



The Influence Of Inquiry Learning On Students' Statistical Reasoning Abilities

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Abstract

Education for Class VIII Students at SMP Negeri 2 Parigi is currently the main focus of scientific research. This research focuses on students' statistical reasoning in applying the Inquiry Model in class VIII. In addition, this research aims to evaluate the extent to which the Inquiry Model is applied in learning to improve the statistical reasoning abilities of class VIII students. This research method uses quasi-experimental research. Two classes were chosen as samples, namely the experimental class (class VIII 3) and the control class (class VIII 1). From the research results, several significant conclusions can be drawn. First, the statistical reasoning ability of class VIII students at SMP Negeri 2 Parigi who received learning using the Inquiry Model showed an average score of 70.0, median 71.85, and mode 81.2. On the other hand, students who received learning using the Direct Learning Model had an average of 63.64, a median of 53, and a mode of 50. Second, the implementation of learning using the Inquiry Model at SMP Negeri 2 Parigi from the level of teacher and student activity during four consecutive meetings reached a percentage 75%, 75%, 90%, and 90% for teachers, and 68.05%, 75%, 90.27%, and 91.66% for students. Therefore, the experimental class that applies the Inquiry Model is considered to meet the success criteria. Third, the results of statistical analysis show that the calculated t value is 1,766, exceeding the t table value of 1,671, with a significance level of 0.05.

Keywords: inquiry; learning; model; reasoning; statistics

INTRODUCTION

In the realm of education, a very crucial aspect is the teaching process, where educators plan learning carefully to foster contact between students, between teachers and students, as well as with various learning sources. Essentially, learning aims to continuously encourage the transformation of students' behavior and thinking in the context of the learning environment (Hidayat & Machali, 2012). Learning often involves students with varying levels of ability, so that not all can be actively involved in the teaching and learning flow. The level of student contribution can be reflected through the achievement of academic grades. According to (Meja, 2017), a large number of students, especially in the mathematics discipline, face difficulties in overcoming various challenges posed by educators, often accompanied by a lack of motivation to participate in mathematics learning. This suggests that mastery of mathematics has a very important role in the development of each individual, contributing to overcoming and resolving various problems. This statement is in line with the goals promoted by the National Council of Teachers of Mathematics (NCTM) regarding the mastery of mathematical abilities that every student is expected to have (Siagian, 2016).

Statistical reasoning ability is the main essence for junior high school students. Through these skills, students can develop competencies in various domains, including: (1) Understanding explicit and implied statistical information in each problem context, (2) Demonstrate a deep understanding of methods for selecting, presenting, reducing and presenting data in solving problems, (3) Have a solid understanding and reasoning regarding

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the entire statistical process, including every calculation involved; (4) Understand statistical problem solving methods based on existing data, and be able to interpret them within a general decision-making framework (Maryati & Pariatna, 2017; Putra et al., 2018).

Based on the initial research test at SMP Negeri 2 Parigi, three students with different levels of ability were given a number of questions that included indicators of statistical reasoning abilities, including describing data, organizing data, presenting data, analyzing data, and interpreting data. Highly skilled students are able to explain questions after reading them, even though the answers are not completely complete. They can plan and solve problems, but are less careful in double-checking. Students with moderate ability can only complete 2 of the 3 questions given, but the answers are not systematic and less accurate. Low ability students answered 2 questions, but not systematically. The conclusion that researchers can draw is that the three students did not apply the correct steps in working on the questions, they tended to immediately write answers without a proper process.

The researcher also conducted an interview with an educator from class VIII of SMP Negeri 2 Parigi who stated that in the context of learning statistics, students were not yet fully able to carry out descriptions and presentations well. Therefore, when they are faced with statistics questions, students still face difficulties in giving the right answer. The teaching approach applied by teachers still tends to rely on lecture methods and other approaches which are completely dependent on the teacher's decision. As a result, the application of students' statistical reasoning abilities does not reach the optimal level

Responding to challenges related to students' low statistical reasoning abilities, a learning model is needed that can improve students' reasoning in the learning process. The learning model used to improve students' reasoning abilities is the Inquiry learning model. The advantages of the Inquiry learning model include 1) Emphasizing the development of cognitive, effective and psychomotor aspects in a balanced manner, so that learning through this method is considered more meaningful. 2) Providing students to learn according to their learning style. 3) Able to serve the needs of students who have above average abilities. 4) Students who have good learning abilities will not be hampered by students who are weak in learning (Al Thabany, 2014).

Based on research conducted by (Wulansari et al., 2019; Martadipura, & Priatna, 2010) on students' statistical reasoning abilities, in their research the average statistical reasoning ability of students in classes using the Inquiry learning model was 68.29, while the average The statistical reasoning ability of students in classes that use the Direct learning model is 57.64. So it can be concluded that the statistical reasoning abilities of students who use the Inquiry learning model are more effective than those who use the Direct learning model. Apart from that, research conducted by (Nahak & Rosalina, 2020; Arisandy, Fitriani, & Ghassani, 2018; Jalal, Lisa, & Syafrudin, 2016) on the learning outcomes of students who used the Inquiry learning model with the help of student worksheets showed that the average score for the experimental class was greater than the control class, namely $68.50 > 50,00$. Based on this research, there is a significant difference in average scores between the experimental class which uses the Inquiry learning model and the control class which uses other learning models. Meanwhile, in this study, which also used the Inquiry learning model to improve students' statistical reasoning, the average score taught using the Inquiry learning model in the experimental class was 70.0, while the average score taught using the Direct learning model in the control class was 63.64. So it can be concluded that the difference between this research and previous research is that in this research the Inquiry learning model emphasizes maximum student activity to search and discover. This means that inquiry learning places students as learning subjects. In the learning process, students not only act as recipients of lessons through the teacher's verbal explanations, but they play the role of discovering for themselves the essence of the subject matter being studied.

This research aims to develop students' knowledge and increase active involvement in learning, so that students can understand concepts better. As a strategy to achieve this goal, the Inquiry learning model was adopted. Therefore, researchers apply the Inquiry learning model to help improve students' statistical reasoning abilities.

METHODS

This type of research is quasi-experimental research *in* which not all variables are controlled. Quasi-experimental research does not allow for control of all relevant variables. Determination of the sample in this study was carried out using the *cluster random sampling technique*, namely by dividing the entire population into groups or clusters. The steps in sampling with *cluster random sampling* are determining the clusters, determining the number of clusters to be sampled (for example n), randomly selecting n clusters, and all members in the selected clusters constitute the research sample. The data collection technique in this research was carried out by giving instruments in the form of observation sheets and tests of students' statistical reasoning abilities in the form of essay tests to students. Observations are carried out at every meeting. Meanwhile, there are two data analysis techniques used in this research, namely descriptive analysis and inferential analysis.

The main objective of this research is to evaluate students' statistical reasoning power between the experimental class which implements the Inquiry learning model and the control class which uses model Conventional learning. A number of research instruments were implemented, involving a variety of tools, including (1) a statistical reasoning ability test consisting of three essay questions presented in a final exam format, and (2) an observation/note sheet.

RESULTS AND DISCUSSION

In this research there are several results of observations of teacher activities in the experimental class and control class. The results of these observations can be seen in the table below. Recapitulation results teacher and student activities in learning models inquiry can be seen in the table 1.

Table 1. Teacher Activities (Class Experiment)

Meeting	Maximum Total Score	Earned Score	Percentage	Category
First	20	15	75%	Good
Second	20	15	75%	Good
Third	20	18	90%	Very good
Fourth	20	18	90%	Very good

Based on table 1, it can be seen that the activeness level of experimental class teachers at the first and second meetings reached 75%, but increased significantly to 90% at the third and fourth meetings. Overall, there was a significant increase in achieving all aspects observed from the third to fourth meetings. Therefore, it can be concluded that there is a need for time for teachers to adapt to the implementation of new learning models, this can be seen from the increase in the percentage of achievement of indicators at each meeting.

Table 2. Activities Students (Class Experiment)

Meeting	Maximum Total Score	Earned Score	Percentage	Category
First	72	49	68.05%	Good
Second	72	54	75%	Good
Third	72	65	90.27%	Very good
Fourth	72	66	91.66%	Very good

Then in table 2, it can be seen that experimental class students, at the first meeting, students achieved 68.05% in achieving all aspects, reflecting unfamiliarity with the Inquiry learning model. At the second meeting, there was an increase in aspect achievement to 75%. Furthermore, at the third and fourth meetings, the achievement of each aspect increased to 90.27% and 91.66%, respectively. Overall, there was a significant increase in achievement in all aspects from the second to fourth meetings. In conclusion, students need time to adapt to a learning approach that is considered new, as reflected by the increase in the percentage of indicators achieved at each meeting.

Recapitulation results Teacher and Student Activities in Learning Models Direct inquiry can be seen in the table 3.

Table 3. Teacher Activities (Class Control)

Meeting	Maximum Total Score	Earned Score	Percentage	Category
First	21	16	76.19%	Good
Second	21	17	80.95%	Very good
Third	21	19	90.47%	Very good
Fourth	21	19	90.47%	Very good

Next, the results of the recapitulation of teacher activities in the direct learning model in the control class can be seen in table 3, that at the first meeting, the teachers succeeded in achieving 76.19% achievement for all aspects observed, indicating their unfamiliarity with the direct learning model. At the second meeting, there was an increase in aspect achievement to 80.95%, while at the third and fourth meetings, it reached 90.47%. Holistically, there was a significant increase in the achievement of all aspects observed from the second to fourth meetings. Based on this explanation, it can be concluded that teachers need time to adapt to learning models that are considered new, as reflected in the increase in the percentage of indicators achieved at each meeting.

Table 4. Student Activities (Control Class)

Meeting	Maximum Total Score	Earned Score	Percentage	Category
First	56	39	69.64%	Good
Second	56	41	73.21%	Good
Third	56	49	87.5%	Very good
Fourth	56	50	89.20%	Very good

Then for control class students, based on table 4, it was found that at the first meeting, student achievement reached 69.64% of all aspects observed, in a condition where they were still adapting to the new group and teacher. The implementation of learning increased at the second meeting, reaching 73.21%. Aspect achievement continued to increase at the third and fourth meetings, reaching 87.5% and 89.20% respectively. Overall, there was a positive increase in the achievement of all aspects observed from the second to fourth meetings. Based on this explanation, it can be concluded that students need time to adapt to new teachers, even though they have often used this learning model. This phenomenon is illustrated by the increase in the percentage of indicators achieved at each meeting.

The statistical reasoning abilities of students in the experimental class and control class can be seen in the following table 5.

Table 5. Descriptive Ability Reasoning Statistics Student Class Experiments And Classes Control

Statistics Descriptive	Class Experiment	Class Control
Average	70.0	63.64
Median	71.85	53
Mode	81.2	50
Standard Deviation	13.06	14.89
Sample Variance	170.76	221.84
Minimum Value	39.5	33.3
Maximum Value	87.5	91.6
N	30	30

Data generated in the Posttest test of students' statistical reasoning abilities . A total of 60 students consisting of two classes, namely 30 students from the experimental class and 30 students from the control class were given the test. Posttest data was obtained from treatment, namely learning about statistics material . The experimental class uses the Inquiry learning model , while the control class uses the Direct learning model . N-gain data was obtained based on posttest data in both classes.

Based on table 5, with a sample size of 30 students for the experimental class and 30 students for the control class, significant differences can be observed in the average value of statistical reasoning ability between the two classes. The average statistical reasoning ability in the experimental class reached 70.0, while in the control class it was 63.64. The median in the experimental class was 71.85, while in the control class it reached 53. The mode in the experimental class was 81.2, while in the control class it was 50. The standard deviation and sample variance in the experimental class were 13.06 and 170.76, while in the control class were 14.89 and 221.84. The range of scores (minimum and maximum) in the experimental class is 39.5 and 87.5, while in the control class it is 33.3 and 91.6.

As for distribution mark ability posttest reasoning statistics For taught students with using a learning model Inquiry and learning models Direct can seen in the distribution diagram following:

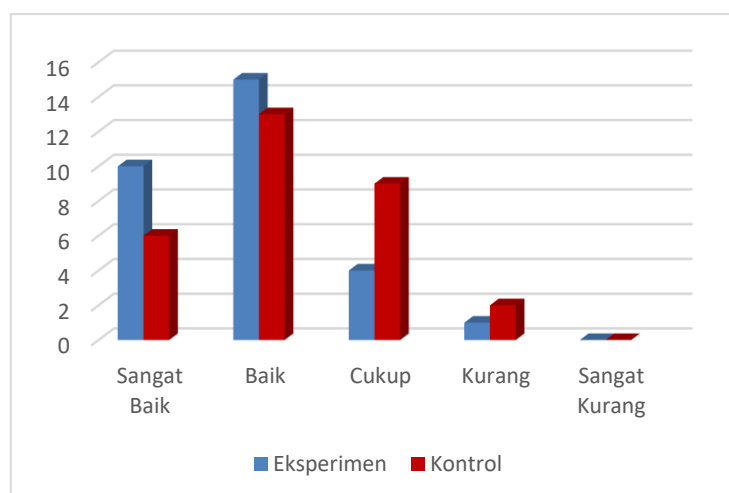


Figure 1. Distribution of Posttest Scores Ability Reasoning Statistics Student

Based on this table, the percentage of teacher activity in both classes increases at each meeting when compared to the initial meeting . This means that in general teachers have been able to adapt in delivering learning in both classes.

Based on Figure 1, it can be concluded that there are differences in the distribution of posttest scores for students' statistical reasoning abilities, reflecting variations in the level of mastery. In the very good category, the number of students in the experimental class reached 10, while in the control class there were 6 students. In the good category, there are 15 students in the experimental class and 13 students in the control class. In the sufficient category, there were 4 students in the experimental class and 9 students in the control class. Meanwhile in the poor category, there was 1 student in the experimental class and 2 students in the control class. There were no students in either class who reached the level of mastery in the very poor category.

Analysis Inferential research This using normality test , homogeneity test , and hypothesis test . Results of the normality test can seen in the table 6.

Table 6. Experimental Class and Control Class Students

Class	D _{max}	D _{table}	Information
Class <i>posttest</i> experiment	0.094	0.242	Normal
Class <i>posttest</i> control	0.120	0.242	Normal

The results of calculations in the experimental class using the Kolmogorov-Smirnov test on the table reveal that the D_{max} value is 0.094, which is smaller than the D_{table} value of 0.242. Thus, it can be concluded that the distribution of data from the posttest results of students' statistical reasoning abilities in the experimental class, who received learning using the inquiry model on the subject of statistics, tends to approach a normal distribution .

Based on the control class analysis in the table using the Kolmogorov-Smirnov test, it was found that the D_{max} value was 0.120, which was significantly lower than the D_{table} value of 0.242. Thus, it can be concluded that the data from the posttest results on students' statistical reasoning abilities in the control class, who were given learning using a direct model on statistics material, shows a tendency to approach a normal distribution. Based on the results of inferential analysis using the homogeneity test, from the calculation results for the posttest in the experimental class and control class, it was found that the F_{count} value was 1.30, while the F_{table} value was 1.86. It can be seen that F_{count} = 1.30 < 1.86 = F_{table}, so it can be concluded that the data shows homogeneity of variance.

Table 7. Homogeneity Ability Reasoning Statistics in the Classroom Experiments and Classes Control

Class	Variance (S ²)	F _{count}	F _{table}	Information
Experiment	170.30	1.30	1.86	Homogeneous
Control	221.84			

The results of hypothesis testing obtained a value of t_{count} = 1.766 and t_{table} = 1.671 with dk = 58. Because t_{count} ≥ t_{table}, H₀ is rejected, meaning the posttest results of the experimental group are better than the control group.

Table 8. Hypothesis testing Ability Reasoning Statistics Student

Class	N	t _{count}	t _{table}	Information
Experiment	30	1,766	1,671	H ₀ rejected
Control	30			

The main difference between the two classes lies in the treatment applied in each class. The experimental class implements the Inquiry learning model, while the control class uses the Direct learning model. This learning model is a model that is generally applied in class before carrying out research. It can be concluded that the results of teacher activities in implementing learning using the Inquiry model are that during four learning sessions data was collected regarding teacher and student activities in managing and undergoing the learning process in the experimental class. Teachers admit that implementing the Inquiry learning model is not easy, so that several stages of learning implementation cannot be fully implemented. At the beginning of the learning implementation, the teacher experienced limited time so that one of the stages, such as providing the opportunity to present the results of group discussions, could not be realized.

Students often face problems that are difficult to resolve well, triggered by students' incompetence in solving problems and teachers' limitations in reviewing each group during discussions. Therefore, if students have difficulty solving problems, the teacher only provides an explanation of the problem solving process on the blackboard. At the first meeting in the experimental class, preliminary activities were carried out to condition the class, maintain focus, and create conducive conditions. The teacher gives appreciation, motivates students, and discusses the learning material that day. The teacher's first step is to introduce the learning model that will be used, namely the Inquiry model. In the closing activity, the teacher and students draw conclusions and summarize the material for the next meeting. From the second to the last meeting, the teacher continued to improve teaching methods and time management well.

As for the results of observations of student activities in implementing learning using the Inquiry model during four meetings in the learning process using the Inquiry learning model, student participation continues to increase at each meeting. Based on the results of observations of student activity at the first meeting, an activity level of 68.05% was recorded. In the initial phase of learning, student activity is still low because they are adapting to the learning model applied in class. Students' lack of enthusiasm can be seen from their shyness when asked to observe and formulate the problem of a phenomenon. Some students are also not familiar with group work, as can be seen from their own choice of group mates and the lack of cooperation within the group, so that few students adapt actively. However, as time went by, these obstacles were successfully overcome. Students who were initially less active became more enthusiastic at subsequent meetings. This increase can be seen from the observation sheet of student activity which increases at each meeting. At the second meeting, the level of student activity reached 75%, and at the third meeting it reached 90.27%, showing significant improvement.

Even though there are still several obstacles, with the teacher's guidance and direction, students begin to understand the Inquiry learning model. They are also increasingly brave to explain the results of their work and provide feedback. At the last meeting, student activity and responsibility in the group was much better than before, as seen from the student activity level which reached 91.66%. Thus, it can be concluded that the criteria for influence in the learning process are met over time from the first meeting to the last. In the posttest regarding students' statistical reasoning abilities, quantitative data was used in this research. The implementation of the Posttest aims to evaluate the potential influence of the Inquiry learning model on students' statistical reasoning abilities after the teaching process.

Through descriptive analysis of Posttest data on students' statistical reasoning abilities in the experimental class, an average of 70.0 was found, exceeding the average score in the control class which only reached 63.64. The variance of the experimental class data (170.30) is lower than the control class (221.84), indicating that the variation in posttest results in the control class is greater. The standard deviation of the experimental class (13.0) is also smaller than the control class (14.89), indicating that the variation in students' statistical reasoning abilities in

the control class is higher than the average. The median of the experimental class (71.85) is higher than the control class (53), and the mode of the experimental class (81.2) is higher than the control class (50).

From the analysis of the qualifications of students' statistical reasoning abilities in the experimental class, which utilizes the Inquiry learning model, it was found that out of 30 students, 1 student was in the poor category (3.33%), 4 students were sufficient (13.33%), 15 students were good (50%), and 10 students are very good (33.33%). In the control class which uses the Direct learning model, out of 30 students, 2 students are in the poor category (6.67%), 9 students are sufficient (30%), 13 students are good (43.33%), and 6 students were very good (20%). The application of the Inquiry learning model in the experimental class showed an increase in students' statistical reasoning abilities compared to the control class which applied the Direct learning model. Even though there are several obstacles, such as some students who choose to be silent or lack enthusiasm, Inquiry provides activity for students because learning does not only depend on the teacher. Students in the experimental class seemed more focused and had the courage to work on questions seriously based on their understanding. This explains why the statistical reasoning abilities of students in the experimental class were higher compared to the control class who took part in direct learning.

The t-test shows that the value of tcount (1.766) is greater than ttable (1.671) at an error level of 0.05, so H_0 is rejected. It can be concluded that the Inquiry learning model has a significant influence on improving students' statistical reasoning abilities. Overall, it can be concluded that in this research, the Inquiry learning model was significantly more effective in improving students' statistical reasoning abilities compared to the Direct learning model. This can be seen from the average score of the experimental class which reached 70.0, while the control class only reached 63.64. This finding is consistent with the research results of (Wulansari et al., 2019; Permana & Sumarmo, 2007) which states that the statistical reasoning abilities of students taught using the Inquiry learning model are higher compared to the Direct learning model in statistical material.

CONCLUSION

Based on the results and discussion of this research, it can be concluded that to develop student knowledge and increase active involvement in teaching and learning, a learning model is needed that can understand concepts better. As a strategy to achieve this goal, the inquiry learning model will be used during the learning process. Therefore, researchers apply the Inquiry learning model to help improve students' statistical reasoning abilities. Apart from that, the results of implementing the Inquiry learning model on students' statistical reasoning abilities have increased students' knowledge in learning. It can be seen that before using the Inquiry learning model the average student score was 63.64, whereas by using the Inquiry learning model the average student score increased to 70.0. Using this Inquiry learning model can improve students' statistical reasoning abilities more effectively compared to the Direct learning model.

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