

Original Article

Improving the Mathematical Problem-Solving Ability of Junior High School Students through Two Stay Two Stray Learning Based on a scientific learning approach on Cube and Block Material

Siti Hajar Yusuf[✉]

Universitas Khairun Ternate, Indonesia

sitihajaryusuf15@gmail.com[✉]

Abstract:

Education is the initial foundation for humans to be able to walk in this life. Since the beginning of human creation, education has become a part of life to be able to adapt to the environment, this pre-experimental research with a one group pretest-posstest research design, the population in this study is all grade VIII students of SMP Negeri 7 Ternate City. The sample of this study was class VIII-i students consisting of 20 students. The data collection of this study used a mathematical problem-solving ability test instrument in the form of an essay. The data were analyzed using descriptive statistics, namely the Benchmark Reference Guidelines (PAP) based on the category of students' mathematical problem-solving ability and normalized N-Gain calculations and inferential statistics using the t-Test for abnormal distribution data. The results showed that: the mathematical problem solving ability of grade VIII-i students of SMP Negeri 7 Ternate City after the implementation of the Two Stay Two Stray learning model Based on the Scientific Learning Approach obtained 3 students (15%) satisfactory qualifications, 3 students (15%) good, 5 students (25%) sufficient, 6 students (30%) less qualifications and 3 failed qualifications (15%)., increased mathematical problem solving ability of grade VIII-i students of SMP Negeri 7 Ternate City after applying the model Two Stay Two Stray learning based on the Scientific Learning Approach obtained an N-gain value of 0.59 which shows that the increase is in moderate interpretation., the application of the Two Stay Two Stray learning model Based on the Scientific Learning Approach can significantly improve students' mathematical problem solving skills on cube and block material.

Keywords: Mathematical problem-solving ability, Two Stay Two Stray model Scientific Approach, cubes and blocks.

Indtroduction

*E*ducation is the initial foundation for humans to be able to walk in this life. Since the beginning of human creation, education has been a part of life to be able to adapt to the environment (Susanti & Rustam, 2018). According to the National Education System Law No. 20 of 2003, concerning the functions an objectives of national education



<https://jurnal.usk.ac.id/riwayat>

namely: National education functions to develop the ability and shape the character and civilization of a dignified nation in order to educate the nation's life, aims to develop the potential of students to become human beings who believe and fear God Almighty, have noble character, healthy, knowledgeable, capable, creative, independent, and be a democratic and responsible citizen ([Sumarmo, 2010](#)). One of the subjects that supports the availability of quality human resources is mathematics ([Widjajanti, 2009](#)). Mathematics as one of the subjects in schools is considered quite important in shaping students to be qualified, because mathematics is a means of thinking to study something logically and systematically. According to ([Delyana, 2015](#)), mathematics is a branch of exact science and is organized systematically. Thus learning mathematics is learning with concepts and structures in the subject that have not been studied and looking for relationships, so that the process of learning mathematics occurs ([Fadillah, 2009](#)). Mathematics discussion should not be presented in a structured form, but students can be actively involved in finding concepts ([Lestari, n.d.](#)). Apply concepts and solve mathematical problems, both problems simulated by teachers, as well as problems faced in everyday life. So that when students are expected to have different questions from the questions that have been exemplified, students know how to solve them ([Fathurrahman et al., 2019](#)). So that students are motivated to learn mathematics and students tend to act actively during learning.

NCTM (National Council of Teachers of Mathematics) divides mathematical thinking skills into two, namely low order mathematical thinking or low level mathematical thinking and high order mathematical thinking or high level mathematical thinking ([Fajrina et al., 2022](#)). The skills of high-level mathematical thinking include mathematical problem solving, mathematical communication, mathematical reasoning and mathematical connections ([Saragih & Habeahan, 2014](#)). Problem-solving skills are very important because they include methods, procedures and strategies that are core processes in the mathematics curriculum, as stated by ([Annas & Purtanti, 2014](#)) that "Problem solving is central to mathematics teaching". In addition, Soedjadi ([Angkotasan, 2013](#)) stated that mathematics learning is expected to develop more useful abilities to overcome problems that are expected to be faced by students in the future, these abilities include the ability to solve problems. Based on the initial conservation of teaching and learning activities at SMA Negeri 8 Kota Ternate in class XII, the learning process is often focused on the teacher, learning without using relevant learning media is one-way learning, where the teacher is the center of attention while students are only limited to listening to the explanation of the material given by the teacher. Therefore, students become bored, bored and not enthusiastic and even sleepy because students are not given the opportunity to learn independently, show their abilities, perform innovative work and participate as information during the learning process ([Sari, 2022](#)). This ultimately does not lead to the acquisition of students' mathematical problem-solving abilities. Based on the learning that occurred, students obtained an average score of problem-solving ability in the final semester assessment (PAS) of class XII in 2023 for trigono metric function derivative material is Researchers made observations on Wednesday, January 9, 2019, at SMP Negeri 7 Kota Ternate and based on information received from mathematics subject teachers that the learning outcomes of grade VIII students of SMP Negeri 7 Kota Ternate in odd semesters there were 87.5% of students who did not reach KKM. During the interview, the teacher also said that the learning strategy in the teaching and learning process in mathematics subjects that are often used is conventional learning, namely by

using lecture methods, discussion methods, questions and answers, and assignments (Oktarina & Aprizan, 2019). Based on the teaching experience that teachers get, students still experience difficulties in cube and block material, this is because there are many concepts and properties or rules needed in solving problems. In addition, students are also required to be skilled in drawing cubes and blocks (Zakaria et al., 2015). Furthermore, researchers also provide initial tests to measure the ability to understand concepts and mathematical problem solving abilities with test instruments about flat shapes that have been studied before. Based on the test results, students tend to have difficulty in solving problems related to the problem-solving aspect rather than the aspect of the ability to understand concepts. The following is a diagram of the preliminary test results of students of SMP Negeri 7 Kota Ternate Class VIII-I who did not achieve KKM in every aspect of ability.

Methods

The method used in this study is the Pre-Experimental Design method which is one type of experimental research. In this study, the research design used was One Group Pretest and Posttest Design (Sugiyono, 2013). In this design, before the treatment is given, the research subjects are first given a pretest (initial test) and at the end of learning the research subjects are given a posttest (final test). This design is used in accordance with the goal to be achieved, which is to find out the improvement of mathematical problem solving skills by applying Two Stay Two Stray learning based on a scientific approach. The following is a table of one group pretest design research designs. Data collection techniques used to obtain data are by tests, descriptions, and documentation. Written test There are two test instruments in this study, namely the Pretest and Posttest question instruments. The Pretest question instrument is given to measure the ability of Shiva before applying Two Stay Two Stray learning based on a scientific approach. While the Posttest question instrument is given to determine the ability after applying Two Stay Two Stray learning based on a scientific approach. Before the instrument is given to students, it must be tested for the validity of the instrument and the reliability of the instrument. The instrument development consists of conceptual definition, operational definition, validity testing, and data reliability testing.

Results

Data on students' mathematical problem-solving abilities are obtained from test results consisting of an initial test (pretest) and a final test (posttest). Pretest data is data on the results of students' mathematical problem-solving ability tests before applying models in learning that aim to determine students' initial abilities of the material to be taught. Meanwhile, posttest data is the result of a test of students' mathematical problem-solving abilities after applying a model that aims to determine students' mathematical problem-solving abilities after being given treatment. The following is the data of the results of the research class test.

Table 1. Data Qualification Results of Students' Mathematical Problem Solving Ability Before and After the Application of the Two Stay Two Stray Model

Deskripsi	Two Stay Two Stray Berbasis Pendekatan Pembelajaran Saintifik	Sesudah Perlakuan
	Sebelum Perlakuan	
Nilai Minimum	8,33	52,77
Nilai Maksimum	63,88	100

Rata-rata	39,57	74,99
Standar Deviasi	4,711	4,974
Variansi	22,197	24,737
Jumlah Siswa	20	20

Before carrying out learning activities by applying the two stay two stray learning model based on a scientific learning approach, researchers held an initial test (pretest) to obtain initial data on students' mathematical problem-solving abilities. From the test, the average grade point before treatment was 39.57 with a minimum score of 3 (8.33) and a maximum score of 23 (63.88). Pretest and posttest data in appendices 9 and 10.

After conducting the initial test (pretest), at the following meeting researchers applied the two stay two stray model based on a scientific learning approach as an effort to improve students' mathematical problem-solving abilities. In its implementation, students are grouped into 5 groups, with each group brainng 4 people. The researcher then briefly explained about the material of cubes and blocks. After that, researchers distributed LKPD which was then done by students in groups. At the following meeting, researchers gave a final test (posttest) as a result of the application of the two stay two stray model based on a scientific learning approach. The final test result data obtained an average score of 74.99, a minimum score of 19 (52.77) and a maximum score of 36 (100). From the table above can be presented the following diagram:

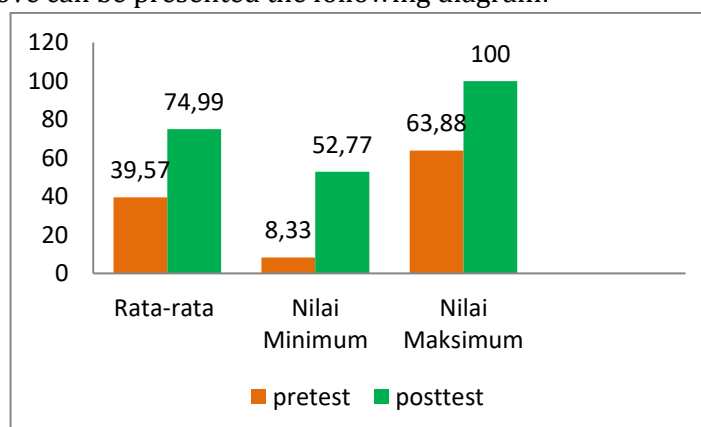


Chart 1. final test (posttest) application of the two stay two stray model

Knowing the classification of mathematical problem-solving abilities of grade VIII-I students of SMP Negeri 7 Ternate City before and after the application of the two stay two stray model based on a scientific learning approach, student work data was analyzed descriptively. The results of the descriptive analysis are then adjusted to the Benchmark Reference Assessment (PAP) Scale 5. The following is a table of the results of the classification of students' mathematical problem-solving abilities before and after the application of the two stay two stray model based on a scientific approach.

Table 2. Qualifications of Students' Mathematical Problem Solving Ability Before and After Application of the Two Stay Two Stray Model Based on Scientific Learning Approach

No	Value	Before	Presented	Qualification	After	Presented
1	91%-100%	-	-	Satisfactory	3	15%

2	81%-90%	-	-	Good	3	15%
3	71%-80%	-	-	Enough	5	25%
4	61%-70%	1	5%	Less	6	30%
5	≤60%	19	95%	Gagal	3	15%

Based on the data in table 8 above, the qualification of mathematical problem solving skills before and after being given the implementation of the two stay two stray model based on a scientific learning approach on cube and block material can be explained that before learning as many as 19 students (95%) in failed qualifications and 1 student (5%) in less qualifications. Meanwhile, after the application of the two stay two stray model based on the scientific learning approach, there were 3 (15%) students in failed qualifications, 5 (25%) students in less qualifications, 6 (30%) students in sufficient qualifications, 3 (15%) students with good qualifications, and 3 (15%) students in satisfactory qualifications.

This difference shows that the application of the two stay two stray model based on a scientific learning approach can usher in the creation of students' mathematical problem-solving skills on cube and block material. That is, the application of the model two stay two stray Based on scientific learning approaches can improve students' mathematical problem solving skills. Improvement of students' mathematical problem-solving ability on cube and block material after application of the model two stay two stray based on scientific learning approach. The following is presented in the form of a diagram:

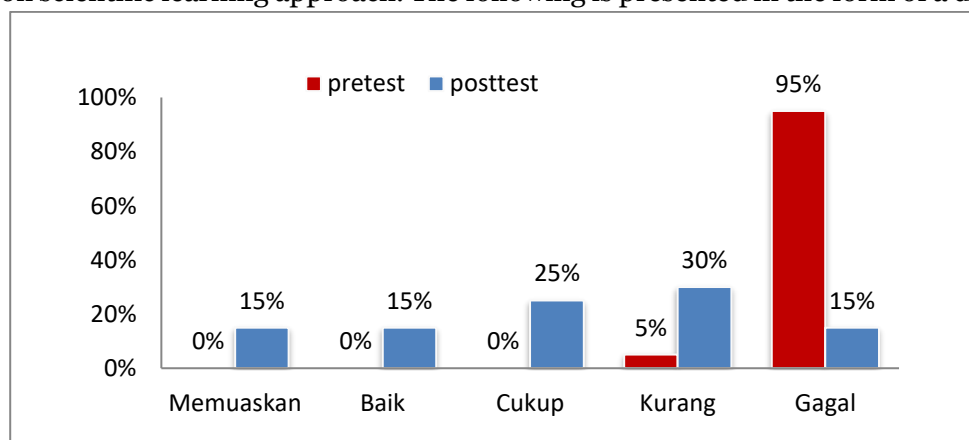


Chart 2. Before and After Application of the Two Stay Two Stray Model Based on Scientific Learning Approach

Improving the mathematical problem-solving ability of grade VIII-i students of SMP Negeri 7 Kota Ternate in learning cube and block material before and after learning both individually and classically as described above.

Table 3. Improving the Mathematical Problem Solving Ability of Class VIII-I Students of SMP Negeri 7 Ternate City Individually on Cube and Block Material through the Two Stay Two Stray Model Based on a Scientific Learning Approach

Interval	Frekuensi	Presentase	Interpretasi
$<g> \geq 0,70$	5	25%	Tinggi
$0,30 \leq <g> < 0,70$	4	20%	Sedang

$<g>< 0,30$	11	55%	Rendah
-------------	----	-----	--------

Based on table 9 above, individually the improvement of mathematical problem solving skills of grade VIII-I students of SMP Negeri 7 Ternate City on cube and block material through the two stay two stray model based on a scientific learning approach was as many as 5 students (25%) with high interpretation, 4 students (20%) with medium interpretation and as many as 11 students (55%) with low interpretation. This shows that students' ability in solving problems individually is categorized as high, medium and low. The following is an increase in classical mathematical problem solving skills obtained from the average pretest and posttest.

Table 4. Improving the Mathematical Problem Solving Ability of Class VIII-I Students of SMP Negeri 7 Ternate City Classically on Cube and Block Material through the Two Stay Two Stray Model Based on a Scientific Learning Approach

Installment- Installment Pretest	Installment- Installment Posttest	N-Gain	Interpretasi
39,57	74,99	0,59	Sedang

Based on table 10 above, it shows that the average value of pretest and posttest, namely mathematical reasoning ability before and after applying the two stay two stray model based on scientific learning approaches is 39.57 and 74.99 respectively. From the calculation results obtained an increase in student mathematical problem solving using the N-Gain formula classically, which is 0.59, the interpretation obtained is moderate, meaning that the increase in student mathematical problem solving after applying the two stay two stray model based on the scientific learning approach as a whole is moderate. N-Gain data.

Test Normality of Research Results Data

Test the normality of data on students' mathematical problem-solving abilities in this study using the help of SPSS 23 for windows i.e. test Shapiro-wilk. Results of data normality test of mathematical problem solving ability of grade VIII-i students of SMP Negeri 7 Kota Ternate after the application of the model two stay two stray Based on Scientific Learning Approach More in the appendix. The following tests the normality of students' mathematical problem-solving ability data after applying the model two stay two stray Based on Scientific Learning Approach

Table 5. Normality Test Results Before and After Treatment

KPMMS	Variabel	Signifikansi Komolgorov Smirnov	Signifikansi Saphiro Wilk
Before treatment	Mathemati cal problem- solving skills	0,200	0,663

After treatment	Mathematical problem-solving skills	0,200	0,778
-----------------	-------------------------------------	-------	-------

Based on the table above, it shows that the significance value for before and after treatment is greater than 0.05 (sig. > 0.05) so accept which means that the data is normally distributed. Analysis of the Normality test in appendix 15. H_0

Test Research Hypothesis

,000 model based on a scientific learning approach in studying cube and block material was normally distributed, so that testing this hypothesis was carried out using a t-test. This test is intended to see if there is an improvement in students' mathematical problem solving ability after applying the two stay two stray model based on a scientific learning approach. The following are the results of the calculation of the t-test with the help of the SPSS 23 program.

Table 6. Hasil Uji Paired Samples Test

		Paired Differences					T	df	Sig. (2-tailed)
		95% Confidence Interval							
		Std. Mean	Std. Deviation	Std. Error Mean	of the Difference				
		Mean	Deviation	Mean	Lower	Upper			
Pair 1	posttest - pretest	12,750	4,216	,943	10,777	14,723	13,524	19	,000

Based on the results in the table above, it is known that the significant value (2-tailed) is 0.000, and $t = 13.524$. rejected if the value of sig.<. Because of the sing value. <, then it is rejected and accepted. Therefore, it can be concluded that there is an increase in students' mathematical problem solving ability after applying the model $\alpha = 0,05H_0$ $\alpha \alpha = 0,05H_0H_1$ two stay two stray based on scientific learning approach. Hypothesis Test Analysis.

Conclusion

The mathematical problem-solving ability of students after applying the two stay two stray model based on a scientific learning approach showed that the final test results (posttest) were 3 students (15%) with satisfactory qualifications, 3 students (15%) with good qualifications, 5 students (25%) with sufficient qualifications, 6 students (30%) with less qualifications, and 3 students (15%) GAGA's qualifications. Improving the mathematical problem-solving ability of grade VIII-i students of SMP Negeri 7 Tota Ternate after applying the two stay two stray model based on an individual scientific learning approach was obtained by 5 students with high interpretation, 4 students with medium interpretation, and as many as 11 students with low interpretation. There was an increase in the mathematical problem-solving ability of grade VIII-i students after

applying the two stay two stray model based on a scientific learning approach to cube and block material.

References

- Angkotasan, N. (2013). Model PBL dan cooperative learning tipe TAI ditinjau dari aspek kemampuan berpikir reflektif dan pemecahan masalah matematis. *Pythagoras Jurnal Pendidikan Matematika*, 8(1), 92–100.
- Annas, S., & Purtanti, S. D. (2014). Additive main effect and multiplicative interaction on fixed Model of two factors design.
- Delyana, H. (2015). *Peningkatan kemampuan pemecahan masalah matematika siswa kelas VII melalui penerapan pendekatan open ended*. LEMMA: Letters of Mathematics Education, 2(1).
- Fadillah, S. (2009). Kemampuan pemecahan masalah matematis dalam pembelajaran matematika. *Prosiding Seminar Nasional Penelitian, Pendidikan Dan Penerapan MIPA*, 16.
- Fajrina, U., Ibrahim, L., & Yani, M. (2022). THE INFLUENCE OF ETHNOMATHEMATICS-BASED REALISTIC MATHEMATICS LEARNING ON COMPREHENSION ABILITY MATHEMATICS CONCEPTS OF SMP/MTs STUDENTS. *Jurnal Ilmiah Pendidikan Dan Pembelajaran Matematika*, 2(2).
- Fathurrahman, A., Sumardi, S., Yusuf, A. E., & Harijanto, S. (2019). Peningkatan Efektivitas Pembelajaran Melalui Peningkatan Kompetensi Pedagogik Dan Teamwork. *Jurnal Manajemen Pendidikan*, 7(2), 843–850.
- Lestari, S. (n.d.). Konsep Pendekatan Saintifik di Sekolah Dasar. Social, Humanities, and Educational Studies (SHES): Conference Series, 3(4), 1095–1099.
- Oktarina, Y., & Aprizan, A. (2019). Optimizing Students' Literacy Ability at STKIP-MBin Indonesian Language Learning by Using Think Pairs Share Model. 1st International Conference on Innovation in Education (ICoIE 2018), 235–239.
- Saragih, S., & Habeahan, W. L. (2014). The improving of problem solving ability and students' creativity mathematical by using problem based learning in SMP Negeri 2 Siantar. *Journal of Education and Practice*, 5(35), 123–133.
- Sari, P. D. (2022). THE EFFECTIVENESS OF COOPERATIVE LEARNING MODEL NUMBERED HEAD TYPE TO STUDENT MATHEMATICS PROBLEM SOLVING ABILITY. *GPH-International Journal of Educational Research*, 5(01), 12–22.
- Sugiyono, D. (2013). *Educational research methods approach quantitative, qualitative and R&D*. Bandung: Alfabeta.
- Sumarmo, U. (2010). *Mathematical thinking and disposition: What, why, and how it is developed in students[in Bahasa]*. Bandung: FPMIPA UPI.
- Susanti, G., & Rustam, A. (2018). The effectiveness of learning models realistic mathematics education and problem based learning toward mathematical reasoning skills at students of junior high school. *Journal of Mathematics Education*, 3(1), 33–39.
- Widjajanti, D. B. (2009). Kemampuan pemecahan masalah matematis mahasiswa calon guru matematika: apa dan bagaimana mengembangkannya. *Seminar Nasional FMIPA UNY*, 5.
- Zakaria, P., Ismail, S., & Kiu, I. P. I. (2015). *Pengembangan instructional video berbasis multimedia untuk materi sistem koordinat*.