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# THE IMPLEMENTATION OF SCIENTIFIC APPROACH TO INCREASE MATHEMATICS UNDERSTANDING ABILITY ON ALGEBRAIC DERIVATIVE MATERIALS

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## ABSTRACT

Referring to the objectives of learning mathematics and NCTM, one of the abilities that must be developed is the ability to understand mathematics. The importance of having the ability to understand mathematics includes this ability listed in the learning of mathematics in the 2006 KTSP mathematics curriculum and the 2013 curriculum. This study aims to examine the increased understanding of the material concept of derivatives of algebraic functions in class XI high school students. This type of research is classroom action research. This research was conducted on class XI high school students for the 2020/2021 academic year, consisting of 16 students. The instrument used is a test of students' mathematical understanding abilities, in the form of 6 questions that focus more on students' understanding abilities regarding the derivative of algebraic functions; observation sheet for teachers and students to see the condition of the implementation of the action. This study shows that students' mathematical understanding abilities have increased as seen from the questions tested on each test with an increase in mastery from initially 31.25% to 56.25%. The results of this study indicate that the application of a scientific approach can improve the comprehension skills of class XI students on material derived from algebraic functions.

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## INTRODUCTION

Mathematics is a science that is always taught from the most basic level, such as the kindergarten level, to the upper level, such as the tertiary level, in education in Indonesia. According to (Aripin & Purwasih, 2017), "By studying mathematics, students must be able to reason and think logically, analytically, critically, and creatively. This is what makes mathematics an important subject to study at various levels. In line with the previous opinion, mathematics lessons are very influential in life because there are many uses in the scope of everyday life, as according to (Munawaroh et al., 2018), "Mathematics is one of the most

widely used activities in human life. In other words, human activity must start with housewives, traders, students, etc. and use their mathematical knowledge."

Referring to the objectives of learning mathematics and NCTM, one of the abilities that must be developed is the ability to understand mathematics. The importance of having the ability to understand mathematics includes that this ability is included in learning mathematics in the 2006 KTSP mathematics curriculum and the 2013 curriculum (Cahyani et al., 2018). This statement is also in accordance with Hudoyo's opinion in Mulyani et al. (2018) which states "The purpose of teaching mathematics is so that the knowledge conveyed can be understood by students". Santrock in Mulyani et al. (2018) also suggests that understanding concepts is a key aspect of learning. Thus, the ability to understand mathematics is an important basis for thinking in solving mathematical problems as well as in real life problems. From this statement, it can be concluded that increasing comprehension skills in learning mathematics is very necessary because understanding and mathematics are an inseparable unit.

Conditions in the field show that students' mathematical comprehension abilities are still low, this is evidenced by research conducted by Kusnadi et al. (2021) on trigonometry material at a public high school in West Bandung Regency that the ability to understand mathematics in trigonometry material is still very low and needs to be improved through various learning strategies that are considered appropriate to the situation, conditions and material to be studied. Further research was conducted by Mulyani et al. (2018) on algebraic material at a junior high school in West Bandung Regency, it shows that the mathematical understanding ability of class VIII students of West Bandung Regency Middle School in solving algebraic questions is still low. The study also stated that to improve students' comprehension skills, innovation in mathematics learning was needed, such as using innovative learning approaches or models. Further research conducted by (Putra et al., 2018) on rectangular material at a junior high school in West Bandung Regency found that as many as 15 students (41.67%) had low comprehension abilities.

According to (Gracia et al., 2020), "Mathematics is closely related to the use of logical thinking and the use of mathematical formulas in almost every subject studied. With so many formulas to remember, learning should be a fun process." According to (Satria & Zanthi, 2019) "A good mathematics learning process is that teachers need to create a learning environment that is comfortable and easily accepted by students so that they can encourage them to be involved in learning activities."

As we know, in general, one of the many materials in the field of mathematics that is studied at the SMA or MA level, one of which is material on the derivative of functions. Derivatives are closely related to other sciences such as the rate of spread of disease and the speed of vehicles, the maximum and minimum costs in the production of an item, not only that, derivatives are also very influential in everyday life. This can prove that derivatives need to be studied, understood and applied to students. Because in reality there are still many students who experience difficulties in learning material derived from algebraic functions.

(Sugita & Tandiyuk, 2019) argues that students find it difficult when understanding and studying material for derivatives of algebraic functions, this can be caused by students' low understanding of the properties of derivative functions, not only that students' low willingness to work on and complete practice questions that given can also affect the low understanding. In line with the opinion (Megariati, 2011) he said that the main reason why students have difficulty understanding derivative function material is students' lack of knowledge about the concept and properties of derivatives. From these statements it can be concluded that the material for the derivative of algebraic functions is one of the sub-mathematical materials which is difficult for students to understand.

The researcher suspects that this problem is also experienced by high school students in the location used for research. To confirm this assumption, the researcher here conducts interviews with a mathematics teacher at the school. The results of the interviews conducted by the researchers obtained information that it was true that students at the high school could not understand the material for derivatives of algebraic functions, besides that students also found it difficult to solve the questions given by the teacher.

According to (Sulaiman, 2018), argues that "Teachers must be able to create a comfortable learning environment according to the level of cognitive development of students.". Where if the application of the learning process is carried out in a fun, exciting and not boring way it can be a challenge for educators.

(Kurniawan, 2016) states, "Learning with the scientific method can be defined as learning that is designed in such a way that students actively construct concepts, laws, or principles with the stages of observing (to identify problems they want to know), formulating questions (and formulate hypotheses), collect data/information using various techniques, process analyze data/information and draw conclusions and communicate conclusions".

According to (Widiani et al., 2016) "Learning with a scientific approach does not see learning outcomes like the estuary of the past. However, the learning process is considered very important. The learning process with this approach depends on the ability of students to come up with concepts or build their own mathematical problems. According to Sanjaya in (Magdalena, 2018) "A learning device based on a scientific approach is a series of learning activities that emphasize critical and analytical thinking processes in order to find and find answers to the problem in question." So that in the process of finding answers, students' mindsets regarding the material being taught will be formed.

The scientific approach has also been proven to be able to improve students' mathematical understanding skills in research conducted by (Mardiyani, 2016) on function composition and inverse function material. In the research I did here, there was an update where the material I took was material for derivatives of algebraic functions.

From these statements, I am here as a researcher trying to be able to apply a scientific approach to material for derivatives of algebraic functions in the hope of improving the results of learning tests and increasing the ability to understand mathematics in high school students.

## **METHOD**

This research method is Classroom Action Research (CAR), namely research to provide an overview of appropriate learning actions and strategies to improve the ability of students' mathematics teachers and students' interactive learning. The time for this study starts from Wednesday, November 29, 2021 to December 9, 2021 in the odd semester of the 2020/2021 academic year at a high school in the Ciwidey area. The research subjects in this study were class XI with a total of 16 people consisting of 6 male students and 10 female students.

The technique used in analyzing data and determining the percentage of student learning completeness using the Ministry of Education and Culture formula (Rosna, 2016) is as follows:

Learning completeness

$$\text{Learning completeness} = \frac{\text{number of students who complete}}{\text{total number of students}} \times 100\%$$

A class is said to have completed learning classically if the percentage of completeness standards achieved is at least 65%.

$$\text{Average Value (AV)} = \text{total} \frac{\text{score}}{\text{maximum score}} \times 100\%$$

The criteria for the level of success of the action are determined as follows:

**Table 1.** Action Success Level Criteria

Percentage	Category
$80\% < AV \leq 100\%$	Very good
$60\% < AV \leq 80\%$	Good
$40\% < AV \leq 60\%$	Enough
$20\% < AV \leq 40\%$	Not enough
$0\% < AV \leq 20\%$	Very less

## RESULTS AND DISCUSSION

### *Results*

At this stage, the things that must be done are the preparation of a learning implementation plan (RPP) based on the syllabus which is used as a reference for implementing this classroom action research. Then the researcher made an observation sheet which was shown to the teacher and students, and made an evaluation tool for the cycle 1 test. Another preparation was to further strengthen the knowledge and understanding of the researcher regarding the implementation of learning with a scientific approach. Cycle 1 was carried out in one meeting attended by 16 students consisting of 6 male students and 10 female students. Teaching and learning activities are carried out by the author as a teaching teacher who is assisted by a mathematics teacher as an observer. In cycle 1 learning was carried out for 2x40 minutes. The teacher carries out learning activities with a scientific approach to material derived from algebraic functions. The design of cycle 1 is carried out by the teacher with steps arranged in the form of a lesson plan (RPP) which as a whole describes the activities of the teacher and students and their realization. Data on student learning outcomes on material derived from algebraic functions was obtained by conducting tests at the end of cycle 1. Out of 16 students, the results were obtained which can be seen in table 2 below.

**Table 2.** Student Learning Outcomes Test Scores on Derivatives of Algebraic Functions  
 Cycle 1

Information	The Number of Students	Percentage
Finished	5	31,25%
Not finished	11	68,75%
Total	16	100%

From table 2 it can be concluded that students who received a complete score with KKM 70 were 5 students or 31.25% and those who had not completed were 11 students or 68.75%. of the number of students in the class as many as 16 people. At this stage, the researcher and the teacher together discussed the deficiencies found in the implementation of the cycle 1 action. Because in this cycle 1, learning using a scientific approach was considered less than optimal

as seen from the unsatisfactory results. Therefore, the researcher re-implemented learning in cycle 2 while continuing to use a scientific approach with several changes based on what had been discussed with the teacher, such as having to pay more attention to students who were not active.

At this stage of cycle 2, the things that must be done are making lesson plans (RPP) as in cycle 1. Then the researcher makes observation sheets that are shown to teachers and students, and makes evaluation tools for cycle 1 tests. Other preparations are more strengthen the knowledge and understanding of researchers regarding the implementation of learning with a scientific approach. Cycle 2 was carried out in one meeting attended by 16 students consisting of 6 male students and 10 female students. Teaching and learning activities are carried out by the author as a teaching teacher who is assisted by a mathematics teacher as an observer. In cycle 2 learning is still carried out at the same time as in cycle 1, namely for 2x40 minutes. The teacher carries out learning activities with a scientific approach to material derived from algebraic functions. The design of cycle 2 is carried out by the teacher with steps arranged in the form of a lesson plan (RPP) which as a whole describes the activities of the teacher and students and their realization. Data on student learning outcomes on material derived from algebraic functions was obtained by conducting tests at the end of cycle 1. Out of 16 students, the results were obtained which can be seen in table 3 below.

**Table 3.** Student Learning Outcomes Test Scores on Derivatives of Algebraic Functions  
Cycle 2

<b>Information</b>	<b>The Number of Students</b>	<b>Percentage</b>
Finished	9	56,25%
Not finished	7	43,75%
Total	16	100%

From table 3 it can be concluded that 9 students or 56.25% got a complete score with KKM 70 and 7 students or 43.75% who did not complete it. of the number of students in the class as many as 16 people. At this stage, students who are less active can play a more active role in learning so that there is an increase in results by increasing students who complete the questions to obtain a minimum KKM score (70).

This reflection activity in cycle 2 showed satisfactory results for both teachers and researchers, because with the application of this scientific approach, there was an increase in the number of students who were able to play an active role in learning which resulted in better results as well. So that it can be said that the weaknesses in the implementation of cycle 1 actions can be corrected in cycle 2 even though there are still students who are still unable to achieve the KKM score.

### ***Discussions***

This classroom action research consisted of 2 cycles, each cycle consisting of 1 meeting which was carried out according to research procedures. The number of meetings in each cycle is based on the density of the material discussed. Learning is carried out using a scientific approach with more emphasis on 2-way communication such as question and answer until students can conclude from the learning process that has been carried out. Before carrying out this research, the researcher first conducted interviews with mathematics teachers

at a high school in the Ciwidey area in order to find out the extent to which students' understanding of concepts was. In cycle I there were still deficiencies in the learning process with a scientific approach because new students were getting experience learning offline at the high school level.

In cycle II there was an increase in the quality of learning, seen from the presentation results and students' activeness in group discussion activities. This was also reinforced by the results of the students' final test which showed an average score of 73.33 out of a maximum score of 100, in other words, students' understanding of concepts increased. Of course this is very satisfying for researchers and teachers because learning with a scientific approach uses running optimally.

This is also in line with research conducted by (Mardiyani, 2016) regarding the application of a scientific approach to improving students' mathematical understanding abilities. The results of (Nurzaman et al., 2022) previous research show that the scientific approach has a better impact on students' mathematical comprehension abilities. From the results obtained during the research, information was obtained that learning with a scientific approach can improve the ability to understand mathematics, although the increase is less significant. This of course can happen if the approach procedure is carried out consistently and with the appropriate material.

## **CONCLUSION**

Based on the results of the analysis and discussion, it can be concluded that a scientific approach can improve students' mathematical understanding abilities in the material of derivatives of algebraic functions.

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