

Analyzing Students' Mathematical Communication Ability in Solving Numerical Literacy Problems

Annisa Rahmawati¹, Yus Mochamad Cholily², Zukhrufurrohmah^{3*}

Mathematics Education Study Program, Universitas Muhammadiyah Malang
Jalan Raya Tlogomas No.246, Malang, Jawa Timur

¹annisarahmaa99@gmail.com, ²yus@umm.ac.id, ^{3*}zukhrufurrohmah@umm.ac.id

Article received: 05-08-2022, revised: 19-01-2023, published: 31-01-2023

Abstrak

Masih perlu ditingkatnya kemampuan komunikasi matematis siswa, menunjukkan bahwa perlu adanya analisis yang baik dan tepat untuk merancang langkah perbaikan yang efektif. Analisa kemampuan komunikasi matematis dapat memberikan deskripsi yang jelas berkaitan dengan kemampuan komunikasi matematis siswa. Oleh karena itu, tujuan dari penelitian ini adalah untuk mendeskripsikan kemampuan komunikasi matematis siswa dalam menyelesaikan soal berciri literasi numerasi. Subjek penelitian ini adalah 6 siswa kelas VIII-B SMP Negeri 1 Pasrujambe. Metode yang digunakan dalam penelitian ini menggunakan pendekatan kualitatif dengan jenis penelitian deskriptif. Instrumen yang digunakan dalam penelitian ini adalah lembar tes tulis dan lembar pertanyaan tes lisan. Penelitian ini dilakukan melalui tahapan perencanaan, pelaksanaan dan tahap akhir. Teknik analisis data dalam penelitian ini terbagi menjadi tiga tahapan yaitu reduksi data, penyajian data, dan penarikan kesimpulan. Hasil dari penelitian diperoleh 4 kategori, antarlain: siswa dengan kemampuan komunikasi matematis tulis sedang dan komunikasi matematis lisan tinggi, siswa dengan kemampuan komunikasi matematis tulis sedang dan komunikasi matematis lisan sedang, siswa dengan kemampuan komunikasi matematis tulis rendah dan komunikasi matematis lisan sedang, serta siswa dengan kemampuan komunikasi matematis tulis rendah dan komunikasi matematis lisan rendah.

Kata kunci: Komunikasi matematis; Literasi numerasi; Penyelesaian soal matematika.

Abstract

The necessity to improve students' mathematical communication skill indicates that a good and appropriate analysis is required to design effectively corrective measures. An analysis of mathematical communication skills could provide convinced descriptions related to students' mathematical communication abilities. Therefore, the purpose of this study was to describe students' mathematical communication abilities in solving numerical literacy questions. The participants of this study were six students of class VIII-B of SMP Negeri 1 Pasrujambe. The method used was a qualitative approach, specifically descriptive research. This study utilized written test sheets and oral test question sheets. This study was conducted through the stages of planning, executing, and finalizing stage. The data analysis technique was divided into three stages, namely data reduction, data presentation, and drawing conclusions. The results of the study obtained 4 categories, including students with moderate written mathematical communication skills and high oral mathematical communication, students with moderate written mathematical communication skills and moderate oral mathematical communication skills, students with low written mathematical communication skills and moderate oral mathematical communication as well as students with low written mathematical communication skills and low oral mathematical communication skills.

Keywords: Mathematical communication; Numerical literacy; Solving math problems.

I. INTRODUCTION

In learning mathematics, one of the important basic skills that students must have is mathematical communication (Sandy., et al, 2022; Mutiarani & Sofyan, 2022). Mathematical communication is students' skills in expressing mathematical ideas in written or oral forms (Rachmayani, 2020; Hanisah & Noordyana, 2022). Mathematical communication skills consist of written mathematical communication and oral mathematical communication (Hodiyanto, 2017; Linda & Afriansyah, 2022). Written mathematical communication deals with an explanation of problem solving strategies that represent students' ability to express mathematical ideas in the form of pictures, graphs, tables using their own language. While oral mathematical communication is the ability of students to convey mathematical ideas in words or oral form (Meiliyah & Setianingsih, 2019; Berliana & Sholihah, 2022).

Mathematical communication is one of the indicators to measure students' numerical literacy skills (Siskawati et al., 2021). According to Ratnasari (2020), numerical literacy ability is the ability of students to use basic mathematical concepts to solve problems in everyday life. Numerical literacy questions are different from math word problems. Math story problems are math problems that are presented in the form of short stories and need to be translated into mathematical sentences and

mathematical equations (Dwidarti et al., 2019). Meanwhile, numerical literacy questions are math story problems with more complex problems. According to Patriana et al., (2021) numerical literacy is divided into 4 types of characteristics, namely personal context, socio-cultural context, scientific context, and HOTS criteria.

In Indonesia, students tend to have low mathematical communication skills which need improvement (Munawaroh et al., 2018; Nuraeni & Afriansyah, 2021; Kanah & Mardiani, 2022). This was also conveyed by Vale and Barbosa (2017) who stated that there were many students who were struggling to convey mathematical ideas both in written and oral forms. Most students have mastered the basic concepts of mathematics, but the implementation of the concepts was unstructured (Pangesti, 2018). The main factor of students' errors was that students were struggling changing problems in questions into mathematical forms (Fitriatien, 2019).

This was in line with the observations made by the researchers at the setting, namely SMP Negeri 1 Pasrujambe in class VIII-B. The results of the observations showed that students experienced difficulties while working on story problems based on students' everyday lives. Students were able to understand the formula of the material, but students were not able to use the formula to present a coherent problem solving.

Students often write certain symbols, for example arrows, to replace the meaning of the equals sign. The difficulty of students conveying the idea of solving the problem often results in incomplete presentation of problem solving by students. The variety of student failures in conveying problem solving ideas encouraged studies probing the analysis of students' mathematical communication skills.

Based on the background of the problem and the description above, the purpose of this research was to describe the ability of written and oral mathematical communication in class VIII-B of SMP Negeri 1 Pasrujambe in solving numerical literacy questions with a socio-cultural context. The socio-cultural context was chosen because of this context. This context was chosen in this study because the socio-cultural context was closely related to the lives of students and the surrounding community. The results of this study were expected to provide information for teachers to give appropriate assistance to students in solving numerical literacy questions in number pattern material.

II. METHOD

The study was a descriptive study with a qualitative approach. The participants of this study were six students of class VIII-B at SMP Negeri 1 Pasrujambe. They were selected based on the results of the written mathematical communication test for all Grade VIII students as well as

recommendations from the mathematics teacher at SMP Negeri 1 Pasrujambe. Six students were selected and categorized into three students for moderate skill of written mathematical communication ability, and three students with low written mathematical communication ability. This study was conducted in the even semester of the 2021/2022 academic year.

In this study, the data collection involved tests. The test was carried out twice, namely a written mathematical communication ability test and an oral mathematical communication ability test. The written test was used to measure students' written mathematical communication abilities according to the indicators of written mathematical communication skills. The rubric used to measure mathematical communication on numerical literacy questions consisted of indicators of mathematical communication ability. The indicators used in this test were adapted from research by Syafina & Pujiastuti (2020) as presented in Table 1.

Table 1.
Indicator of Mathematical Communication Ability
Write

No.	Indicator
1.	Write down information in the form of data that is known and asked in the problem
2.	Create and complete a number pattern from the given questions
3.	a. Write down the mathematical operations that match the problems in the problem b. Write down the solution to the

	problem in the problem coherently
4.	Write a conclusion from the solution obtained

	orally
4.	Explain the conclusions of the solutions obtained orally

The written test was given to a class VIII-B, consisting of twenty one students. This written test was developed based on a grid of numerical literacy questions. In this test, 3 questions were given with numerical literacy characteristics estimated 60 minutes of work which had been validated by one of UMM mathematics education lecturers and one mathematics teacher at SMPN 1 Pasrujambe. Then, from the results of the written test, three students were taken from each category of written mathematical communication skills. The oral test was carried out the day after the written test. In this test, students were provided a number of questions in the written test form using predetermined oral mathematical communication indicators. The indicators of oral mathematical communication used in this study were adapted from research by Permata et al.

Table 2.

Indicator of Mathematical Communication Ability Oral	
No.	Indicator
1.	Disclose information in the form of known data and problems in the problem verbally
2.	a. Make a number pattern from the problems presented b. Explain the pattern of numbers obtained orally
3.	a. Explain the operations used in solving problems verbally b. Explain the solution steps obtained

Data analysis techniques in this study went through three stages, namely data reduction, data presentation and drawing conclusions. At the data reduction stage, the test results obtained would be analyzed to determine the level of the students' mathematical communication abilities in solving numerical literacy questions both in writing and oral forms. The maximum score for each written and spoken mathematical communication test was 48. The data on the results of the students' written and oral mathematical communication ability tests can be calculated using the following formula:

$$Nilai = \frac{\text{skor yang diperoleh}}{\text{skor maksimal}} \times 100$$

Furthermore, the score obtained by each student was categorized according to the categories of written and oral mathematical communication skills adopted from the study Andini & Marlina (2021).

Table 3.

Communication Skills Category		
No.	Intervals	Category Ability
1.	> 66	Tall
2.	> 33	Currently
3.	≤ 33	Low

(Andini and Marlina, 2021)

At the data presentation stage, the results of student tests that had been categorized were presented in a descriptive form based on the indicator that the students had met both in written and oral forms. Then the last stage of this

research was drawing conclusions. The conclusion of this study was a description of the students' mathematical communication abilities in solving numerical literacy both in writing and oral.

III. RESULT AND DISCUSSION

This study was conducted in class VIII-B at SMP Negeri 1 Pasrujambe with a total of 21 students. It was carried out in two stages, namely a written mathematical communication ability test and an oral mathematical communication ability test. Based on the mathematical communication test results, the data was generated with the results of the category distribution described in the bar chart below.

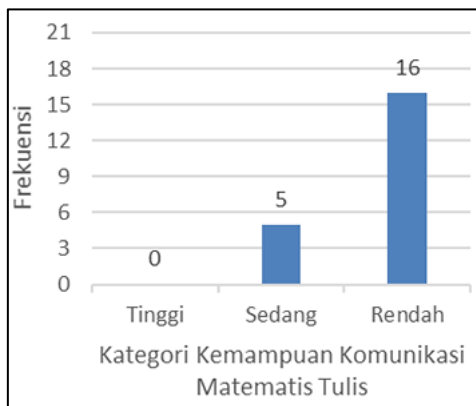


Figure 1. Frequency of Student Writing Mathematical Communication Test Results

Based on the bar chart above, the number of students with written mathematical communication skills in the medium category were 5 students and 16 students in the low category. Meanwhile, there was no high category on written mathematical communication ability.

Furthermore, from the grouping results of the written test, 3 students were taken from the medium category and 3 students from the low category for the oral test. The selection of participants in each category was based on the recommendation from the mathematics teacher at SMP Negeri 1 Pasrujambe while taking into account the characters of the students so they could work together in the oral test. The results of students' oral mathematical communication tests are presented in the following table:

Table 4.
The Results of Written and Oral Mathematical Communication Skills

Student Code	Category Writing Mathematical Communication Skills	Category Oral Mathematical Communication Skills
AFK	Currently	High
DNR		High
VDA		Moderate
AAP	Low	Moderate
DNA		Moderate
DVY		Low

In Table 4 it showed that two students with the category of moderate written mathematical communication skills got the results of the oral test in the high category, one student with the medium category of written mathematical communication skills got moderate results of the oral test, two students with low written mathematical communication skills got the results of the category oral test medium, and one student with low category of written mathematical

communication ability got low category oral test results.

In indicator (1) written mathematical communication, only 1 student wrote down information in the form of given information of the problem. While the other 20 students did not write down given or asked information. However, while taking an oral test on indicator (1) of oral mathematical communication, many students were able to state information in the form of data that was given and asked correctly. In line with research Nisa & Setianingsih (2019) which stated that on the written test students did not write down the information of what was given and asked, but students could state what was given and asked in the questions completely and fluently. Ramadhan & Minarti (2018) revealed that students considered that writing down what was given and asked in the problem was not important.

In indicator (2) of written mathematical communication, only 2 students were able to make correct number patterns. 8 students also understood the number pattern from the given problem but were not accurate in completing the number pattern. While other students did not write down and complete the number pattern of the problems given. In the question, there were 9 rows of seats with 5 rows of known numbers and 4 other rows of unknown numbers. The number pattern had a pattern plus 4 then minus 1. Some students did not complete the

number pattern because students they inaccurately calculate the number. As a result, the next pattern also experiences errors. Some students also did not understand the meaning of the questions. Students were confused by the sentence "...follow the same pattern", Cholily et al., (2020) mentioned that students usually did not have important conceptual knowledge so that they could not solve certain problems consistently. This showed that to be able to communicate ideas well, students needed to understand the concept of the problem to be solved. This was in line with the statement of Tanjung and Nababan (2019) that in mathematical communication the messages conveyed were related to mathematical concepts.

The results of this study indicated that there were difficulties among the students in presenting problem solving ideas related to number patterns. In Soraya, Rosmayadi, & Wahyuni's research, (2021) revealed that there were still many students who were not able to express questions in determining or drawing a pattern from an arrangement of several numbers. In line with this study, some students were able to determine and formulate number patterns from the questions given while other students were unable to formulate these number patterns. The results of the oral test on indicators (2a) and (2b) of oral mathematical communication also did show a significant difference from the

written test. Some students were able to explain the number patterns they got fluently, and some students were not able to make and explain the number patterns from the problems in the questions.

In indicators (3a) and (3b) written mathematical communication, for questions number 1 and 2, many students already understood the formulation to find solutions to the problems given and wrote down the steps correctly. However, only 2 students were able to write down the appropriate mathematical operations and the steps and provide the final result correctly. Some students were able to write down the appropriate mathematical operations and write down the correct steps but provided wrong final results. This was due to the lack of accuracy of students in calculating processes or due to the wrong pattern of numbers. These results were in line with a study by Khadijah et al., (2018) which revealed that some students were able to solve problems correctly and some students experienced errors due to lack of accuracy. And some students did not write down the steps of the process or students only wrote down the final results. During the oral test on indicators (3a) and (3b) of oral mathematical communication, most students were able to explain the operations used and were able to explain the steps for solving the problem correctly and fluently. But some students still had difficulties in explaining the steps of the mathematical solution. In line with the

study by Nisa & Setianingsih (2019) which stated that some students were able to write down the steps for solving the problem completely and were able to explain the steps completely and fluently, but some students were not able to write down the steps for solving the problem completely and could not explain the steps of the problem solving correctly. While in question number 3 none of the students answered the question correctly. They did not calculate the number correctly and could not understand the purpose of the questions. From the results of the oral test, it was found that some students did not understand the sentence "...the audience was filled with three quarters of the capacity of all the seats". As a result, students multiplied the ticket price by the total number of the seats in the theater.

In indicator (4) written mathematical communication, only some students wrote conclusions from the solutions obtained. Some other students only wrote down the final results, such as answering short questions. As in the study by Syafina & Pujiastuti (2020) which stated that only high-ability students wrote the conclusions from the solutions obtained, while students with moderate and low mathematical communication ability categories did not write the conclusions from the solutions obtained. A study by resultIsmayanti & Sofyan (2021) revealed that students were not used to writing conclusions from the solutions obtained among students with high, medium and

low mathematical communication abilities. In indicator (4) of oral mathematical communication, most of the students were able to explain the conclusions from the solutions obtained.

From the results of the tests, the written mathematical communication ability test results were greater than the students' oral mathematical communication ability tests. This was in line with Kula et al., (2019) stating that students' oral mathematical communication skills were categorized in higher level than students' written mathematical communication abilities. Tong et al., (2021) also stated that the students' oral mathematical communication skills were in a higher level classification compared to the students' written mathematical communication skills. Laksananti et al., (2017) revealed that this happened partly because the study on the students' written and oral communication ability tests was carried out on different days, so that students were better prepared when doing oral mathematical communication ability tests.

IV. CONCLUSION

Based on the previous chapter, it was found that students in the medium category of written communication skills and in the high category of oral communication skills met almost all written indicators and were able to fulfill all indicators of the oral test. Students in the category of moderate written

mathematical communication skills and moderate oral mathematical communication skills met almost all written and spoken indicators. Students with low written mathematical communication skills and moderate oral mathematical communication skills met 2 of the 4 communication indicators-written mathematics and met almost all indicators in oral mathematical communication. Students in the category of low written mathematical communication skills and communication skills-low oral mathematics, based on the written test, only wrote down answers similar to the type of short answer questions. Then on the oral test, students were unable to fulfill all indicators of oral mathematical communication.

In this study, there were several shortcomings as the basis of suggestions for further research, including: (1) from the results and discussion above, many students did not meet the indicators of written mathematical communication, namely writing down information in the form of given and asked data, make a number pattern and write down the conclusions obtained, so further studies may focus on these indicators; (2) it was suggested conducting the studies with larger participants; as well as, (3) it was suggested observing the mathematical communication ability among teachers.

The implication of this study included: 1) For teachers, the results may provide information to design appropriate lessons,

develop mathematical communication, and identify problems experienced by students in mathematical communication; 2) For future researchers, this study was a reference to develop another study regarding mathematical communication.

BIBLIOGRAPHY

- Andini, S. F., & Marlina, R. (2021). Analisis Kemampuan Komunikasi Matematis Siswa SMP Dalam Menyelesaikan Soal Pada Materi Himpunan. *Jurnal Pembelajaran Matematika Inovatif*, 4(2), 343–354. <https://doi.org/10.22460/jpmi.v4i2.343-354>
- Ariyanti, S. N., & Setiawan, W. (2019). Analisis Kesulitan Siswa SMP Kelas VIII Dalam Menyelesaikan Soal Pola Bilangan Berdasarkan Kemampuan Penalaran Matematik. *Journal On Education*, 01(02), 390–398. <https://doi.org/10.26618/sigma.v13i1.2832>
- Berliana, D. P., & Sholihah, U. (2022). Kemampuan Komunikasi Matematis Siswa dalam Menyelesaikan Masalah Open-Ended Ditinjau dari Self-Efficacy. *Plusminus: Jurnal Pendidikan Matematika*, 2(2), 243-254. <https://doi.org/10.31980/plusminus.v2i2.1791>
- Cholily, Y. M., Kamil, T. R., & Kusgiarohmah, P. A. (2020). Secondary School Students' Error Of Term Of Algebraic Forms Based On Mathematical Communication. *Jurnal Program Studi Pendidikan Matematika*, 9(2), 252–258. <https://dx.doi.org/10.24127/ajpm.v9i2687>
- Fitriatien, S. R. (2019). Analisis Kesalahan Dalam Menyelesaikan Soal Cerita Matematika Berdasarkan Newman. *JIPMat*, 4(1), 1–12. <https://doi.org/10.26877/jipmat.v4i1.3550>
- Hanisah, H., & Noordiana, M. A. (2022). Kemampuan Komunikasi Matematis Siswa pada Materi Penyajian Data di Desa Bojong. *Plusminus: Jurnal Pendidikan Matematika*, 2(1), 131-140. <https://doi.org/10.31980/plusminus.v2i1.1588>
- Hodiyanto. (2017). Kemampuan Komunikasi Matematis Dalam Pembelajaran Matematika. *AdMathEdu : Jurnal Ilmiah Pendidikan Matematika, Ilmu Matematika Dan Matematika Terapan*, 7(1), 9–18. <https://doi.org/10.12928/admathedu.v7i1.7397>
- Ismayanti, S., & Sofyan, D. (2021). Kemampuan Komunikasi Matematis Siswa SMP Kelas VIII di Kampung Cigulawing. *PLUSMINUS: Jurnal Pendidikan Matematika*, 1(1), 183–196. <https://doi.org/10.31980/plusminus.v1i1.1036>
- Kanah, I., & Mardiani, D. (2022). Kemampuan Komunikasi dan Kemandirian Belajar Siswa Melalui

- Problem Based Learning dan Discovery Learning. *Plusminus: Jurnal Pendidikan Matematika*, 2(2), 255-264.
<https://doi.org/10.31980/plusminus.v2i2.1825>
- Khadijah, I. N. A., Maya, R., & Setiawan, W. (2018). Analisis Kemampuan Komunikasi Matematis Siswa SMP Pada Materi Statistika. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, 1(6), 1–7.
<https://dx.doi.org/10.22460/jpmi.v1i6.p1095-1104>
- Kula, K., Muniasih, T. R., & Wulandari, T. C. (2019). Kemampuan Komunikasi Tertulis Peserta Didik Pada Materi Lingkaran. *Jurnal Pendidikan Matematika*, 2(1), 1–15.
- Laksananti, P. M., Setiawan, T. B., & Setiawani, S. (2017). Analisis Kemampuan Komunikasi Matematis Dalam Menyelesaikan Masalah Pokok Bahasan Bangun Datar Segi Empat Ditinjau Dari Kecerdasan Emosional Siswa Kelas VIII-D SMP Negeri 1 Sumbermalang. *Jurnal Kadikma*, 8(1), 88–96.
- Linda, L., & Afriansyah, E. A. (2022). Kemampuan Komunikasi Matematis Siswa Berdasarkan Self-efficacy pada Materi Segiempat dan Segitiga di Desa Sirnajaya. *Journal of Mathematics Science and Computer Education*, 2(1), 20-43.
- Meiliyah, A., & Setianingsih, R. (2019). Profil Komunikasi Matematis Tulis Siswa SMP Dalam Memecahkan Masalah Matematika Ditinjau Dari Perbedaan Kemampuan Matematika. *Journal of Mathematic Education UNESA*, 8(2), 318–327.
- Mutiarani, A., & Sofyan, D. (2022). Kemampuan komunikasi matematis siswa pada materi persamaan dan fungsi kuadrat berdasarkan gender di desa sukamenak. *Jurnal Inovasi Pembelajaran Matematika: PowerMathEdu*, 1(1), 1-14.
<https://doi.org/10.31980/powermathedu.v1i1.1911>
- Nisa, U., & Setianingsih, R. (2019). Kemampuan Komunikasi Matematis Siswa Dalam Menyelesaikan Soal Statistika Ditinjau Dari Kecerdasan Intrapersonal Dan Interpersonal. *Jurnal Penelitian Pendidikan Matematika Dan Sains*, 3(2), 91–100.
<https://doi.org/10.26740/jppms.v3n2.p8-100>
- Nuraeni, K., & Afriansyah, E. A. (2021). Perbedaan kemampuan komunikasi matematis dan self confidence siswa antara tps dan stad. *SIGMA: Jurnal Pendidikan Matematika*, 13(1), 33-40.
- Pangesti, F. T. P. (2018). Menumbuhkembangkan Literasi Numerasi Pada Pembelajaran Matematika Dengan Soal Hots. *Indonesian Digital Journal of Mathematics and Education*, 5(9), 566–575.
- Patriana, W. D., Wulandari, M. D., & Utama. (2021). Pengelolaan

- Pembelajaran Berorientasi Literasi Numerasi di Sekolah Dasar dalam Kegiatan Kurikuler dan Ekstrakurikuler. *Jurnal Pemikiran Dan Pengembangan Sekolah Dasar*, 9(2), 116–131.
<https://doi.org/10.24246/j.js.2022.v12.i3.p216-224>
- Permata, C. P., Kartono, & Sunarmi. (2015). Analisis Kemampuan Komunikasi Matematis Siswa Kelas VIII SMP Pada Model Pembelajaran Tsts Dengan Pendekatan Scientific. *Unnes Journal of Mathematics Education Research*, 4(2), 127–133.
<https://doi.org/10.15294/ujme.v4i2.7452>
- Rachmayani, D. (2020). Penerapan Pembelajaran Reciprocal Teaching untuk Meningkatkan Kemampuan Kominikasi Matematis dan Kemandirian Belajar Siswa. *Journal of Mathematics Education*, 3(1), 1–21.
- Ramadhan, I., & Minarti, E. D. (2018). Kajian Kemampuan Komunikasi Matematik Siswa SMP dalam Menyelesaikan Soal Lingkaran. *Journal of Medives : Journal of Mathematics Education IKIP Veteran Semarang*, 2(2), 151–161.
<https://dx.doi.org/10.22460/jpmi.v4i2.p%25p>
- Ratnasari, E. M. (2020). Outdoor Learning terhadap Literasi Numerasi Anak Usia Dini. *Jurnal Inovasi Pendidikan Guru Raudhatul Athfal*, 9(2), 182–192.
<https://dx.doi.org/10.21043/thufula.v8i2.8003>
- Sandy, D. N., Cholily, Y.M., Zukhrufurrohmah, Z., Ummah, S.K. (2022) Pengembangan *Flipbook* Bermuatan Literasi Numerasi untuk Meningkatkan Kemampuan Komunikasi Matematis. *Jurnal Tadris Matematiks*, 5(2), 135-148.
- Siskawati, F. S., Chandra, F. E., & Irawati, T. N. (2021). Profil Kemampuan Literasi Numerasi Di Masa Pandemi COV-19. *Ejurnal.Mercubuana*, 253–261.
- Soraya, Rosmayadi, & Wahyuni, R. (2021). Pengaruh Model Pembelajaran SQ3R Terhadap Kemampuan Komunikasi Matematis Siswa SMP Materi Pola Bilangan. *Jurnal Pendidikan Matematika Indonesia*, 28-34.
- Syafina, V., & Pujiastuti, H. (2020). Analisis Kemampuan Komunikasi Matematis Siswa Pada Materi SPLDV. *Jurnal Ilmiah Pendidikan Matematika*, 7(2), 118–125.
- Tanjung, H. S., & Nababan, S. A. (2019). Pengembangan Perangkat Pembelajaran Berbasis Masalah Untuk Meningkatkan Kemampuan Pemecahan Masalah Dan Komunikasi Matematis Siswa SMA Negeri 3 Kuala Kabupaten Negan Raya. *Genta Mulia*, 178-187.
- Tong, D. H., Uyen, B. P., & Quoc, N. V. A. (2021). Heliyon The improvement of 10 th students ' mathematical communication skills through learning ellipse topics. *Heliyon*, 7(11), 1–12.

<https://doi.org/10.1016/j.heliyon.2021.e08282>

Vale, I., & Barbosa, A. (2017). The Importance of Seeing in Mathematics Communication. *Journal of the European Teacher Education Network*, 12(1), 46-63.

AUTHORS' BIOGRAPHY

Annisa Rahmawati, S.Pd.



Born in Madiun, on June 6, 2000. Undergraduate study in Mathematics Education at the University of Muhammadiyah Malang, graduated in 2022.

Prof. Dr. Yus Mochamad Cholily, M.Si.



Born in Jombang, August 18, 1966. Teaching staff and director of research and community service at the University of Muhammadiyah Malang. Study S1 Mathematics at IKIP Negeri Malang, graduated in 1990; Masters in Mathematics at the Bandung Institute of Technology, graduated in 1993; Doctor of Mathematics at the Bandung Institute of Technology, graduated in 2005.

Zukhrufurrohmah, M.Pd.



Born in Nganjuk, August 11, 1991. Teaching staff at Muhammadiyah University Malang. Bachelor of Mathematics Education, State University of Malang, graduated in 2013; Master of Mathematics Education, State University of Malang, graduated in 2016.