



Innovative Learning Strategies: The Influence of Inquiry Learning and Reciprocal Teaching on Students' Critical Thinking Skills in Mathematics Learning

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Abstract : This research is motivated by the importance of students' critical thinking skills in mathematics learning in the 21st century, which requires students not only to understand concepts but also to be able to analyze and solve problems logically. However, teacher-centered learning results in low student engagement and underdevelopment of critical thinking skills. Therefore, innovative learning strategies are needed that encourage activeness and higher-order thinking processes. Inquiry Learning and Reciprocal Teaching are two potential approaches, where Inquiry Learning emphasizes the process of discovery through investigation, while Reciprocal Teaching develops interaction and understanding through activities of summarizing, asking questions, and clarifying. The integration of these two strategies is expected to create more active and meaningful learning and improve students' critical thinking skills. Therefore, this study aims to analyze the influence of these two approaches in mathematics learning. The research employed a quasi-experimental approach using The Matching Only Post-test Only Group Design. The population consisted of eighth-grade students of MTs Nurul Jannah NW Ampenan. Class VIII A (20 students) was assigned to the Inquiry Learning group, while Class VIII B (16 students) received Reciprocal Teaching. Data were collected using an essay-type critical thinking test validated by experts. Analysis techniques included normality test, homogeneity test, and t-test at a 5% significance level. The findings reveal that both strategies significantly influence students' critical thinking skills. Additionally, Inquiry Learning demonstrates a greater effect compared to Reciprocal Teaching, as indicated by higher mean scores and significant t-test results. The study highlights the importance of implementing innovative learning strategies to enhance students' critical thinking skills in mathematics.

Keywords : Inquiry Learning, Reciprocal Teaching, Critical Thinking, Mathematics Learning.

INTRODUCTION

Mathematics education, as a scientific discipline, is a means of scientific thinking, thus fostering and developing the ability to think critically, systematically, logically, and creatively

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(Putra, 2021). This realm of scientific achievement makes mathematics a bridge between science and technology. Mathematics education plays a role in the development of other fields of science, both exact and social (Ariningsih et al., 2020). Furthermore, mathematics education is also applied to other areas of daily life, such as economics. Based on this, it is increasingly clear that a mastery of mathematics is necessary to better understand other fields. Mathematics as a tool has been widely applied to simplify, improve, and streamline human work. However, the process of learning mathematics faces many problems. One such problem is students' lack of critical thinking skills (Laia & Harefa, 2021). Critical thinking is an intellectual process in which thinkers deliberately assess the quality of their thinking, using reflective, independent, clear, and rational thinking.

Innovative learning strategies are needed to bridge this gap. Among the strategies proven effective for improving students' higher-order skills are Inquiry Learning and Reciprocal Teaching (Anggraeni, Rahayu, & Zajuli Ichsan, 2018). Inquiry Learning emphasizes student-centered discovery, hypothesis building, investigation, and conclusion-drawing. Meanwhile, Reciprocal Teaching engages students in collaborative learning through summarizing, questioning, clarifying, and predicting (Lusiyana, Rohim, & Rohman, 2017). Prior studies highlight the effectiveness of these strategies in improving comprehension and critical thinking. Yet, comparative empirical evidence regarding their impact on students' mathematical critical thinking skills, especially in Indonesian middle schools, is still limited. Therefore, this study seeks to analyze and compare the influence of Inquiry Learning and Reciprocal Teaching on students' critical thinking skills in mathematics learning.

Based on observations of the mathematics learning process in seventh-grade students at SMPN 3 West Lombok, it appears that students still struggle with the learning process. The implementation of mathematics learning and evaluation focuses more on procedural skills through routine practice and low-level questions, thus focusing on closed-ended questions, or those with only one solution. Another problem identified was the broad material targets and a greater focus on solving the material. This meant that mastery of the material was prioritized over students' understanding of mathematical concepts. This also contributed to students' lack of critical thinking skills. To address this issue, researchers attempted to use inquiry learning and reciprocal teaching methods (Bell, 2015).

Inquiry learning and reciprocal teaching models emphasize student independence in identifying and solving their own problems (Jong, 2016). These learning methods were chosen to improve students' problem-solving abilities and skills. Previous research conducted by Devi

Talina Wati found that the application of the inquiry method combined with reciprocal teaching was effective (Andrini, 2016). The increase in critical thinking skills is indicated by a score from cycle I to cycle II of 5.56 or 8.93%. Then another example of research, namely research conducted by Finoli Marta Putri, stated that the critical thinking skills of students who received learning using a combination of inquiry and reciprocal teaching methods (experimental class) were overall better than students who received inquiry method learning (control class).

The novelty of this research lies in the integration of both models within the same experimental framework on the topic of number patterns, with a focus on analyzing the degree of influence each model contributes to students' critical thinking skills. The purpose of this study is to determine: 1). whether Inquiry Learning and Reciprocal Teaching significantly influence students' critical thinking skills, and 2). which model provides a greater impact on critical thinking performance.

RESEARCH METHODS

This study uses an experimental method with a quantitative approach based on positivistic philosophy to test the effect of the Inquiry Learning and Reciprocal Teaching models on students' critical thinking skills. The study population was all students of MTs Nurul Jannah in the 2024/2025 academic year, with samples of class VIII A (20 students) as the Inquiry Learning group and class VIII B (16 students) as the Reciprocal Teaching group. The study was conducted in the even semester of agustus 2025 at MTs Nurul Jannah NW Ampenan. The research variables consisted of independent variables (X1: Inquiry Learning, X2: Reciprocal Teaching) and dependent variables (Y: critical thinking skills). The research design used was the Matching Only Post-test Only Group Design, with a matching technique based on the equality of class average scores before treatment (Barra Purnama Pradja, 2020).

The instrument used was a descriptive test of critical thinking skills on number pattern material compiled based on indicators of interpretation, analysis, evaluation, and inference, and equipped with an observation sheet for learning implementation. Data were collected through tests and observations, then analyzed using prerequisite tests (normality and homogeneity) and hypothesis tests in the form of t-tests (separate or combined variances) according to sample conditions to determine differences in learning outcomes between groups at a significance level of 5%.

RESULTS AND DISCUSSION

From the results of the critical thinking ability test given to students in class A and class B, data on the test scores of students who were given the inquiry learning model and the reciprocal teaching model were obtained, in this case can be seen in Table 1 below.

Table 1. Critical Thinking Ability Test Results Data for Class A and Class B

No	Data	Eksperimen	Kontrol
1.	Jumlah	1625	1202,5
2.	Number of data	20	16
3.	Minimum Data	75	65
4.	Maksimum Data	87,5	87,5
5.	Mean	81,25	75,1563
6.	Standard deviation	7,09429	6,67512
7.	Varians	50, 3289	44, 5573

Then in the balance test of class A and class B, it was obtained that in class A for the semester exam results it was known that the lowest score was 65 and the highest score was 84 with an average of 78.15, while for class B for the semester exam results the lowest score was 65 and the highest score was 84 with an average of 75. So the difference between class A and class B is 3.15. The average value is obtained from the total number of scores obtained divided by the number of samples of each group.



Figure 1. Documentation of class A and class B students

Normality Prerequisite Test. Based on the normality test for the Class A mathematics exam results In Class A, the lowest score was 65 and the highest score was 84, with an average of 78.15, a standard deviation of 4.91534, and a variance of 24.1605. Based on the degrees of freedom $(dk) = 3$, the significance level is $0.05 = 7.82$, and we obtain $\chi^2_{hitung} = \chi^2_{7,3004}$ with the testing criteria is If $\chi^2_{hitung} < \chi^2_{tabel}$ then the data is normally distributed. In other circumstances,

the data is not normally distributed. Based on the test results, it can be concluded that $\chi^2_{hitung} <$

$\chi^2_{tabel} = \chi^2_{7,3004} < \chi^2_{7,82}$ then the data is normally distributed.

In class B for the semester exam results, it is known that the lowest score is 65 and the highest score is 84 with an average of 75, the standard deviation is 6.33246 and the variance is 40.1. Based on the degree of freedom (dk) = 2. The significance level is 0.05 = 5.99 and it is obtained $\chi^2_{hitung} = \chi^2_{2,0863}$ with the testing criteria is If $\chi^2_{hitung} < \chi^2_{tabel}$ then the data is normally distributed. In other circumstances, the data is not normally distributed. Based on the test results it can be concluded that $\chi^2_{hitung} < \chi^2_{tabel} = \chi^2_{2,0863} < \chi^2_{5,99}$ then the data is normally distributed.

Table 2. Normality Test in Experimental Class and Control Class

Characteristics	Experimental class	Control class	Conclusion
χ^2_{hitung}	6,287	2,505	Normally distributed
χ^2_{tabel}	7,82	5,99	$\chi^2_{hitung} < \chi^2_{tabel}$
taraf signifikan (α)	5 %		

Homogeneity Prerequisite Test. Based on the results of the semester exam scores of the experimental class and the control group, it was obtained $\bar{X}_1 = 78,15$ and $S_1^2 = 24,1605$ for the experimental class while for the control class $\bar{X}_2 = 75$ and $S_2^2 = 40,1$ The hypothesis to be tested at a significant rate $\alpha = 0,05$ for $F_{hitung} = 1,6597$ and $F_{tabel} = 2,345$. Based on the results of the data analysis above, it was obtained $F_{hitung} < F_{tabel} = F_{1,6597} < F_{2,345}$, then it can be concluded that the sample variance is homogeneous.

Table 3. Homogeneity Test in Experimental Class and Control Class

Characteristics	Experimental class/ Control class	Conclusion
sF_{hitung}	1,129	Normally distributed
F_{tabel}	2,345	
Taraf signifikan (α)	5%	$F_{hitung} < F_{tabel}$

Hipotesis Test. Based on the prerequisite tests conducted, the pooled variance formula will be used. This test is conducted to determine whether the preliminary assumptions or tentative answers formulated in the research hypothesis are accepted or rejected. For more details on the results of the hypothesis test calculations, see Table 4 below.

Table 4. T-test on Experimental Class and Control Class

Karakteristik			H_a
t_{count}	t_{table}	Interprestasi	accepted
2,543	1,690	$t_{hitung} > t_{tabel}$	

From the results above, the analysis results of the Polled Variance t-test show that the t_{hitung} obtained for the experimental class and control class learning test score data is 2.543. t_{hitung} then converted to the value $t_{tabel} = t_{(0,05;34)} = 1,690$ Provided that if $t_{hitung} < t_{tabel}$ then the hypothesis H_a is rejected and H_o is accepted and if $t_{hitung} > t_{tabel}$ then the hypothesis is accepted and rejected with a significance level (α) of 5%. This shows that $t_{hitung} > t_{tabel}$ Or $t_{2,543} > t_{1,690}$ it can be concluded that the hypothesis is accepted and H_a is rejected, this means that the Inquiry Learning and Reciprocal Teaching learning models have an effect on the critical thinking skills.

CONCLUSION

Based on the results of the research and discussion, it can be concluded that there is an influence of the Inquiry Learning and reciprocal teaching learning models on the critical thinking skills. This can be proven through the analysis of the Polled Varian t-test data obtained a t_{count} value of 2.534 greater than t_{table} 1.690 in the experimental class, this means that the critical thinking skills of students who were treated with the inquiry learning model were better than the learning outcomes of students who were treated with the reciprocal teaching learning model (control class).

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