621*	.059	.000	.14755	.44487

The calculation results presented in the table above show that:

a) The calculated sig value between low and medium was 0.008. The resulting value is less than 0.05 (sig < 0.05), which means H_0 is rejected, so it can be concluded that there is a difference between low and medium learning motivation. This conclusion can also be seen in Table 9, where the marginal average of the low motivation category is 0.402, and the marginal average of the medium learning motivation category is 0.513. Based on the marginal average value, it can be concluded that students with moderate learning motivation are better than those with low learning motivation toward problem-solving.

b) The calculated sig value between low and high was 0.000. The resulting value is less than 0.05 (sig < 0.05), which means H_0 is rejected, so it can be concluded that there is a difference between medium and high learning motivation. This conclusion can also be seen in Table 9, where the marginal average of the moderate motivation category is 0.513, and the marginal average of the high learning motivation category is 0.808. Based on the marginal average value, it can be concluded that students with high learning motivation are better than those with low learning motivation in problem-solving.

c) A sig value of 0.000 was obtained from the calculations between medium and high. The resulting value is less than 0.05 (sig < 0.05), which means H_0 is rejected, so it can be concluded that there is a difference between low and high learning motivation. This conclusion can also be seen in Table 9, where the marginal average of the low motivation category is 0.402, and the marginal average of the high learning motivation category is 0.808. Based on the marginal average value, it can be concluded that students with high learning motivation are better than those with low learning motivation in problem-solving.

Conclusion

Based on the results of calculations and analysis obtained by researchers through hypothesis testing, it can be concluded that: (1) there is an influence of the lightening the learning climate learning strategy on increasing mathematical problem-solving abilities. Students who receive the "lightening the learning climate" learning strategy have better mathematical problem-solving abilities than conventional learning treatment. (2) Learning motivation improves one's ability to solve mathematical problems. Students with high learning motivation solve problems better than those with low motivation. (3) There is no interaction between learning climate improvement strategies and learning motivation toward increasing problem-solving skills.

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