
THE IMPLEMENTATION OF SCIENTIFIC APPROACH TO INCREASE MATHEMATICAL PROBLEM SOLVING ABILITY ON JUNIOR HIGH SCHOOL STUDENTS

Siti Nurlelah¹, Heris Hendriana², Aflich Yusnita Fitrianna³

¹ IKIP Siliwangi, Jl. Terusan Jend. Sudirman, Cimahi, Jawa Barat, Indonesia
noorlelah25@gmail.com

² IKIP Siliwangi, Jl. Terusan Jend. Sudirman, Cimahi, Jawa Barat, Indonesia
herishen@ikipsiliwangi.ac.id

³ IKIP Siliwangi, Jl. Terusan Jend. Sudirman, Cimahi, Jawa Barat, Indonesia
aflichyf@ikipsiliwangi.ac.id

ARTICLE INFO

Article history:

Received Apr 15, 2023

Revised May 05, 2023

Accepted Jun 16, 2023

Keywords:

Scientific Approach
Mathematical Problem
Solving Ability
Junior High School

ABSTRACT

Mathematics is a field of study that plays an important role in the world of education. Mathematics as a science that must be mastered because it supports and is interrelated with other subjects. The background of writing this article is the low ability of students to solve mathematical problems. This research was conducted because there are still many teacher centered learning activities. To improve the ability to solve the need for an approach model that can be developed to position students as learning centers is the application of scientific models. The scientific approach is an approach aimed at students. In learning activities direct students to be active and understand the concept. This study aims to apply a scientific approach to Dharma Kartini Junior High School students. The research target was class VIII with a 28 students on the subject matter of a two variable linear equation system. The research conducted was classroom action research. Classroom action research trains critical, systematic thinking, starting from planning, implementing, observing and reflecting. This study provided instruments, namely pre-test and post-test in the form of 5 questions of problem solving abilities to students which were carried out in 2 cycles. The research results obtained for the first cycle showed that students mastery of mathematical concepts was still not good. Therefore, proceed to the next stage, namely the second cycle. Based on the implementation of learning in the second cycle, a very significant increase was obtained. Thus it can be concluded that the scientific approach can be applied in learning to improve problem solving abilities in the matter of a system of two variable linear equations.

Copyright © 2023 IKIP Siliwangi.

All rights reserved.

Corresponding Author:

Siti Nurlelah,
Department of Mathematics Education,
Institut Keguruan dan Ilmu Pendidikan Siliwangi,
Jl. Terusan Jend. Sudirman, Cimahi, Indonesia
Email: noorlelah25@gmail.com

How to Cite:

Nurlelah, S., Hendriana, H., Fitrianna, A.Y (2023). The Implementation of Scientific Approach to Increase Mathematical Problem Solving Ability on Junior High School Students. *JIML*, 6(3), 178-185.

INTRODUCTION

Mathematics is a field of study that plays an important role in the world of education. Mathematics as a science that must be mastered, because it supports and is interrelated with other subjects. In addition, mathematics is needed both in everyday life and in dealing with

advances in science and technology, therefore mathematics must be offered to every student from elementary and kindergarten Davita & Pujiastuti (2020). Learning is a process of interaction between students and teachers, students with learning resources in a learning environment. The purpose of learning is a communication that produces changes in attitudes, skills and knowledge in relation to specific goals related to individual behavior patterns to realize certain tasks (Nurfadilah & Hakim, 2019). Learning is assistance provided by the teacher so that the process of acquiring knowledge and knowledge can occur mastering skills and habits, as well as forming attitudes and beliefs in students. In other words, learning is a process to help students learn well. The learning process is experienced throughout a person's life and can apply anywhere and anytime (Suardi, 2018).

Currently the problem in learning is the lack of student's reasoning abilities in solving math problems is low, this is addressed by the learning process which is still dominated by the lecture method, resulting in a lack of student motivation in learning mathematics, student learning outcomes are still low and student's abilities in solving problem are still low mathematics (Izzah & Azizah, 2019). Mastery of concepts in mathematics needs to be emphasized in learning mathematics so that when students find problem solving questions they can solve them according to the skills in mastering mathematical concepts that students must have, namely instilling basic concepts and developing skills that include planting and understanding concepts from the mastery of concepts students are expected to be able to solve mathematical problem solving well (Ginancar, 2019).

Based on the results of interviews conducted by researchers with mathematics teachers at Junior High School Dharma Kartini, it was found that students' mathematical problem solving abilities were still low. This is because learning is still conventional or learning is still centered on the teacher and the lecture method, the facilities and infrastructure are not qualified, the enthusiasm of students in learning is lacking, and the low ability of students to solve mathematical problems. Especially on story problems, students still have difficulty solving them. The reason students are less able to solve problems in the form of stories is a lack of understanding of the initial concept of the material. Like the material being studied at the moment, namely system of linear equations of two research variables material and judging from the results of the daily test it was found that it had not reached the minimum completeness criteria. In the material that presents problems in the form of everyday stories, namely system of linear equations of two research variables Indahsari & Fitrianna (2019) show that most students make mistakes when completing the assignments given.

To improve student's mathematical problem solving abilities. It is necessary to have an approach in the learning process. One learning model that can be developed to position students as learning centers is the application of scientific models. The scientific approach is an approach in learning activities using a scientific approach that directs students to be active in knowing and understanding concepts (Iasha, 2018). In line with Meilani et al. (2020) the scientific approach is an approach to the learning process that provides opportunities for students to actively construct concepts, laws and principles with activities in the form of observing, asking reasoning, associating and communicating. Learning with a scientific approach is able to make a positive contribution in improving critical thinking skills in children, developing children's character and intelligence so that children are able to solve simple problems (Yunita et al., 2019). The result of Setiawan (2019) show that learning activities using a scientific approach can train scientific literacy.

In addition, the scientific approach has the characteristic of being student centered. Involve science process skills, involve potential knowledge process skills and can develop student

character (Iasha, 2018). The learning objectives of using a scientific approach are based on the advantages of this approach, including: (1) increasing intellectual abilities, especially higher order thinking skill, (2) to shape students ability to solve a problem systematically, (3) creating learning conditions in which students feel that learning is a necessity, (4) obtain high learning outcomes, (5) to train students in communicating ideas, especially in writing articles, and (6) to develop student character (Yuliyanto et al., 2018).

There have been several previous studies investigating the application of a scientific approach to problem solving skills with mixed results. The resultss of research conducted by explaining the development of learning devices using a scientific approach meet practical criteria with the results of test of mathematical problem solving abilities with completeness of 80% (Nahdi & Cahyaningsih, 2018). These findings can be linked by researchers, namely applyng a scientific approach to improve avilities with pre-test and post-test. Research by Widiastuti et al. (2018) explains the significant influence of the scientific approach on problem solving abilities. These findings can be related by researchers to apply a scientific approach to the problem solving abilities of class VIII students at Juior High School Dharma Kartini. The results obtained by Indahsari & Fitrianna (2019) show that problem solving and students understanding of concepts are still low. To minimize this, one of the choices implemented by the teacher is tto pose practical questions and meaningful learning so that students understand concepts longer. This finding can be related by reseahers to problem solving skills with Two-Variable Linear Equation System material in class VIII Junior High school

METHOD

The research conducted was Classroom Action Research. This type of research is able to offer new ways and procedures to improve and improve the profesionalism of educators in the teaching and learning process in the classroom by looking at students. Educators can see for themselves the practice of leraning with other teachers where they can conduct research on students in terms of their interactions in the learning process. This research trains critical and systematic thinking starting from planning, implementing, observing and reflecting. classroom action research will be able to improve learning processes and products. Classroom action research will not burden educational work in their daily lives (Susilowati, 2018). *Classroom Action Research* (CAR) is a reflective study that uses certain activities to enhance the professionalization of classroom learning practices (Rahmawati et al., 2022).

The entire class action research subject was taken many as 28 students of class VIII at Junior HigH School Dharma Kartini. This classroom action research provides test instruments, the instruments used are pretest and post test in the form of 5 problem solving abilities to students in cycle I and cycle II to see how to improve students mathematical problem solving abilities using a scientific approach. Each research cycle includes the following procedures: (1) planning, (2) taking action, (3) data collection, (4) analisis, (5) reflecting.

Calculating information on the application of a scientific approach to mathematical problem solving skills:

To find out individual learning scores, using the formula:

$$\text{Final score} = \frac{\text{students acquisition score}}{\text{total score}} \times 100$$

Determine the percentage of classical learning completeness by using the formula Parahita et al. (2019):

$$\text{Classical mastery} = \frac{\text{the number of students who earned grades} \geq 75}{\text{the number of students who took the test}} \times 100$$

RESULTS AND DISCUSSION

Results

This research uses classroom action research which consist of two cycles, where each cycle consist of planning activities, implementation, observation and evaluation actify results and reflections.in stage I of this cycle the researcher prepares a learning implementation plan based on the curriculum used as a benchmark measuring the implementation of classroom action rsearch, after that the research, after that the reseacher prepared observation sheets for theachers and students, as well as made an evaluation tool for the first cycle mathematical problem solving ability test. Planning for cycle I carried out a survey of schools which were the point for research and saw what material was being studied in learning activities. The results obtained for the material being studied are the system of two variable linear equations.

First Cycle Stages

Cycle 1 was carried out in two meetings attended by 28 students consisting of 14 male students and 14 female students. The teaching and learning process in cycle 1 was carried out by researchers as teachers and supported by experienced mathematics teachers who acted as observers. Cycle 1 wa carried out for 2 x 40 minutes. Learning activities are carried out using scientific and pedagogic approaches designed in such a way that students actively construct the concept of a two variable linear equation system. Cycle 1 planning is carried out by theteacher according to the learning implementation plan with arranged steps, which as a whole describe the activities of the teacher and students during the lesson. After passing through the stages of research implementation, the observation and evaluation stages of cycle 1 have been completed. The test results obtained showed that only some students were able to solve problems in the two-variable linear equation systemmaterial, wit unsatisfactory results, it was necessary to follow up so that students understood the material.

Table 1. Student Test Score Cycle I

Description	The number of students	Percentage
Finished	7	25%
Not Finished	21	75%
Total	28	100%

It can be seen in table 1. The learning outcomes data of 28 students revealed that students who were able to solve problems in the first cycle test, who achieved a score of 75 and above were 7 students with a percentage (25%) while students who had not reached a score of 75 were 21 students with percentage (75%). Classically, student learning activities in this first cycle obtained a score of 1375 with a presentation of 49.10%. Student learning activities are said to be successful if classically the percentage of activities carried out in the learning process reaches a minimum of 75%. This shows that students' mastery of mathematical concepts is still not good.

The next stage is reflection in the first cycle, researchers and teachers together see the gaps that occur in learning activities and are corrected in the next cycle stage. In cycle one the application

of this scientific approach was not optimal. By looking at the acquisition of results in cycle one, it has not shown an increase that meets the criteria and there are still many deficiencies in the implementation of activities and the acquisition of learning outcomes for the two-variable linear equation system on the math problem-solving ability test does not meet the integrity indicators in this school year. Therefore, researchers and educators proceed to the next stage, namely the second cycle test stage, and researchers and educators prepare what is needed and what needs to be improved from the first cycle.

Second Cycle Stages

At this stage it is the same as the first cycle, that is, based on the curriculum that is used as a reference in conducting classroom action research, a Learning Implementation Plan is prepared, after which the researcher prepares observation forms for teachers and students and prepares an assessment tool to test mathematical problem solving abilities in cycle two . Another preparation is strengthening the understanding and knowledge of researchers about the applied scientific approach.

Cycle two took place in two meetings attended by 28 people, consisting of 14 male students and 14 female students. Cycle two was carried out for 2 x 40 minutes. Learning activities are carried out using a scientific and pedagogical approach that is designed in such a way that students actively construct the concept of a Two-Variable Linear Equation System. Planning for the second cycle is carried out by the teacher with the steps of the lesson plan which as a whole describe the activities of the teacher and students in learning. After passing through the learning implementation stage, the learning implementation stage is in cycle two and the observation and evaluation stage is complete.

In cycle two to overcome the deficiencies that occurred in cycle one. Besides trying to perfect the previous learning process, the researcher also tried to maximize students' problem-solving abilities in the matter of a system of two variable linear equations in a scientific direction. approach with the hope that the results obtained will increase. The learning activities in the second cycle went well and the students as a whole contributed actively, passionately and enthusiastically. Therefore the researcher gave back the test in cycle two. The test results obtained showed that the results obtained were better and increased.

Table 2. Student Test Score Cycle II

Description	The number of students	Percentage
Finished	22	78,57%
Not Finished	6	21,43%
Total	28	100%

Based on the implementation of learning in the second cycle, student learning outcomes can be seen in table 2. It is known that there are 22 students who have achieved a score of 75 and above with a predicate (78.57%) while those who have not reached a score of 75 are 6 students with a percentage (21.43). %. With the results obtained by students in learning material for the Linear Equation System of Two Variable Mathematics for class VIII Junior High School Dharma Kartini it can be seen that 22 students completed and 6 students had not completed with the highest score of 90 and the lowest score of 60. Practically student learning achievement in cycle I obtained a score 2210 with a presentation level of 78.92%, meaning that classically the learning outcomes are said to be complete and relevant, namely by applying a scientific approach in cycle II, learning achievement in solving math problems increases.

Discussions

Classroom action research is a way for teachers to think creatively to facilitate problems during class learning. Prihantoro & Hidayat (2019) classroom action research is research that examines the causes and effects of treatment in an experimental research and also describes what was the source of research from the start before treatment and also the consequences after treatment, the purpose of this class action. Research not only identifies problems but also applies solutions to solve problems through improvement and change. These improvements and changes will improve the quality of learning in the classroom.

Before conducting this research the researcher first interviewed the teachers who taught the class to find out the extent of students mathematical problem solving abilities. In the first cycle there were many obstacles and deficiencies in the learning process using scientific, because new students received this kind of treatment in their learning activities. From the results of the test tested on students, the scores obtained were very low, students enthusiasm was lacking and they looked confused when solving problems. In cycle II there was an increase. It can be seen from the activeness of students in answering questions and courage in solving problems in front of the class. This is reinforced by the results of student test showing an increased average value. This is of course satisfying for researchers and teachers learning with a scientific approach can improve students mathematical problem solving abilities.

Problem solving ability is competency that students must have. Especially in two-variable linear equation system material where problems are presented with stories, students are focused on understanding the initial concept of the material, as the main capital in solving a problem. The ability to solve problems is a necessary ability in students lives so that it is hoped that students can be trained to solve problems in every day life. Therefore, mathematical problem solving skills are very important and need attention to be further developed. One of the objectives of learning mathematics and one of the graduation standards for students (Kharisma & Asman, 2018).

CONCLUSION

This is based on the results of research on the application of a scientific approach to the mathematical problem solving abilities of Grade VIII students of Junior High School in two-variable linear equation system material in each cycle following the stages of the procedure (1) planning, (2) taking action, (3) data collection, (4) analysis, (5) reflecting. The increase is seen in the test results from the 2 cycles which obtained that only 6 students completed the first cycle with a percentage of 25%, so the research was continued with cycle II and there was an increase in the number of graduates, namely 22 students with 78 representatives. 57%. Thus it can be concluded that the scientific approach can be applied in learning to improve problem solving skills in two-variable linear equation system material.

ACKNOWLEDGEMENTS

Researchers realize that in writing this article a lot of help from various parties. Therefore, on this occasion the researcher would like to thank the Junior High School Dharma Kartini, mathematics teachers and students who have played an active role in this research.

REFERENCES

- Davita, P. W. C., & Pujiastuti, H. (2020). Analisis Kemampuan Pemecahan Masalah Matematika Ditinjau dari Gender. *Kreano, Jurnal Matematika Kreatif-Inovatif*, 11(1), 110–117. <https://journal.unnes.ac.id/nju/index.php/kreano/article/view/23601>
- Ginanjari, A. Y. (2019). Pentingnya Penguasaan Konsep Matematika Dalam Pemecahan Masalah Matematika di SD. *Jurnal Pendidikan UNIGA*, 13(1), 121–129. <https://doi.org/http://dx.doi.org/10.52434/jp.v13i1.822>
- Iasha, V. (2018). Peningkatan Proses Pembelajaran Tematik Terpadu Menggunakan Pendekatan Scientific di Sekolah Dasar. *Jurnal Pendidikan Dasar*, 2(1), 18–36. <https://core.ac.uk/download/pdf/230671344.pdf>
- Indahsari, A. T., & Fitrianna, A. Y. (2019). Analisis Kemampuan Pemecahan Masalah Siswa Kelas X dalam Menyelesaikan SPLDV. *JPMI (Jurnal Pembelajaran Matematika Inovatif)*, 2(2), 77–86. <https://doi.org/http://dx.doi.org/10.22460/jpmi.v2i2.p77-86>
- Izzah, K. H., & Azizah, M. (2019). Analisis Kemampuan Penalaran Siswa dalam Pemecahan Masalah Matematika Siswa Kelas IV. *Indonesian Journal of Educational Research and Review*, 210–218. <https://doi.org/https://doi.org/10.23887/ijerr.v2i2.17629>
- Kharisma, J. Y., & Asman, A. (2018). Pengembangan Bahan Ajar Matematika Berbasis Masalah Berorientasi Pada Kemampuan Pemecahan Masalah Matematis dan Prestasi Belajar Matematika. *Indonesian Journal of Mathematics Education*, 1(1), 34–46. <https://core.ac.uk/download/pdf/228481981.pdf>
- Meilani, D., Dantes, N., & Tika, I. N. (2020). Pengaruh Implementasi Pembelajaran Saintifik Berbasis Keterampilan Belajar dan Berinovasi 4C terhadap Hasil Belajar IPA dengan Kovariabel Sikap Ilmiah pada Peserta Didik Kelas V SD Gugus 15 Kecamatan Buleleng. *Jurnal Elementary: Kajian Teori Dan Hasil Penelitian Pendidikan Sekolah Dasar*, 3(1), 1–5. <https://doi.org/https://doi.org/10.31764/elementary.v3i1.1412>
- Nahdi, D. S., & Cahyaningsih, U. (2018). Pengembangan Perangkat Pembelajaran Matematika Sd Kelas V Dengan Berbasis Pendekatan Saintifik Yang Berorientasi Pada Kemampuan Pemecahan Masalah Siswa. *Jurnal Cakrawala Pendas*, 5(1). <https://unma.ac.id/jurnal/index.php/CP/article/view/1119>
- Nurfadilah, S., & Hakim, D. L. (2019). Kemandirian belajar siswa dalam proses pembelajaran matematika. *Prosiding Sesiomadika*, 2(1), 1214–1223.
- Parahita, I. N., Santiyadnya, N., & Sutaya, I. W. (2019). Learning Community untuk Meningkatkan Hasil Belajar Perawatan PC. *Jurnal Pendidikan Teknik Elektro Undiksha*, 8(3), 118–127. <https://doi.org/https://doi.org/10.23887/jjpte.v8i3.23977>
- Prihantoro, A., & Hidayat, F. (2019). Melakukan Penelitian Tindakan Kelas. *Ulumuddin: Jurnal Ilmu-Ilmu Keislaman*, 9(1), 49–60. <https://doi.org/https://doi.org/10.47200/ulumuddin.v9i1.283>
- Rahmawati, D., Fitrianna, A. Y., & Afrilianto, M. (2022). Penerapan Model PBL Terhadap Kemampuan Pemecahan Masalah Matematis Siswa SMP Kelas VII Pada Materi Himpunan. *JPMI (Jurnal Pembelajaran Matematika Inovatif)*, 5(6), 1725–1734. <https://journal.ikipsiliwangi.ac.id/index.php/jpmi/article/view/11050>
- Setiawan, A. R. (2019). Penerapan Pendekatan Saintifik untuk Melatih Literasi Saintifik dalam Domain Kompetensi pada Topik Gerak Lurus di Sekolah Menengah Pertama. *Prosiding Seminar Nasional Fisika (SiNaFi)*, 2018, 7–13. <https://www.researchgate.net/profile/Adib-Rifqi-Setiawan/publication/334083435>
- Suardi, M. (2018). *Belajar & pembelajaran*. Deepublish.
- Susilowati, D. (2018). Penelitian Tindakan Kelas (PTK) Solusi Alternatif Problematika Pembelajaran. *Jurnal Ilmiah Edunomika*, 2(01). <https://www.jurnal.stie-aas.ac.id/index.php/jie/article/view/175>
- Widiastuti, E., Tegeh, I. M., Ujianti, P. R., & Psi, S. (2018). Pengaruh Pendekatan Saintifik

- Terhadap Kemampuan Pemecahan Masalah Pada Anak Kelompok B Di Taman Kanak-Kanak. *Jurnal Pendidikan Anak Usia Dini Undiksha*, 6(2), 241–250.
- Yuliyanto, A., Fadriyah, A., Yeli, K. P., & Wulandari, H. (2018). Pendekatan Saintifik untuk Mengembangkan Karakter Disiplin dan Tanggung Jawab Siswa Sekolah Dasar. *Metodik Didaktik: Jurnal Pendidikan Ke-SD-An*, 13(2). <https://ejournal.upi.edu/index.php/MetodikDidaktik/article/view/9307>
- Yunita, H., Meilanie, S. M., & Fahrurrozi, F. (2019). Meningkatkan Kemampuan Berpikir Kritis melalui Pendekatan Saintifik. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, 3(2), 425–432. <https://doi.org/https://doi.org/10.31004/obsesi.v3i2.228>