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Implementation of Inquiry Learning Models in Improving Student Collaboration and Learning Results

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ABSTRACT

This study aims to determine the implementation of the inquiry learning model in improving collaboration and student learning outcomes. This study uses a Quantitative method, in this study a quasi-experiment research type is used to find out the comparison before and after the action using the Inquiry learning model. The type of design in the quasi-experiment used is the pretest-posttest nonequivalent control group design. The population in this study is grade VIII student MTS Nurul Huda Beringin. The sample used was 80 students from classes VIII A and VIII B MTS Nurul Huda Beringin. The research instrument uses a test sheet consisting of 10 questions and an observation sheet. Data management techniques use descriptive statistic tests, normality tests, hypothesis tests, and N-Gain tests. The results of the study show that the implementation of the inquiry learning model in improving collaboration and student learning outcomes with the theme of the structure of the earth layer applies learning with 2 class groups, namely the experimental class and the control class. The results showed that the application of the inquiry learning model was able to improve as many as 35 students with an average rank value of 19.86, while negative rank were only 2 student with an average rank of 4.00 and there were 3 student with the same value (ties). These results show that most students experienced an increase in collaboration after the implementation of the inquiry learning model. Thus, the implementation of the inquiry learning model is effective in improving collaboration skills and student learning outcomes.

INTRODUCTION

The inquiry learning model is widely applied in the world of education because it can place students at the center of learning activities. In addition, the inquiry learning model is very relevant in the development of educational strategies that interact, are student-centered, and respect various cultures (Bahtiar et al., 2024). The inquiry learning model is a part that provides an active role for students to discover knowledge through observation, analytical thinking, critical, and creative, so that they can form an understanding and ability to solve problems (Aningsih et al., 2023; Mike & Asrizal, 2023; Okpatrioka, 2022; Samadun et al., 2023; Susmariani et al., 2022a).

Inquiry models are also developed in social communities to build students' thinking discipline and intellectual skills through the discovery of answers and questions triggered by the desire of the year (Nur, 2023). In its stages, the inquiry learning process involves several main stages, namely: 1) Orientation; 2) Forming problems; 3) Propose hypotheses; 4) Collecting data; 5) Testing hypotheses; 6) Draw conclusions. These steps show that the scientific thinking process is relevant for students in the century of competency-based knowledge (Aningsih et al., 2023; Okpatrioka, 2022; Tohir, 2020).

Recent studies have proven that learning approaches based on constructivistic approaches, such as guided inquiry, are able to answer these challenges. According to Pramana et al. (2024), the implementation of the inquiry learning model has been proven to be able to provide a significant improvement in learning achievement and active participation of students during the learning process.

Furthermore, (Lilo et al., 2025) emphasized that the application of this model facilitates students' independence in exploring problem-solving, as well as strengthening interaction between students in group discussion activities. The learning model itself is a conceptual framework that describes a systematic procedure in organizing learning experiences to achieve specific learning objectives that serves as a guideline for lesson planners and teachers in planning and implementing learning activities. This means that teachers can choose a suitable and efficient learning model to achieve their learning goals.

Learning models that can activate students must be applied, especially in science learning. Because science learning is a *competency based learning process*, not just a process of knowledge transfer by teachers (*knowledge-based learning*) to students who make science a way of thinking and acting. Science learning is expected to be a vehicle for students to learn about themselves and the environment scientifically applied in daily life. Therefore, a learning model is needed that can physically and mentally enable students to build their own concepts and process skills in a learning. One of the learning models used is the inquiry learning model. As stated by (Richard Suchman. 2013) stated that: "The essence of the idea of the inquiry model is that students will *inquire* when faced with confusing, unclear, or discrete *events*, students have the ability to analyze their thinking strategies, thinking strategies can be taught and added to students, and inquiry can be more meaningful and effective if done in the context of a group." This means that learning using the inquiry model emphasizes providing direct experience to students by involving the maximum of all students' abilities to search and investigate something systematically, critically, logically, and analytically. So that students are able to formulate their own discoveries with full confidence and can improve student cooperation skills.

Previous research has emphasized that the use of innovative learning models can increase students' activeness, thinking skills, and concept comprehension. However, most of the research focuses more on improving cognitive learning outcomes, while aspects of collaborative skills or student cooperation have not been studied in depth. This is the research gap, namely the need for studies that are not only oriented to academic achievements, but also to collaboration skills as an important part of 21st century competencies.

The main problem that the researcher wants to solve is how to improve collaboration and learning outcomes using the inquiry model and how to implement the inquiry learning model. This is based on the fact that students of grades VIII A and VIII B in science learning are not fully active in group learning, there are still many students whose thinking skills are still low, and focused only on books that are their learning materials because there are still no learning media or creative learning resources, so far teachers rarely use more creative learning models. Problem-

solving skills by students are still low, and students' memory of lessons is still low. As a result, the cooperation skills of some students are still low and have not reached the Minimum Completeness Criteria (KKM) which is 70. Therefore, this study focuses on improving collaboration and learning outcomes using the inquiry model and the implementation of the inquiry learning model.

This study takes a position to support previous findings on the effectiveness of innovative learning models, while expanding the study with a focus on improving students' collaboration skills. The inquiry learning model is seen as relevant because it emphasizes direct experience, activeness, and full involvement of students in the process of critical, analytical, and systematic thinking. In addition, inquiry encourages students to work together in groups to find concepts and solutions to the problems they face, so that they are expected to be able to improve both their learning outcomes and collaborative skills.

The purpose of this study is to find out how the implementation of the inquiry learning model can improve students' collaboration skills as well as their learning outcomes in science subjects. Through the application of the inquiry model, this research is expected to be able to provide a real picture of the effectiveness of learning that emphasizes active engagement, critical thinking processes, and group cooperation so that students not only gain increased academic scores, but also social skills that support their overall learning success.

METHODS

The type of research used is quantitative using experimental research methods. The experimental research method is a method that is carried out in a planned, systematic, and controlled manner to determine the influence of independent variables on dependent variables. This study aims to explain the cause-and-effect relationship between one variable and another (variable X and variable Y), so researchers need to carefully control and measure the variables of their research (Syahrizal & Jailani, 2023).

In addition, the research design uses *quasi-experimental,* which is experimental research that is used because of the difficulty in obtaining a control class that is useful for controlling external variables that have an impact on the research. The type of design in the *quasi-experiment* used is *the pretest-posttest nonequivalent control group design*. The design includes two groups, namely control classes and experiments that are not randomly determined or groups that have been formed naturally. Both classes are given a pretest and a posttest to measure changes in students' collaboration skills.

The research was carried out at MTs Nurul Huda Beringin School, Pangenan District, Cirebon Regency, West Java. Students in this MTs have diverse characteristics in terms of social background and academic ability. Student collaboration is still minimal, so this school is suitable for the application of the inquiry model. The research was carried out from May 23 to May 28, 2025.

Data Analysis Techniques:

1. Normality Test

   Data analysis in this study was carried out through several stages of statistical tests to ensure the validity of the research results. The first stage is a normality test which aims to determine whether the research data has a normal distribution. This test was carried out using the Kolmogorov-Smirnov test through the SPSS version 25 program. The decision-making criteria are if the significance value is greater than 0.05, the data

is declared normally distributed, while if the significance value is less than or equal to 0.05, the data is considered not normally distributed. Data normality is an important requirement because it affects the selection of statistical tests used in the next stage of analysis.

2. Homogeneity Test
   The second stage is the homogeneity test which is used to determine the similarity of data variance between the groups being compared. The homogeneity test was conducted using the Levene test, where the data was declared homogeneous if the significance value was greater than 0.05. This test is important to ensure that the variance between data is not significantly different, so that the results of hypothesis testing can be interpreted validly.
3. Hypothesis Test

   Hypothesis testing was carried out using paired sample t-test. The selection of this test is based on the research design that compares pretest and posttest results in one group of research subjects. This t-test is used to determine whether there is a significant difference before and after treatment, as well as to determine the effect of the learning model on students' collaboration skills. The level of significance used is $\alpha = 0.05$, in accordance with Sugiyono's (2020) guidelines. If the significance value obtained is less than 0.05, the alternative hypothesis is accepted, which means that there is an effect of the learning model on student collaboration skills.
4. N-Gain Test

   To find out how much the learning outcomes improved after the treatment, the N-Gain test was used. This test aims to measure the effectiveness of the treatment in improving learning outcomes by comparing pretest and posttest scores. The N-Gain calculation formula refers to Meltzer (2002), with the following interpretation criteria: improvement is categorized as high if the N-Gain value is more than 0.7, moderate if it is in the range of $0.3 \leq$ N-Gain ≤ 0.7, and low if the N-Gain value is less than 0.3. Thus, the N-Gain test provides a more detailed picture of the level of effectiveness of the treatment on improving student learning outcomes.

RESULTS AND DISCUSSION

1. Results of Increased Collaboration Using the Inquiry Learning Model

Before testing the increase in collaboration in the experimental class, the researcher tested the prerequisite for the questionnaire analysis, namely the normality test, then the researcher continued the Wilcoxon and N-Gain tests to find out the significance of increasing student collaboration

a. Analysis Prerequisites Test

Normality Test

Before further statistical analysis is carried out, a normality test is first carried out on the pretest and posttest questionnaire data to find out whether the data is distributed normally or not. The normality test was performed using Shapiro-Wilk because the sample data was <50. The following are the results of the data normality test:

Table 4. 1 Pretest and Posttest Questionnaire Normality Test

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Angke_Pre	.149	40	.026	.931	40	.018
Angk_Po	.381	40	.000	.668	40	.000

a. Lilliefors Significance Correction

Based on **Table 4.1**, the output of the significance value (Sig.) Shapiro-Wilk for the pretest questionnaire data was 0.018. Meanwhile, for the posttest questionnaire data, a significance value of 0.000 was obtained in both tests. Because the total sig value < 0.05, it can be concluded that the pretest and posttest questionnaire data are not distributed normally.

b. Statistical Analysis Test

Wilcoxon Test

After applying the inquiry learning model, the Wilcoxon test was carried out to find out the difference in questionnaire results between before (pretest) and after (posttest) treatment. The Wilcoxon test was used because the data was not normally distributed as the results of the previous normality test. The following are the results of calculating the rank value from the difference between posttest and pretest scores:

Table 4. 2 Wilcoxon Pretest and Posttest Test

Ranks

		N	Mean Rank	Sum of Ranks
Angk_Po - Angke_Pre	Negative Ranks	2[a]	4.00	8.00
	Positive Ranks	35[b]	19.86	695.00
	Ties	3[c]		
	Total	40		

a. Angk_Po < Angke_Pre

b. Angk_Po > Angke_Pre

c. Angk_Po = Angke_Pre

Based on **Table 4.2,** it can be seen that the number of positive ranks (Angket_Posttest > Angk_Pretest) is 35 students with an average rank score of 19.86, while the negative ranks are only 2 students with an average rank of 4.00, and there are 3 students with the same score (ties). These results show that most students experience an increase in collaboration after the implementation of the inquiry learning model. Thus, there are indications that the inquiry model has a positive effect on improving student questionnaire results.

2. Improving Learning Outcomes Using the Inquiry Learning Model

Before testing the improvement of results in the experimental and control classes, the researcher tested the prerequisites for test analysis, namely the normality test, then the researcher continued the Mann-Whitney U test to determine the significance of student learning outcomes in the experimental and control classes.

a. Analysis Prerequisites Test

Normality Test

This test aims to find out whether the Experimental Posttest and Control Posttest data are normally distributed or not. The normality test was performed using the Shapiro-Wilk method because the sample count was <50. The following are the results of the normality test of posttest data:

Table 4. 3 Experimental and Control Class Normality Test

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Po_Ex	.375	40	.000	.720	40	.000
Po_Kt	.318	40	.000	.827	40	.000

a. Lilliefors Significance Correction

Based on **Table 4.3**, the significance value (Sig.) on the Shapiro-Wilk test for the Experimental Posttest data is 0.000 and for the Control Posttest is also 0.000. Because both sig values < 0.05, it can be concluded that the questionnaire posttest data from both groups is not normally distributed. Thus, for the next hypothesis test, the Mann-Whitney U test was used.

b. Statistical Analysis Test

Mann-Whitney U Test

Before knowing the learning results, the researcher began with applying the inquiry learning model to experimental classes and conventional learning. In the control and experimental classes, the researcher did not test the initial (pretest) but tested the students after the inquiry model was applied in the experimental class and the conventional model in the control class. The analysis was performed using the Mann-Whitney U test because the data were not normally distributed. The following are the results of the average pretest scores of the two groups:

Table 4. 4 Mann-Whitney U Test

Ranks

	Simbol	N	Mean Rank	Sum of Ranks
Nilai Pretest	Kelompok A	40	43.31	1732.50
	Kelompok B	40	37.69	1507.50
	Total	80		

Based on **Table 4.4**, it is known that the average score of the pretest pretest score of group A (experimental class) is 43.31, while group B (control class) is 37.69. This shows that before the application of the inquiry learning model was larger than the conventional model, this difference made the inquiry model have greater opportunities to improve learning outcomes.

3. Improving Collaboration and Learning Outcomes Using the Inquiry Model

a. Hypothesis Results of Increased Collaboration Using the Inquiry Model

The hypothesis results on increasing student collaboration in the Experiment class are as follows:

Table 4. 5 Wilcoxon Pretest and Posttest Test output results

Test Statistics[a]

	QPo - QPre
Z	-5.206[b]
Asymp. Sig. (2-tailed)	.000

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

Table 4.5, explains that this significance value is much smaller than the significance level limit used in the study, which is α = 0.05. Therefore, it can be concluded that the zero (H_0) hypothesis is rejected and the alternative hypothesis (H_1) is accepted. In other words, there is a statistically significant difference between the results of the pretest and posttest of students.

The value of Asymp. Sig. (2-tailed) is 0.000 < 0.05, then it can be known that the hypothesis results (H_0) are rejected and (H_1) are accepted. Furthermore, a negative sign on the value of Z indicates that the majority of the comparison data between the pretest and posttest results in an increase in scores after the treatment is given. This means that posttest scores tend to be higher than pretest scores. This indicates that the treatment provided has a positive impact on improving student learning outcomes.

In general, these findings provide evidence that interventions applied in the learning process have high effectiveness. A significant increase in scores proves that students experience development in understanding or skills after following the learning process that has been designed.

4. Hypothesis Results of Improving Learning Outcomes Using the Inquiry Model

The hypothesis results on increasing student collaboration in the Experiment class are as follows:

Table 4. 6 Output results of Mann Withney U Test Experimental and Control Class

Test Statistics[a]

	Nilai Pret dan Post
Mann-Whitney U	202.500
Wilcoxon W	1022.500
Z	-5.978
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: Group

Based on the output **of Table 4.6** above, the significance value of Asymp. Sig. (2-tailed) = 0.000. Asymp value. A sig. of 0.000 indicates that the significance of the difference between the two groups is very high, as the value is smaller than α = 0.05. Thus, the zero hypothesis (H_0) which states that there is no difference between the learning outcomes of students in the experimental and control classes is rejected, and the alternative hypothesis (H_1) which states that there is a significant difference is accepted. Asymp value. If the sig. (2-tailed) is 0.000 < 0.05, it can be known that the hypothesis

results (H_0) are rejected and (H_1) accepted. Therefore, it can be concluded that the experimental class is more improved than the control class after the experimental class is treated with the inquirer model.

In addition, a negative Z-value (-5,978) indicates that such a significant difference leads to the experimental class having a higher value compared to the control class. This means that better rankings or scores come from the experimental group, which indicates the success of the implementation of the learning model used in improving student learning outcomes.

These results provide an idea that the treatment given to the experimental class has a positive and significant impact on improving student learning outcomes. The learning model or strategy applied has proven to be more effective than conventional learning methods that are still used in control classes. In other words, students who take part in learning with the new approach are able to understand the material better, answer questions correctly, and get higher scores.

5. Implementation of the Inquiry Learning Model in Class VIII A MTs Nurul Huda Beringin

a. Orientation

Starting from greeting and praying, greeting students, checking attendance, and motivating with a short story about an earthquake or volcanic eruption, digging for information, analyzing problems, and finding solutions independently or through group work.

b. Formulating the Problem

Starting by asking questions related to the subject matter of the earth's structure such as the phenomenon of earthquakes or erupting volcanoes in the news, then directing students to find out their relationship with the structure of the earth, then students to ask questions who have listened to learning videos about the structure of the earth, At this stage, they will gain very valuable experience as an effort to develop mentally through their thinking process.

c. Formulating a Hypothesis

Then students are divided into groups to discuss the problems given. Discussions are carried out collaboratively, where each student has the same opportunity to express their opinions, listen to ideas, and draw conclusions together related to the material of the earth's structure, earthquakes and volcanic eruptions. It aims to foster communication, cooperation, and responsibility skills between group members. Students seemed enthusiastic about participating in the activity, because they felt directly involved in the search for answers to questions they made themselves.

d. Collecting Data

Provide a picture or model of the earth's structure, then students identify and explain the function of each layer (crust, mantle, outer core, inner core) given by the teacher. Students seemed enthusiastic about participating in the activity, because they felt directly involved in finding answers to questions given by their teachers.

e. Testing Hypotheses

Students write down the results that have been submitted related to the material on the structure of the earth such as the crust, mantle, outer core, and inner core given by their teacher, then each group presents the results of the discussion together in front, with the other group can ask the group that presents about the results that have been discussed.

f. Summing Up the Conclusion

One of the students concluded the relationship between the structure of the earth and the occurrence of natural disasters such as earthquakes, and volcanic eruptions. From the results of our observations and discussions today, we can conclude that the earth is composed of several layers, namely the earth's crust on which we stand, the mantle that is under the crust and is hot and viscous, the liquid outer core, and the solid inner core. The movement of these layers, especially in the earth's crust consisting of tectonic plates, greatly affects the occurrence of natural phenomena such as earthquakes and volcanic eruptions. So, understanding the structure of the earth helps us know the causes and spread of natural disasters, as well as the importance of preparedness in disaster-prone areas. Next, students also gave homework to make posters or pictures about the structure of the earth.

CONCLUSION

Based on the results of research on the application of the inquiry learning model in improving collaboration and learning outcomes of students in class VIII A MTs Nurul Huda Beringin, it can be concluded that the inquiry learning model has a positive impact on both aspects of collaboration skills and learning outcomes. The results of the pre-test and post-test questionnaire analysis tested using Wilcoxon showed a significant increase in students' collaboration skills. This improvement is reflected in students' ability to divide tasks, respect each other, communicate effectively, and be responsible for their respective roles in the group. Thus, the inquiry learning model is proven to be able to foster social skills

In addition, the inquiry learning model is also effective in improving student learning outcomes. Analysis of posttest data tested using Mann-Whitney U showed that students' scores in the experimental class were higher than those in the control class. This indicates that inquiry-based learning is able to create a more active learning atmosphere, encourage student involvement in the process of finding concepts, and produce a deeper understanding than conventional learning.

The process of implementing inquiry learning in class VIII A is carried out with a collaborative approach, where students are actively involved in observation activities, problem formulation, information search, to drawing conclusions through group discussions. The teacher acts as a facilitator who guides the learning process without dominating, so that the classroom atmosphere becomes more lively, interactive, and participatory.

Overall, the findings of this study confirm that the inquiry learning model not only contributes to improving academic outcomes, but also strengthens students' collaboration skills. The application of this model is able to create learning that is active, meaningful, and in accordance with the demands of 21st century education that emphasizes critical thinking skills, cooperation, and deeper conceptual understanding.

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