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# THE IMPLEMENTATION OF SCIENTIFIC APPROACH TO IMPROVE MATHEMATICAL UNDERSTANDING ABILITY ON JUNIOR HIGH SCHOOL STUDENTS

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## ARTICLE INFO

### Article history:

Received Apr 19, 2023  
Revised May 05, 2023  
Accepted Jun 18, 2023

### Keywords:

Mathematical  
Understanding Ability  
Scientific Approach  
Junior High School

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## ABSTRACT

Mathematical understanding ability is a very important skill for students to achieve, because mastering mathematical involves more than just remembering formulas and knowing how to count, understanding concepts is also needed. But in reality, understanding skills are still low, students are still mostly fixated on existing formulas and examples given by the teacher. The purpose of this study was to see the improvement of mathematical understanding ability of VII students on Algebra material at Dharma Kartini Junior High School. This research uses classroom action research (CAR). The method used the spiral model of action research from Kemmis and McTaggart. The instrument used was a test instrument consisting of 10 questions of algebra material which was prepared based on the mathematical understanding ability of students whose learning used a scientific approach. This research was conducted in 2 cycles, each cycle consists of several stages starting from the planning, action, observation and reflection stages. The results of this study indicate that the aspects of students' mathematical understanding ability have increased as seen from the increasing percentage achievement on the question indicators after 2 learning cycles, namely in cycle I by 48% and cycle II by 78%. It is known that algebra material in class VII students of Dharma Kartini Junior High School can be influenced by the scientific approach with mathematical understanding ability. As more and more students showing understanding they can conclude and explain back what they have learned.

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### How to Cite:

Silvia, S., Fitrianna, A.Y., Hendriana, H. (2023). The Implementation of Scientific Approach to Improve Mathematical Understanding Ability on Junior High School Students. *JIML*, 6(3), 194-201.

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## INTRODUCTION

Mathematical is a science that must be studied, because in learning mathematical, students are equipped with the ability to think logically, analytically, systematically, critically, innovatively and creatively. Mathematical contains abstract concepts in an arranged manner. At present, the role of studying mathematical is so great for students that learning

mathematical in elementary schools affects students' understanding of concepts in secondary schools, understanding will help students think and make decisions.

According to Bernard et al (2018) Mathematical understanding is a very important part, because the material taught to students is not only memorizing formulas in the material, but students' understanding can be better understood when the material is delivered. Agree with Saraji et al (2018) the ability to understand mathematical is a very important skill for students to achieve, because mastering mathematical involves more than just remembering formulas and knowing how to count, an understanding of concepts is also required. In research Yulianty (2019), It is also stated that the ability to understand mathematical is important for learning mathematical.

Sarwoedi et al (2018) stated mathematical understanding is that every student must acquire this basic ability to overcome challenges in the real world, by using mathematical formulas in mathematical that begin with simple examples, resulting in stations that are correctly presented as answers. According to Hendriana, H., Rohaeti, E. E., & Sumarmo students already have the ability to understand mathematical if they are able to do these things: a) Reconvey a theory; b) Designing several objects according to certain characteristics according to the concept; c) Contains references and not theoretical references d) Expresses theories in various forms such as symbols or mathematical descriptions; e) Optimizing important ways in a theory; f) Can be used, utilized and choose the operation of a theory; g) Applying theory in mathematical understanding (Cahyani et al., 2018).

Various studies reveal that actually in Indonesia the ability to understand is still relatively low. In accordance with research Amintoko (2020) students' low understanding of mathematical can be caused by external factors from the teacher and internal factors from students. External student factors can be caused from outside the student, such as strategies in learning. While internal factors are caused from within the student, such as attitudes towards mathematical. Then the results of research Apriliyanto (2019) say that the ability to solve mathematical is low, therefore the ability to understand mathematical is low. In research Fajar et al (2018) stated that students rush to record every concept of the material presented without understanding what they are recording. Furthermore, students are unable to re-understand the concepts in their notes when given practice questions. If this continues, students will be trained to be spoiled students and have a negative impact on their learning outcomes.

Based on the explanation above, the ability to understand still needs to be improved. By increasing students' mathematical understanding abilities, the teacher can improve them, namely by the rules of SC et al (2020): 1) the teacher gives students the opportunity to express opinions; 2) Through the use of students' understanding of mathematical problems, the teacher creates mathematical learning in these problems; 3) the teacher prepares good learning and determines an approach that is in line with the character of the students he teaches. There are many approaches to learning mathematical that are relevant to use, one of which is applying a scientific approach to learning mathematical.

In the results of research Ulfa (2018), mentions the use of a scientific approach to help students understand various things, that knowledge can come from anywhere and knowledge does not depend on one direction from the teacher. Therefore, learning conditions are directed to encourage learners to find out from various sources through observation, and not just being told. students in finding out from various sources through observation, and not just being told. Applying a scientific approach to learning requires expertise and has 6 process characteristics or characteristics, namely (1) learning materials are proven facts; (2) students respond during learning that has been conveyed by the teacher or teacher, students interact with the teacher; (3) motivating students to think critically, be able to correctly identify and apply learning

materials in everyday life; (4) provide support for students to be able to think hypothetically in seeing differences or similarities, distinguishing relationships between one and the other in the material; (5) students can understand the material with a logical mindset; (6) formulated in a simple and clear manner, keeps students interested in learning (Aulia et al., 2020). It can be concluded that learning using a scientific approach is a scientific approach to learning enabling students to solve real-world problems with the aim of developing their capacity for knowledge construction as well as higher-order, analytical, and systematic thinking skills.

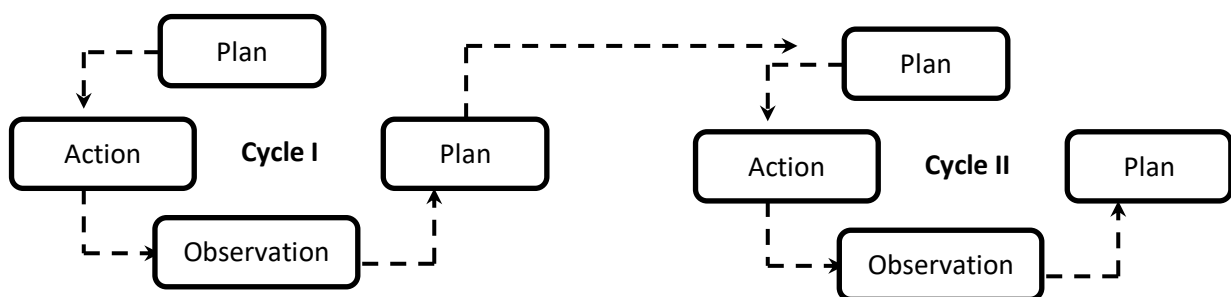
One of the mathematical materials, namely operations in algebra form, is studied in junior high school to university. This material requires understanding and mastery of the correct concept. Based on the research by Loli et al (2018), several errors were found in math problems such as grouping symbols such as coefficients, constants, algebra operations, changing questions in algebra form, making mistakes in distinguishing like and unlike terms, therefore students can't get it done.

Researchers conducted observations, interviews and discussions with mathematical teachers at Dharma Kartini Junior High School. The information obtained is: (1) students in their mathematical abilities are still weak or low; (2) students lack motivation in learning; (3) the application of the scientific approach in learning is not optimal; (4) learning tools used by teachers in the learning process are not helpful; (5) the questions used as assessments are mostly non-context-based and not problem-based

Several previous studies according to Matrahim et al (2019) explained that there was an increase in the scientific approach to students' mathematical understanding abilities taught in groups. These findings are associated by researchers to apply a scientific approach to improving the ability to mathematical understanding and learning in an individual way. Research conducted by Yanti et al (2019) states that the scientific approach to students' mathematical abilities has increased by using geogebra. These findings do not need to be carried out at Dharma Kartini Middle School because of the lack of facilities and infrastructure. In line with research conducted by Nurzaman et al (2022) shows that the scientific approach to the ability to mathematical understanding has increased in SPLDV material. These findings can be linked by researchers to apply a scientific approach to improving students' mathematical understanding abilities with algebra material. Based on the description above, we state that the purpose of this research is to find out the implementation of scientific approach to improve mathematical understand the ability in algebra material at Dharma Kartini Junior High School.

## METHOD

This research is Classroom Action Research (CAR) using the spiral model of action research from Kemmis and McTaggart. PTK can also be called Classroom Action Research (CAR) is a form of research in its nature in the classroom by using actions to enhance the learning process (Susilowati, 2018).



**Figure 1.** Kemmis and McTaggart Model Diagram

This research was conducted in November 2022, which was carried out in the odd semester of the 2022/2023 school year. Conducted 2 cycles with the subjects in this study were 20 class VII students at Dharma Kartini Junior High School and the object studied was a mathematical understanding ability test using 10 essay test questions whose learning used a scientific approach then given to students and understanding abilities in the first cycle and and second cycle.

Then after testing the students, the authors conducted an analysis to find out the results of the mathematical understanding ability test. According to Nuryasana & Desiningrum (2020) the results of students' mathematical understanding ability tests were converted into a percentage scale, then analyzed according to the guidelines for classical completeness criteria. The test results intend to see individual completeness and classical completeness by determining the classical completeness criteria  $\geq 85\%$ . The data analysis technique is by assessing the answers from the tests that have been carried out, using the formula (Masturah et al., 2018) :

$$S = \frac{\text{Scores obtained by students}}{\text{maximum score}} \times 100$$

## RESULTS AND DISCUSSION

### *Results*

#### **First cycle stages**

In this first cycle stage, a learning implementation plan (RPP) is based on the syllabus and uses it as a reference for classroom action research. The researcher then compiled the observation sheet, showed it to the teacher and students, and compiled a mathematical understanding ability test in the form of an evaluation tool for the first cycle (cycle I). Another preparation is to further strengthen the knowledge and understanding of researchers regarding the implementation of scientific learning.

Cycle I was carried out in 1 week 2 meetings attended by 20 students, there were 13 female students and 7 male students. The learning process in cycle I was carried out by the author acting as a teacher who taught accompanied by an experienced mathematical teacher, here the mathematical teacher became an observer. Learning in cycle 1 was carried out for 2 x 40 minutes. The learning process on algebrai material uses a scientific approach. The preparation for cycle I was carried out by the teacher, and the steps were outlined in the form of a lesson plan which in its completeness describes the activities of the teacher and students during the learning process.

The stages of learning implementation have been carried out, as well as the stages of evaluation and observation in cycle I. The findings of the skills test show that not all students are in a position of mastery of algebra material, through these results it is necessary to provide more algebra material to students so they can apply the material.

**Table 1.** Mathematical Understanding Ability Test Scores in Cycle I Algebra Material

<b>Information</b>	<b>The number of students</b>	<b>Percentage (%)</b>
Complete	3	15%
Not Complete	17	85%
Amount	20	100%

The following table shows the learning outcomes data of 20 students. Looking at these results, it can be seen that 3 students have obtained or declared their learning complete based on the

number of test questions for the first cycle stages or 15% of the 20 students who meet the requirements to achieve a score above 60. This shows that students still do not understand mathematical concepts. However, only 17 out of 20 students achieved 85% or achieved scores below 60. This shows that students do not master mathematical concepts, especially algebra material.

The next stage is a reflection of the first cycle. In this step, the teacher and researcher work together to see what problems are found and will be corrected at the next stage of the cycle. The scientific approach is still not optimal at this point in the first cycle.

Taking into account the results of cycle I meetings, they have not shown an increase that meets the criteria, it is also necessary to remember that there are still many shortcomings. Researchers and teachers continued learning activities to the next stage, namely the implementation of learning activities and the results of the first cycle of mathematical understanding ability tests did not meet the completeness indicators in this study. To be more specific, in the second cycle stage test, researchers and teachers work together to prepare what is needed or further improvement from the first cycle.

### **Stages of the second cycle**

At this stage the same as the first cycle was carried out, namely the preparation of a learning implementation plan (RPP) based on the syllabus which was used as a reference for conducting classroom action research. The researcher then compiled the observation sheet, showed it to the teacher and students and made an evaluation tool for the second cycle test (cycle II). Another preparation is to further strengthen the knowledge and understanding of researchers regarding the implementation of scientific learning.

Cycle II was carried out in 1 week 2 meetings attended by 20 students, there were 13 female students and 7 male students. The learning process in cycle I was carried out by the author as a teacher who taught accompanied by an experienced mathematical teacher, here the mathematical teacher became an observer. Learning in cycle 2 was carried out for 2 x 40 minutes. The learning process on algebra material uses a scientific approach. Preparation for cycle II is carried out by the teacher, and the steps are outlined in the form of a lesson plan which in its completeness describes the activities of the teacher and students during the learning process.

The next step is observation and evaluation of the second cycle after the learning implementation stage is complete. Learning activities are carried out optimally during the stages of this second cycle. The implementation of the second cycle stage test is better than the first cycle stage test, this can be observed in terms of learning involvement, student activity and results/scores in administering the mathematical understanding ability test.

**Table 1.** Mathematical Understanding Ability Test Scores in Cycle II Algebra Material

<b>Information</b>	<b>The number of students</b>	<b>Percentage (%)</b>
Complete	15	75%
Not Complete	5	25%
Amount	20	100%

The following table shows the learning outcomes data of 20 students. Looking at these results, it can be seen that 15 students have obtained or stated that their learning is complete based on the number of test questions in the second cycle stage or 75% of the 20 students who meet the requirements to achieve a score above 60. This shows that students mathematical understanding concepts very well. However, only 5 of the students achieved 25% or achieved

scores below 60. This shows that students do not master mathematical concepts, especially algebra material. So, compared to the first cycle test, more students indicated that they understood algebra concepts. In other words, the results of the second cycle stage test showed an increase in student achievement during the second cycle stage.

### ***Discussions***

This classroom action research was divided into two cycles, each of which had two meetings which were carried out according to research procedures. The density of the material discussed determines the number of meetings in each cycle. Learning is carried out using a scientific approach by focusing more on individual understanding ability tests, students are trained to be able to find and solve a problem that has been given by the teacher. Before carrying out this research, the researcher first conducted interviews with mathematical teachers at one of the Dharma Kartini Junior High School to find out the extent of their mathematical understanding abilities. In cycle I there were still many deficiencies in the learning process with a scientific approach, because new students were treated like this, students seemed unfamiliar with this learning process.

In cycle I and cycle II there was an increase in cycle II, as seen from the results of the percentage of students' activeness in answering questions and daring to come forward to answer the questions that had been given. This was also reinforced by the results of the student's final test which showed that the average score had increased close to the maximum value, in other words, students' understanding of concepts had increased. Of course this is very satisfying for researchers and teachers because learning with a scientific approach can improve students' mathematical understanding abilities.

In previous research, that scientific approach learning can improve abilities that influence students' mathematical understanding abilities. The scientific approach has been found to help students improve their mathematical understanding. The results of the study explain that the capacity for understanding mathematical can be optimized through a scientific approach (Nurmaenah et al., 2020).

Students who study mathematical with a scientific approach are better able to understand it than students who study it with other approaches. The scientific approach focuses on active participation in learning, with the instructor or teacher only acting as a facilitator. When students are ready to study independently and research material without a teacher explaining it is satisfying. Thus, it has been proven that using a scientific approach can help students improve their mathematical understanding (Walidah et al., 2020).

### **CONCLUSION**

Based on the results of this research data analysis, it can be concluded that algebra material in class VII students Dharma Kartini Junior High School can be influenced by a scientific approach with mathematical understanding abilities. The results of the mathematical understanding ability test in cycle I did not show an increase and in cycle II there was an increase. This is known by the more students who show their understanding by being able to conclude and explain back what they have learned. Suggestions that can be conveyed to other researchers and also to mathematical teachers who teach in schools are expected to apply a scientific approach to increasing students' mathematical understanding abilities, especially understanding algebra material then students can solve math problems in an understanding and understanding manner.

**ACKNOWLEDGMENTS**

The researcher is very aware that during the preparation of the article, there was a lot of help from various parties. Therefore, the researcher is very grateful especially to the ISSAME 4th Committee for the facilities Coaching Clinic, tutor of mathematical and the principal of Dharma Kartini Junior High School who have allowed researchers to conduct research in schools. The researcher hopes that this article can be useful for readers and other researchers.

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