

The effect of learning with a realistic mathematical approach on students mathematical communication skills in the material algebra

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Abstract

This study aims to determine the effect of a realistic mathematical approach on students' mathematical communication skills, especially in algebraic material. This research was conducted at SMP Negeri 21 Surabaya, with a sample of 72 students in VII class and divided into two classes, namely the experimental class, which applied a realistic mathematical approach, and the control class, which applied the scientific approach. After learning, students are given a test of students' mathematical communication tests and analyzed using a t-test to determine if there are differences in the results of students' mathematical communication tests between the two classes. The study's results revealed differences in students' mathematical communication tests between the experimental and control classes. Furthermore, based on the average results of the mathematics communication test, the students showed that the experimental class was higher than the control class. So the realistic mathematics approach has a better effect on students' mathematical communication than the scientific approach.

Keywords: realistic mathematical approach, scientific approach, mathematical communication, algebra

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INTRODUCTION

According to learning objectives, mathematical communication is needed to determine student learning success (Karmila & Atiqoh, 2021). Communication skills are abilities students need to face challenges in the 21st century (Febriana & Pujiastuti, 2022). NCTM states that mathematical communication skills are basic abilities that students must master. Mathematical communication can train students to convey mathematical ideas orally and in writing (Siregar et al., 2020). By having good communication skills, students can represent abstract mathematical concepts in a more concrete direction and various forms of their implementation in students' daily lives (Ismayanti & Sofyan, 2021). The importance of mathematical communication skills in mathematics learning must be supported by improving students' abilities through appropriate learning (Asnawati, 2017). However, on the ground, Rohid et al. (2019) stated that students' mathematical communication abilities still needed to improve.

Many of the problems with students' low mathematical communication are caused by the difficulties students experience in solving story problems or everyday events in mathematical symbols (Muzaki, A. & Yulianti, 2021). Students need help connecting pictures to mathematical ideas (Dzarian et al., 2021). In addition, students often need to understand the intent of the existing questions. Material in mathematics at the junior high school level that has yet to be available at the elementary level, and many students experience difficulties in determining mathematical symbols is Algebraic material (Annur & Hermansyah, 2020). Algebra is a material that is difficult for students to complete, especially concerning concepts and principles (Sugiarti, 2018). Difficulties in communicating algebraic material, namely difficulties in interpreting mathematical ideas rationally through writing, difficulties in interpreting mathematical problems in mathematical modeling, and difficulties in the ability to express ideas in the form of descriptions (Fitriani et al., 2021).

The low ability of students' mathematical communication, including algebraic material, can be improved through learning that supports the achievement of indicators in mathematical communication. Realistic Mathematics Learning is one of the lessons that can support the achievement of these indicators. The effectiveness of this learning is included in the good category and can improve mathematical communication and increase the ability to understand concepts high (Wardani et al., 2020). There are three principles in designing learning with a realistic mathematics approach, namely: 1) guided reinvention and progressive mathematizing; 2) learning phenomena (didactical phenomenology); 3) self-developed models (Sohilait,

2021). The research results of Nofrianto, Maryuni, and Amri (2017) also show that the Realistic Mathematics approach significantly affects the 95% confidence level, meaning that the Realistic Mathematics approach influences students' mathematical communication abilities.

Research on improving mathematical communication skills in realistic mathematics learning has been done a lot. Sa'idah et al. (2021) researched to determine the effect of increasing students' mathematical communication using a realistic approach in the V class of SD Muhammadiyah. A realistic approach is effective in increasing students' mathematical communication skills. Yuliyanti et al. (2021) conducted research at SMPN 1 Way Bungur, concluding that a realistic mathematics approach gives better results than ordinary learning. Syamsudin et al. (2018) stated that based on the research results, students' mathematical communication abilities in a system of two-variable linear equations could be improved by applying a realistic mathematical approach. Agusta (2020) at MTs. Negeri 28 Jakarta consistently believed that a realistic mathematical approach could improve students' mathematical communication skills. However, from several studies in the last four years, research on the effectiveness of a realistic mathematics approach in improving students' mathematical communication skills in algebra material at the junior high school level has yet to be carried out. This needs to be studied in more depth because algebraic material in VII class is a new material for students, with various abstract mathematical symbols and ideas, so many students in VII class experience difficulties in understanding algebraic concepts (Herawati & Kadarisma, 2021; Setyawati & Queen, 2021). Students' understanding of algebraic material is necessary to understand other materials in mathematics (Sakiah & Effendi, 2021). Understanding abstract mathematical concepts in algebraic material closely relates to students' mathematical communication skills. For this reason, this study aims to determine the effect of a realistic mathematical approach on students' mathematical communication skills in algebra material in VII class.

METHOD

This research is a comparative study experiment of two groups using a post-test-only control group design (Sugiyono, 2018). The population in this study were class VII students at SMP Negeri 21 Surabaya, and 36 students in the experimental class and 36 students in the control class were selected as samples using a simple random sampling technique. The data collection technique in this study was a test on algebraic material in accordance with a realistic mathematical approach. The test questions consist of 3 algebra questions, with the difficulty level in the C3-C4 category. The instrument used is a mathematical communication test sheet on Algebra material. The instruments used in this study were compiled based on the criteria of a realistic mathematics approach and were validated by two realistic mathematics experts and teaching teachers at schools who were used for the data collection process. Based on the results of the validation that has been carried out, a valid research instrument is obtained and ready to be used. The data collection process begins with applying a realistic mathematical approach in the experimental class and conventional learning with a scientific approach in the control class. Then, a mathematical communication test was carried out in the control and experimental classes to determine students' mathematical abilities in Algebra material. Furthermore, the data obtained were analyzed statistically quantitatively using the t-test, where before the t-test was carried out, the normality test and homogeneity test were first carried out on the data obtained as a precondition for carrying out the t-test.

RESULTS AND DISCUSSION

Based on the research method formulated above, the samples taken were divided into two classes, namely the experimental and control classes. The experimental class was given treatment by applying mathematics learning to algebraic material with a realistic mathematical approach, while the control class was given a scientific approach. Students in both classes were then given tests to test students' mathematical communication abilities. The data obtained were then analyzed using the t-test. Before the t-test of the data in this study was carried out, the normality and homogeneity tests were first carried out as prerequisites.

From the results of tests of mathematical communication skills in the experimental class and control class, the highest and lowest scores in the experimental class were 82 and 43, respectively, while those in the control class were 52 and 26. The classical average value in the experimental class was 58.94, and the classical average in the control class was 38.69. From the calculation of statistical data, the result is that data from both groups are normally distributed and homogeneous.

From the data on the average score of the mathematical communication test in the two sample classes, it is known that the average score of the mathematical communication test in the experimental class is higher

than that of the control class. Next, a hypothesis test will be carried out that there are differences in the results of mathematical communication tests using statistical tests using the t-test. Before the t-test, the data obtained were tested for normality and homogeneity first. The results of the data normality test are presented in Table 1.

Table 1. Data Normality Test Results

	Post-test Control	Experimental Post-test
Chi-Square	11.056 ^a	11,667 ^a
Df	10	10
asymp. Sig.	0.353	0.308

Table 1 shows 36 data in the control and experimental classes, and $df = n-1 = 35$ with $sig. >0.005$ obtained a value of 11.056 in control and 11.667 in the experimental classes. This value is known to be less than the Chi table value of 49.80 so that it can be concluded that the data obtained is normally distributed, and to determine the similarity of the variance of the data obtained in the control class and the experimental class, a homogeneity test is carried out. The results of the homogeneity test of the two classes are presented in Table 2 below.

Table 2. Data homogeneity test results

	Sum of Squares	Df	MeanSquare	F	Sig.
Between Groups	410,489	10	41,049	1048	0.435
Within Groups	979,150	25	39,166		
Total	1389639	35			

Based on the data presented in Table 2, the calculated F value is 1.048 with $sig. >0.005$, with df (between groups) worth ten and df denominator (within groups) worth 25, it is known that the result of the F_{table} is 2.24.

Based on the results of the ANOVA test in Table 2 above, it is known that $F_{count} \leq F_{table}$, then H_0 is accepted. So it can be concluded that the two classes have no difference in ability level or are homogeneous.

Once it is known that the data are normally distributed and homogeneous, the research data can be analyzed using the t-test to test whether or not there is a difference between the two classes, namely the control and experimental classes, in Table 3, the results of the different test analysis that have been carried out are presented.

Table 3. Test Results for Differences in Mathematical Communication Test Results

	Paired Differences				t	df	Sig. (2-tailed)
	Means	std. Deviation	std. Error Means	95% Confidence Interval of the Difference			
Pair 1. Post-test Control Experimental Post-test	-20.25000	9.66991	1.61165	-23.52183 -16.97817	-12,565	35	0.000

Based on the different test results of the mathematical communication test using the t-test in Table 3, it is known that the calculated t value is -12.565 and a sig (2-tailed) value of 0.000 will fulfill the criteria of $Sig (2-tailed) \leq 0.05$, so H_0 that stating there is no difference in the average score of the mathematical communication test in the control and experimental classes is rejected, and H_1 is accepted. This shows that there is a difference in the average mathematical communication test scores between the control class and the experimental class.

The difference in the t-test results of the control and experimental classes shows that realistic mathematics learning influences the results of the mathematical communication test for VII class students at SMP Negeri 21 Surabaya on Algebra material. Judging from the average results of students' mathematical communication tests, it is known that the average score in the experimental class taught using a realistic mathematics approach is higher than the control class. Hence, a realistic mathematics approach better influences the results of students' mathematical communication tests in VII class on Algebra material.

The learning approach is a collection of several methods and methods used by teachers in carrying out the learning process (Musfiqon & Nurdyansyah, 2015). An approach to learning mathematics that is believed to have a good influence on improving mathematical communication skills is the Realistic Mathematics Approach (Karmila & Atiqoh, 2021; Siregar et al., 2020). The realistic mathematical approach has advantages in building a good understanding for students about the application of mathematical concepts in students' daily

lives (Puspitasari & Airlanda, 2021). The realistic mathematics approach motivates students to dare to express opinions during the learning process, helping students understand lessons and supporting students in exploring new knowledge and experiences during the learning process (Putra, 2016). The realistic mathematics approach teaches abstract mathematical concepts through real objects in students' daily lives.

Mathematical communication ability in terms of written and spoken mathematics, where indicators of mathematical communication ability include 1) linking concrete objects to mathematical concepts; 2) explaining ideas, concepts, and relationships in mathematics orally or in writing; 3) expressing everyday events in mathematical language; 4) listen, discuss, and write about abstract mathematical ideas; 5) represent mathematical concepts in writing; 6) compile real problems that are relevant to concepts in mathematics; 7) making conjectures, constructing arguments, formulating definitions and generalizations (Faizah & Sugandi, 2022; Nooryanti et al., 2020). Mathematical communication indicators that relate mathematical concepts to real objects or images are closely related to a realistic approach to learning mathematics.

The research that has been carried out shows that the realistic mathematical approach influences students' mathematical communication at SMP Negeri 21 Surabaya, which is analyzed using the t-test. It is shown that the average results of students' mathematical communication tests in the experimental class that apply a realistic mathematics approach are higher than those in the experimental class. Control class. The same results were also obtained in a study conducted by Nofrianto et al. (2017); the results show that a realistic mathematics approach has a good effect on improving students' mathematical communication skills. Nooryanti et al. (2020) gave the same result: a realistic mathematics approach has a better impact than direct learning. Qualitatively, Ahmad, and Nasution (2018) stated that the mathematical communication of students in classes given learning with a realistic mathematics approach reached 22.5% which was categorized as high, 37.5% as a medium, and 40% low, so it can be concluded that a realistic mathematics approach gives a good impact on students' mathematical communication skills. Nopiyani, Turmudi, and Prabawanto (2018) also obtained the same results that a realistic mathematical approach influenced students' mathematical communication skills. Karmila & Atiqoh (2021) and Suhaedi (2012) have the same opinion based on their research; namely, the realistic mathematical approach can improve students' mathematical communication skills. So, students' mathematical communication skills will increase with the right learning approach, which is a realistic mathematics approach. Based on these results, students' mathematical communication can be improved with an approach and learning that involves the help of appropriate learning media or software.

CONCLUSION

The approach of mathematics realistic gives a better influence on the results of test communication with mathematical students on the material algebra at SMP Negeri 21 Surabaya compared with the scientific approach. The different test results show that the results obtained to fulfil the stated hypothesis that there is a difference in mark results communication mathematical students in experiment class with approach mathematics realistic with class control with approach scientific. Besides, it is supported by average yield value test communication mathematical students learning mathematics realistically better than with class control in a given class learning mathematics. Research results still need to be expanded to trials in class VII SMP Negeri 21 Surabaya only, so we need to do more studies deeply related to the influence approach mathematics realistic to ability mathematics students. Moreover, research can be developed to support enhanced ability communication with mathematical students; for example, it can apply to learn with approach mathematics supported realistic with learning media or appropriate learning software, such as GeoGebra software.

REFERENCES

- Agusta, E. (2020). Pendekatan Pendidikan Matematika Realistik Indonesia. *Histogram: Jurnal Pendidikan Matematika*, 1(2), 61–75.
- Ahmad, M., & Nasution, D. P. (2018). Analisis Kualitatif Kemampuan Komunikasi Matematis Siswa yang Diberi Pembelajaran Matematika Realistik. *Jurnal Gantang*, 3(2), 83–95. <https://doi.org/10.31629/jg.v3i2.471>
- Annur, M. F., & Hermansyah. (2020). Analisis Kesulitan Mahasiswa Pendidikan Matematika dalam Pembelajaran Daring pada Masa Pandemi Covid-19. *Jurnal Kajian, Penelitian Dan Pengembangan Kependidikan*, 11, 195–201.
- Asnawati, S. (2017). Peningkatan Kemampuan Komunikasi Matematis Siswa SMP Dengan Pembelajaran Kooperatif Tipe Teams-Games tournaments. *Euclid*, 3(2), 561–567. <https://doi.org/10.33603/e.v3i2.332>

- Dzarian, W. O., Salam, M., & Anggo, M. (2021). Analisis Kemampuan Komunikasi Matematis Siswa Ditinjau dari Gender. *Jurnal Pembelajaran Berpikir Matematika (Journal of Mathematics Thinking Learning)*, 6(1), 173–184. <https://doi.org/10.33772/jpbm.v6i1.18618>
- Faizah, H., & Sugandi, E. (2022). Analisis Kemampuan Komunikasi Matematis Tulis Siswa SMP pada Soal Cerita Bentuk Aljabar Dalam Pembelajaran Daring. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 11(1), 291–304.
- Febriana, A. E., & Pujiastuti, H. (2022). Analisis 21 St Century-Learning Design : Kemampuan Komunikasi Matematis Mahasiswa. *Jurnal Pembelajaran Matematika Inovatif*, 5(3), 649–658. <https://doi.org/10.22460/jpmi.v5i3.649-658>
- Fitriani, F., Siregar, Y. A., & Novitasari, W. (2021). Analisis kesulitan kemampuan komunikasi matematika mahasiswa menggunakan aplikasi google classroom pada matakuliah aljabar. *Journal of Didactic Mathematics*, 2(1), 18–25. <https://doi.org/10.34007/jdm.v2i1.596>
- Herawati, E., & Kadarisma, G. (2021). Analisis Kesulitan Siswa SMP Kelas VII Dalam Menyelesaikan Soal Operasi Aljabar. *Jurnal Pembelajaran Matematika Inovatif*, 4(2), 355–364. <https://doi.org/10.22460/jpmi.v4i2.355-364>
- Ismayanti, S., & Sofyan, D. (2021). Kemampuan Komunikasi Matematis Siswa SMP Kelas VIII di Kampung Cigulawing. *PLUSMINUS: Jurnal ...*, 1(1), 183–196. https://journal.institutpendidikan.ac.id/index.php/plusminus/article/view/pv1n1_15
- Karmila, U., & Atiqoh, K. S. N. (2021). Pendekatan Matematika Realistik Dan Kemampuan Komunikasi Matematis Siswa Di Madrasah Ibtidaiyah. *Jurnal Padagogik*, 4(1), 01–11. <https://doi.org/10.35974/jpd.v4i1.2387>
- Musfiqon, H., & Nurdyansyah. (2015). Pendekatan Pembelajaran Saintifik. In *News.Ge*. Nizamia Learning Center.
- Muzaki, A. & Yulianti, S. (2021). Analisis Kemampuan Penalaran Matematis pada Materi Operasi Bentuk Aljabar Ditinjau dari Disposisi Matematis Siswa Kelas VII SMP N 2 Gondangrejo Karanganyar *Jurnal Ilmiah IKIP Mataram*, 8(1), 198–205.
- Nofrianto, A., Maryuni, N., & Amri, M. A. (2017). Komunikasi matematis siswa: pengaruh pendekatan matematika realistik. *Jurnal Gantang*, 2(2), 113–121.
- Nooryanti, S., Utaminingsih, S., & Bintoro, H. S. (2020). Pengaruh Pendekatan Pendidikan Matematika Realistik Berbasis Etnomatematika terhadap Komunikasi Matematis Siswa Sekolah Dasar. *ANARGYA: Jurnal Ilmiah Pendidikan Matematika*, 3(1), 30–34. <https://doi.org/10.24176/anargya.v3i1.4739>
- Nopiyan, D., Turmudi, T., & Prabawanto, S. (2018). Penerapan Pembelajaran Matematika Realistik Berbantuan GeoGebra untuk Meningkatkan Kemampuan Komunikasi Matematis Siswa SMP. *Mosharafa: Jurnal Pendidikan Matematika*, 5(2), 45–52. <https://doi.org/10.31980/mosharafa.v5i2.259>
- Puspitasari, R. Y., & Airlanda, G. S. (2021). Meta-Analisis Pengaruh Pendekatan Pendidikan Matematika Realistik (PMR) Terhadap Hasil Belajar Siswa Sekolah Dasar. *Jurnal Basicedu*, 5(2), 1094–1103. <https://doi.org/10.31004/basicedu.v5i2.878>
- Putra, F. G. (2016). Pengaruh Model Pembelajaran Reflektif dengan Pendekatan Matematika Realistik Bernuansa Keislaman terhadap Kemampuan Komunikasi Matematis. *Al-Jabar : Jurnal Pendidikan Matematika*, 7(2), 203–210. <https://doi.org/10.24042/ajpm.v7i2.35>
- Rohid, N., Suryaman, & Rusmawati, R. D. (2019). Students' Mathematical Communication Skills (MCS) in Solving Mathematics Problems: A Case in Indonesian Context. *Anatolian Journal of Education*, 4(2), 19–30.
- Sa'idah, R., Sintawati, M., & Nurhadiyani, F. D. (2021). Pendidikan Matematika Realistik: Pendekatan Untuk Meningkatkan Kemampuan Komunikasi Matematika Dan Pemecahan Masalah. *Jurnal Pendidikan Matematika Universitas Lampung*, 9(2), 197–210. <https://doi.org/10.23960/mtk/v9i2.pp197-210>
- Sakiah, N. A., & Effendi, K. N. S. (2021). Analisis Kebutuhan Multimedia Interaktif Berbasis PowerPoint Materi Aljabar Pada Pembelajaran Matematika SMP. *JP3M (Jurnal Penelitian Pendidikan Dan Pengajaran Matematika)*, 7(1), 39–48. <https://doi.org/10.37058/jp3m.v7i1.2623>
- Setyawati, A., & Ratu, N. (2021). Analisis Kesulitan Belajar Matematika Siswa SMP pada Materi Aljabar Ditinjau dari Mathematics Anxiety. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, 5(3), 2941–2953. <https://doi.org/10.31004/cendekia.v5i3.957>
- Siregar, S. U., Harahap, A., Milfayetti, S., & Hajar, I. (2020). Peningkatan Kemampuan Komunikasi dan Self-Efficacy Matematis Siswa melalui Pendekatan Pembelajaran Matematika Realistik. *Jurnal Penelitian Dan Pengkajian Ilmu Pendidikan: E-Saintika*, 4(2), 151. <https://doi.org/10.36312/e-saintika.v4i2.207>
- Sohilait, E. (2021). Pembelajaran Matematika Realistik. *OSF Preprints*, 1–10.
- Sugiarti, L. (2018). Kesulitan Siswa dalam Menyelesaikan Soal Operasi Bentuk Aljabar. *Prosiding Seminar*

- Nasional Pendidikan Matematika Etnomatnesia*, 323–330.
- Sugiyono. (2018). *Metode Penelitian Kuantitatif Kualitatif dan RD*. Alfabeta.
- Suhaedi, D. (2012). Peningkatan Kemampuan Komunikasi Matematis Matematis Siswa Smp Melalui Pendekatan Pendidikan Matematika Realistik. *Prosiding*, 9(November), 978–979.
- Syamsudin, N., Afrilianto, M., & Rohaeti, E. E. (2018). Meningkatkan Kemampuan Komunikasi Matematik Siswa Kelas Viii Smp Negeri 2 Cariu Pada Materi Sistem Persamaan Linier Dua Variabel dengan Pendekatan Realistic Mathematic Education (Rme). *JPMI (Jurnal Pembelajaran Matematika Inovatif)*, 1(3), 313. <https://doi.org/10.22460/jpmi.v1i3.p313-324>
- Wardani, H., Bahri, S., & Nasution, H. A. (2020). Efektifitas Pembelajaran Matematika Realistik Berbasis Masalah Kontekstual Dalam Meningkatkan Kemampuan Komunikasi Matematika dan Pemahaman Konsep Siswa. *Seminar Hasil Penelitian*, 122–128.
- Yuliyanti, R. S., Masykur, R., & Suri, I. R. A. (2021). Peningkatan Kemampuan Komunikasi Matematis: Dampak Pendekatan Matematika Realistik Indonesia (PMRI) Bernuansa Islami. *Journal of Mathematics Education and Science*, 4(1), 23–29. <https://doi.org/10.32665/james.v4i1.172>