THE EFFECT OF SCIENTIFIC APPROACH ON MATHEMATICAL CONCEPT UNDERSTANDING ABILITY AND MATHEMATICS LEARNING ACHIEVEMENT

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Abstract

The purpose of this study is to describe whether the scientific approach in statistics material influences the ability to understand mathematical concepts. This research uses a quantitative method and a Pre-experimental design with a one group Pretest-Posttest model. Thus, pretest and posttest results were obtained within the research design so that experimental results could be compared with pre-experimental results. The research was conducted at SMA Al-Irsyad Kota Tegal. The subjects in this study were 32 students in the experimental class and 32 students in the control class. The data collection technique used pretest and posttest tests. Data analysis techniques were performed by testing the research instrument, analysis testing and hypothesis testing using paired t-test. Based on the research results obtained, it means that there is an influence on the model obtained $t\_hitung = -6.044$, then $|t\_hitung| = 6.044$. Then with the t_tabel distribution table $= 2.039$. Because $|t\_hitung| > t\_tabel$ it can be concluded that H_o is rejected. Because the average value of understanding the concept of mathematics $\mu\_1 \neq \mu\_2$, there is an influence of understanding the mathematical concepts of students before and after using a scientific approach.

Keywords : Scientific Approach, Understanding of Mathematical Concepts, Statistics

1. INTRODUCTION

Education serves as a means to enhance and develop the quality of human resources. One of the main issues in formal education (schools) is the low absorption rate of students. This encourages students to possess abilities that require critical, creative, logical thinking, and a willingness to cooperate so they can solve the problems they face (Sari et al., 2019:320). Learning is a crucial process for students to develop insights, creativity, and their mindset regarding knowledge. This is essential for achieving the educational goal of changing students' attitudes. Success in learning mathematics is considered achieved if educators can bring about changes in knowledge. Mathematics learning is also expected to help students solve problems, engage in logical games, and reason (Suci and Taufina, 2020:506).

A. Scientific Approach

According to Nisa et al. (2018:45), the scientific approach refers to methods of science. Scientific methods are used by scientists to discover new facts or theories, fostering creative thinking. According to Anderson (2015:563), the scientific approach encompasses five learning experiences: (1) Observing, using the senses to identify information needed to take specific actions so that students can identify problems in mathematics lessons; (2) Questioning, creating and asking questions, engaging in Q&A sessions, discussing unclear information or seeking additional information; (3) Gathering information/trying, experimenting, reading other sources and textbooks, observing objects/events/activities, interviewing sources to gather relevant data/information for questions; (4) Reasoning/associating, processing gathered information to answer questions/draw conclusions. Data processing forms include tables, graphs, charts, concept maps, calculations, and modeling. Subsequently, students analyze data to compare or determine relationships between processed data and existing theories, drawing conclusions; (5) Communicating, presenting reports/conclusions in charts, diagrams, or graphs; compiling written reports; presenting reports including processes, results, and conclusions orally. These activities enable students to describe and present their findings from observing, questioning, gathering, and processing data; (6) Creating, innovating, creating, designing models, drafts, products/works based on acquired knowledge.

B.   Understanding Mathematical Concepts

The ability to understand mathematical concepts is a skill expected to be achieved in mathematics learning, demonstrating understanding of learned mathematical concepts, explaining interconnections between concepts, and applying them flexibly, accurately, efficiently, and precisely in problem-solving. Understanding mathematical concepts is the core focus of mathematics learning (Fitri, 2017:243). Students' current mathematical concept understanding does not meet curriculum expectations, where concept comprehension is a primary focus in mathematics learning (Dewi et al., 2020:4). Mathematical understanding is a crucial aspect of mathematics learning. Thus, mathematical understanding cannot be forced; it entails concepts and logic in mathematics conveyed by teachers through several indicator stages. Mathematical understanding indicators highlighted by NCTM include: (1) defining concepts verbally and in writing; (2) identifying and providing examples and non-examples; (3) using models, diagrams, and symbols to represent a concept; (4) transforming one form of representation into another; (5) recognizing various meanings and interpretations of a concept; and (6) identifying properties of a concept and recognizing conditions defining a concept (Praja et al., 2021:14).

According to one mathematics subject teacher at SMA Al-Irsyad Kota Tegal, the process of learning mathematics at SMA Al-Irsyad still faces several problems including the low ability of students' understanding of mathematical concepts. This can be seen from the many students who get grades below standard. In addition, teachers have not applied varied and innovative learning, so students still have difficulty working on mathematics problems, and low mathematical critical thinking skills of students. Students seem inactive in class, they only listen to the teacher's explanation and then take notes of the information that has been conveyed, while the teacher plays an active role in conveying information.

The results of learning mathematics of SMA Al-Irsyad Kota Tegal students are still in the low category, this can be seen from the average value of the X class UAS in the academic year 2023/2024 has not reached 60% above the achievement criteria of learning goals (KKTP) which is with criteria of 66-85% to achieve the goals of learning. He also said that during teaching and learning mathematics in class using a conventional model with expository strategies, namely learning with verbal or oral delivery of material (discussion or lectures), he also said that most of the students did not have active attitudes and responded less to learning mathematics. In addition, learning about statistics from year to year has not yet met the KKTP criteria when daily tests are carried out. This is because when learning is carried out, students still respond less well to the material presented by teachers. This is because according to most students they do not like statistics because of the difficulty in understanding the questions, especially in determining mean, modus, range, deviation, and variety.

Based on the explanation above, the aim of this study is to describe whether the scientific approach in statistics material influences the ability to understand mathematical concepts. It is necessary to be aware of the existing conditions which indicate the need for the application of more effective learning models such as a scientific approach to improve understanding of mathematical concepts and learning achievement in statistics material for grade X at SMA Al-Irsyad Kota Tegal. The benefits of this research are expected to contribute to the development of science, especially in managing schools to improve school quality.

2.   METHODOLOGY

According to Oktaviani & Sholikhakh (2021:641), the technique used to collect data in this study is using a questionnaire. This research is also many started by deductive thinking in order to lower the hypothesis, after that did the examination in the field. This research is carried out using a quantitative approach and a Pre-experimental design with a one group Pretest-Posttest model. Thus, the results of the posttest obtained are included in the research design so that the experimental results can be compared with the results before the experiment. This research is also mostly started by deductive thinking in order to lower the hypothesis, after that did the examination in the field. The research results collected in the form of numbers are then analyzed using statistical models. This type of research is an experimental research type, namely knowing whether there is an influence of a scientific approach on the ability to understand mathematical concepts of grade X students on statistics material at SMA Al-Irsyad Kota Tegal. The population of this study is all students of class X even semester SMA Al-Irsyad Kota Tegal academic year 2023/2024 amounting to 128. samples in this study used random cluster sampling (random area sampling) where the population was divided into several separate (cluster) groups which were then taken randomly. In this study there is class X-2 as the experimental class, and class X-1 as the control class. The research design is described using a table as follows. Information :

Table 1. Research Design

Group	*Pretest*	*treatment*	*Posttest*
experimental class	H_1	X_1	H_2

Explanation :

H_1 : Pretest Results of Mathematical Concept Understanding of Students in the Experimental Class

H_2 : osttest Results of Mathematical Concept Understanding of Students in the Experimental Class

X_1 : Learning using the Scientific Approach in the experimental class

The research was conducted in April - May 2024 with 32 students from Grade X at Al-Irsyad High School. Data collection techniques involved tests and documentation. The impact of the scientific approach on mathematical concept understanding and learning achievement was measured using pretest and posttest tests via Microsoft Excel. The test results were analyzed using paired t-tests.

3. RESULTS

The data on mathematical concept understanding in this research focuses on understanding relational mathematical concepts obtained through two stages of tests: pretest and posttest given to the experimental class (X-2). Here are the results of students' learning in mathematical concept understanding and learning achievement.

Tabel 2 Mathematical Understanding Results Data

	Size	**Pre Test**	**Post Test**
1.	Mean	57	59
2.	Median	63	66
3.	Maximum Value	95	98
4.	Minimum Value	18	21

Based on the table above, it shows that there is a difference in students' scores before and after being taught using the scientific approach. The highest and lowest scores on the pretest were 95 and 18 respectively, with an average of 57. Meanwhile, the highest and lowest scores on the posttest were 98 and 21 respectively, with an average of 59. Therefore, it can be concluded that the scientific approach can enhance students' understanding of mathematical concepts in statistics.

The data obtained from the pretest and posttest were then subjected to a paired t-test using Microsoft Excel to determine the impact before and after using the scientific approach. The results of this test are as follows:

Tabel 1 Paired t-test test results

Variable	t_{hitung}	$t_{tabel(33;0,05)}$	**Conclusion**
Concept Understanding Student Mathematics	6,004	2,039	6,004 > 2,039 Ho rejected
Student learning achievement	6,004	2,039	6,004 > 2,039 Ho rejected

The results of the paired t-test show that the t-value for mathematical concept understanding is 6.004. From these data, it is concluded that since the t-value is greater than the t-table value, the scientific approach has a significant impact on students' mathematical concept.

4. CONCLUSION

After conducting research in Grade X at SMA Al-Irsyad Tegal on statistics, it can be concluded that:

1. The Scientific Approach is suitable to be used as an alternative in the classroom learning model.

2. The results of the paired t-test analysis indicate that the understanding of mathematical concepts improved when taught using the Scientific Approach compared to before using it. Therefore, it can

be concluded that the Scientific Approach influences the mathematical concept understanding of Grade X students at SMA Al-Irsyad Kota Tegal in statistics.

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