

## Analysis of Mathematical Communication Ability Participants of the National Science Olympiad (OSN) for City/Regency Junior High Schools in Kupang Seen from a Gender Perspective

**Sahat Pandapotan Nainggolan**

Faculty of Vocation, Del Institute of Technology, Indonesia

Email: [sahat.nainggolan@del.ac.id](mailto:sahat.nainggolan@del.ac.id)

### Abstrak

Kemampuan komunikasi matematis siswa sangat penting dimiliki siswa dalam meningkatkan pemahaman terhadap pelajaran matematika. Penelitian ini bertujuan untuk mendeskripsikan kemampuan komunikasi matematis peserta Olimpiade Sains Nasional (OSN) SMP Tingkat Kota/Kabupaten se-Kupang yang telah mengalami proses seleksi terlebih dahulu. Subjek penelitian ini adalah 18 siswa dengan 9 siswa laki-laki dan 9 siswa perempuan. Teknik pengumpulan data yaitu menggunakan tes, observasi, dan wawancara terkait kemampuan komunikasi matematis. Prosedur penelitiannya melalui beberapa tahapan yaitu: 1) penyusunan soal tes kemampuan komunikasi matematika, 2) memvalidasi soal tes dan analisis hasil, 3) memberikan tes dan mengumpulkan hasil tes, 4) menganalisis hasil tes, 5) menarik kesimpulan. Berdasarkan hasil analisis data didapatkan kemampuan komunikasi matematis siswa perempuan pada semua indikator memiliki nilai lebih tinggi dari siswa laki-laki. Siswa perempuan lebih teliti, cermat dan sabar dalam menyelesaikan masalah matematika sehingga mampu mengkomunikasikan ide-ide matematika baik dengan gambar, diagram atau simbol dan memiliki representasi matematika yang lebih baik dari siswa laki-laki. Kemampuan komunikasi matematika siswa perempuan lebih tinggi dari kemampuan komunikasi matematika siswa laki-laki yaitu sebesar 59,11 % atau selisih 16,62%.

**Kata Kunci:** *Komunikasi matematis, olimpiade sains nasional (OSN), perspektif gender*

### Abstract

Students' mathematical communication skills are very important for students to improve their understanding of mathematics. This study aims to describe the mathematical communication skills of participants in the National Science Olympiad (OSN) for City/Regency Junior High Schools in Kupang who have undergone a selection process first. The subjects of this study were 18 students with 9 male students and 9 female students. Data collection techniques are using tests, observations, and interviews related to mathematical communication skills. The research procedure went through several stages, namely: 1) preparing test questions for mathematical communication skills, 2) validating test questions and analyzing results, 3) giving tests and collecting test results, 4) analyzing test results, 5) drawing conclusions. Based on the results of data analysis, it was found that the mathematical communication skills of female students on all indicators had higher scores than male students. Female students are more thorough, careful and patient in solving mathematical problems so that they are able to communicate mathematical ideas either with pictures, diagrams or symbols and have better mathematical representations than male students. The mathematical communication

ability of female students is higher than the mathematical communication ability of male students, which is 59.11% or a difference of 16.62%.

**Keywords:** *Mathematical Communication; National Science Olympiad (OSN), Gender Perspective*

## INTRODUCTION

Mathematics learning can also shape a person's mindset as a structure and logic. By learning mathematics, students are expected to connect and understand a relationship between one mathematical concept and another. Where in the end students can use it in everyday life. The importance of mastery of mathematics is also seen in the RI Law no. 20 Th. 2003 Regarding the National Education System, Article 37 emphasized that mathematics is one of the compulsory subjects for students at the primary and secondary education levels [1]. Solving these mathematical problems requires a standard of mathematical competence that is expected to be found in students. The National Council of Teachers of Mathematics or (NCTM) recommends five main standard competencies in learning mathematics, namely problem solving skills, communication skills, connection skills, reasoning abilities, and representations. ) [2].

Communication is very important in the student learning process because of communication students can convey ideas and can convey messages both in writing and directly. Communication is thought about so that what is conveyed can be understood easily by others. The existence of communication can be conveyed in several ways, one of which is mathematical communication. Mathematical communication is a very important thing that must be owned by students.

The delivery of mathematical communication sometimes has very different things between men and women both in terms of listening, reading, or in terms of writing. Gender is very influential in the process of students' communication skills, both creative thinking skills and the delivery of ideas for students [3]. So that the delivery of communication between men and women is very different, the difference sometimes lies in solving problems and understanding problems.

Based on observations of participants in the National Science Olympiad (OSN) at the city/district level in Kupang, the researchers found that students' mathematical communication skills differed by gender, especially in terms of listening, reading, or writing. These differences have not been identified in detail, so the exact direction of the trend is not known. Meanwhile, information about trends regarding differences in understanding is very important to know in order to determine the method used in learning. In addition, it is known that students' mathematical communication is still not optimal. This is caused by their lack of curiosity about something new. There are still many students who are learning by just sitting, silent, and taking notes; few of them are active in learning. On average, students are still hesitant and passive in conveying their mathematical ideas. Most students are still not used to writing down what is known and what is asked of the problem before solving it, so students often misinterpret the meaning of the question. In addition, gender differences are also possible to contribute to students' thinking processes such as students' communication skills in learning [4]. So it is possible that there will be differences in mathematical communication between men and women.

Based on initial observations by interviewing one of the coaches of the mathematics olympiad at the city/district level OSN junior high school participant coaching event in Kupang, the researchers found that the communication skills between female students and male students had different communication skills. This is shown both as a whole and in certain aspects. There is an aspect of the mathematical communication ability of male students that is higher than the mathematical communication ability of female students. Meanwhile, there are certain aspects of the mathematical communication ability of female students which is higher than the mathematical communication

ability of male students. Thus there is a diversity of students' mathematical communication skills from the gender aspect. The learning process in the classroom between female students and male students, female students are more active than male students. As a result, the learning process in the classroom is dominated by female students, so that the learning process is not optimal due to the lack of opportunities that students receive to convey their ideas.

Based on this, the teacher must provide opportunities for students to learn actively. So that students can see and experience for themselves the usefulness of mathematics in real life, and provide opportunities for students to be able to construct their knowledge through communication skills that lead to critical and creative thinking. Thus, based on the above review, researchers are interested in researching "Analysis of Mathematical Communication Skills for Participants in the National Science Olympiad (OSN) at City/Regency Junior High Schools in Kupang from a Gender Perspective".

## **METHODS**

This research uses qualitative research with descriptive qualitative research methods. This study aims to describe the mathematical communication skills of students in solving OSN questions at the city/district level in Kupang on algebraic material. This research was conducted at SMP Negeri 1 Kupang for the academic year 2021/2022. The data sources in this study were 18 students who had passed the OSN preparation selection for district/city levels throughout Kupang, consisting of 9 boys and 9 girls. The data collection technique used is a test of mathematical communication skills.

The mathematical communication indicators used in this study refer to Lestari and Yudhanegara (2017:83) which are simplified to; (1) linking real objects, pictures and diagrams, into mathematical ideas; (2) explain mathematical ideas, situations and relations, orally and in writing with real objects, graphs and algebra; (3) the ability to understand, interpret and evaluate mathematical ideas; (4) the ability to use terms, mathematical symbols, and structures to present ideas, describe relationships and create models; (5) express everyday events in mathematical language or symbols.

The research procedure went through several stages, namely: 1) preparing mathematical communication skills test questions, 2) validating test questions and analyzing results, 3) giving tests and collecting test results, 4) analyzing test results, 5) drawing conclusions. The instrument is in the form of test questions arranged in the form of a description of 5 numbers on the Pythagorean Theorem material. Each question number represents one indicator of mathematical communication ability.

Data on student work results were analyzed by gender, using descriptive statistics to find the average value and percentage of each indicator and interpreted and then described.

## **RESULTS AND DISCUSSION**

Research conducted on 18 students including 9 male students and 9 female students to measure students' mathematical communication skills in terms of gender, the data shown in Table 1.

The results of data analysis in Table 1 show that mathematical communication skills male and female students are different. For indicators of connecting real objects, pictures and diagrams, into mathematical ideas, female students scored 5% higher than male students. From the results of student work, it can be seen that most male students have difficulty understanding images so that they are unable to connect images into mathematical ideas causing the work of male students not to arrive at the final result or wrong. This is supported by the results of Pratiwi's research (2015) which states that male students who are used to solving problems in a predetermined way state problem solving steps by trial and error, respond verbally but are difficult to understand and are less thorough in adjusting the results with pictures.

Indicators related to explaining mathematical ideas, situations and relations, verbally and in

writing with real objects, graphs and algebra, show that female students scored 0.48% higher than boys.

No.	MATHEMATIC COMMUNICATION ABILITY INDICATORS	AVERAGE VALUE OF FEMALE STUDENTS	% FEMALE STUDENT VALUES	AVERAGE VALUE OF MALE STUDENTS	% MALE STUDENT VALUES
1	Connecting real objects, pictures and diagrams, into mathematical ideas	80	53.5	78	48.5
2	Explaining mathematical ideas, situations and relations, orally and in writing with real objects, graphs and algebra	72	50.24	65	49.76
3	Ability to understand, interpret and evaluate ideas mathematical ideas	85	58.72	70	43.28
4	Ability to use mathematical terms, symbols, and structures to present ideas, describe relationships and create models	62	68.03	40	34.97
5	Expressing daily events in mathematical language or symbols	62	65.04	35	35.96
<b>TOTAL</b>		<b>72.2</b>	<b>59.11</b>	<b>57.6</b>	<b>42.49</b>

This result is actually not too different between men and women because both men and women are unable to explain n ideas in writing. From the results of student work, it shows that both male and female students have not been able to write correctly and complete the steps for solving problems, do not write formulas, do not solve problems correctly and do not draw conclusions so that the ability to explain mathematical ideas in writing is still lacking.

This is in line with the results of research by Dilla, Hidayat and Rohaeti (2018) which concludes that students with mathematical resilience who are less likely to do what they are, do not even finish until the final process of solving the questions because of the fear of being wrong and lack of interest in answering questions both male and female. both men and women. The results of the analysis for the third indicator, namely the ability to understand, interpret and evaluate mathematical ideas, the results obtained are the scores of female students are also higher than male students with a difference of 15.44%. Male students are lacking in writing and re-evaluating the work that has been written, preferring to write directly on the final result, not being thorough, resulting in many shortcomings in the final result which then reduces the maximum score. Analysis of indicators 4 and 5 regarding the ability to use terms, mathematical symbols, and structures to present ideas, describe relationships and modeling and express everyday events in mathematical language or symbols, on average student and male scores are quite low compared to the previous 3 indicators. The fourth indicator has a difference in value of 33.06% while the 5th indicator has a difference of 29.14% in value. In this indicator, female

students tend to solve problems in their own way but answer until the final result. Meanwhile, male students are more proficient in describing mathematical ideas with symbols, but do not write down the answers until the end so that the final answer is more likely to be wrong or not even written down. The results of the research by Nugraha and Pujiastuti (2019) showed that for female students, the completion indicator component was higher in value than expressing a mathematical situation or idea in the form of a mathematical symbol or model. This can be seen from the results of the answers of female students who tend to prioritize solving through their own way by ignoring the components in expressing a mathematical situation or idea in the form of symbols or mathematical models. On the other hand, male students are higher in indicators of stating a mathematical situation or idea in the form of a mathematical symbol or model rather than solving it, as seen from the results of students' answers that prioritize components in expressing a mathematical situation or idea in the form of symbols or mathematical models but less right at solving it. This means that female students have more control over the solution, while male students have more control over indicators of expressing a situation or mathematical idea in the form of pictures.

Overall, female students' mathematical communication skills were higher than male students where the total average score of female students was 72.2 or 59.11% while the total average score of male students was 57.6 or 42.49 %. Amir's research (2013) shows that boys have high abilities in mathematics, but girls are superior in effective aspects (diligent, thorough, careful). On the other hand, female students are superior in mathematical (verbal) communication skills, more motivated, organized in learning.

Students' mathematical communication skills will be better apart from gender factors, also determined by learning activities in class. Mathematics communication skills can be formed by teachers by getting students used to expressing opinions either orally or in writing, creating interesting learning by involving students and giving students opportunities to explore. Interesting learning can be created by applying innovative teaching methods, not monotonous and fixated on the teacher.

The research of Ula, Murtono and Ulya (2018) concludes that: 1) there is a difference in the average mathematical communication ability in the class that received the TPS learning model treatment with the class that received the expository learning model treatment, 2) the mathematical communication ability of the students who received the TPS model learning achieve the specified effectiveness qualifications. The same result was also stated by Kadarisma (2018) that the increase in mathematical communication skills using *Open-Ended* was better than those using conventional approaches. Gender differences not only result in differences in ability in mathematics, but also in how to acquire mathematical knowledge. Many opinions say that women are not quite successful in learning mathematics compared to men. In addition, women almost never have a thorough interest in theoretical questions like men. Women are more interested in practical things than theoretical. But on the other hand, not a few female students have success in math skills (Amir, 2013). Therefore, gender equality and the application of appropriate learning methods will make students have good mathematical abilities, especially mathematical communication skills that lead students to mastery of competencies that support life skills.

The right learning pattern can increase students' interest, motivation and self-confidence which indirectly improves students' mathematical communication skills. In line with the results of research by Hendriana and Kadarisma (2019) that mathematical communication skills are influenced by *self-efficacy*. And self-efficacy has a positive effect on students' communication skills, meaning that the higher students' self-efficacy, the higher students' communication skills.

## CONCLUSION

The conclusion of this study is that the mathematical communication ability of female students is higher than the mathematical communication ability of male students by 59.11% or a difference of 16.62%. The mathematical communication ability of female students on all indicators has a higher score than male students. Female students are more thorough, careful and patient in solving mathematical problems so that they are able to communicate mathematical ideas either with pictures, diagrams or symbols and have better mathematical representations than male students. Based on the results of this study, it is recommended that teachers seek to improve their mathematical communication skills by paying attention to gender and the use of learning methods that increase the interest and learning motivation of male and female students.

## REFERENCES

- Amir, Z. 2013. Perspektif Gender dalam Pembelajaran Matematika. Jurnal UIN Sultan Syarif Kasim Riau, 12.
- Andini, S. F. & Marlina, R. (2021). Analisis Kemampuan Komunikasi Matematis Siswa SMP Dalam Menyelesaikan Soal Pada Materi Himpunan. Jurnal Pembelajaran Matematika Materi Himpunan, Vol. 4, No. 2, Hal. 343-354.
- Aryanti. (2020). Inovasi Pembelajaran Matematika di SD (Problem Based Learning Berbasis Scaffolding, Pemodelan dan Komunikasi Matematis). Yogyakarta: CV Budi Utama.
- Dilla, S. C., Hidayat, W. dan Rohaeti, E. E. 2018. Faktor Gender dan Resiliensi dalam Pencapaian Kemampuan Berpikir Kreatif Siswa SMA. Journal of Medives, 2 (1): 129-136.
- [2] Elly Rizki Diandita et al., "Kemampuan Komunikasi Matematis dan Metakognitif Siswa SMP pada Materi Lingkaran Berdasarkan Gender", Jurnal Pendidikan Matematika 11, no.2 (2017). <http://dx.doi.org/10.22342/jpm.11.2.2533>.
- Fahradina, N. 2014. Peningkatan Kemampuan Komunikasi Matematis dan Kemandirian Belajar Siswa SMP dengan Menggunakan Model Investigasi kelompok. Jurnal Didaktik Matematika. Vol 1, No 1, September 2014. pp 54-64.
- Henderiana, Heris dan Kadarisma, Gida. 2019. Self-Efficacy dan Kemampuan Komunikasi Matematis Siswa SMP. JNPM (Jurnal Nasional Pendidikan Matematika), 3(1): 153-164.
- Kadarisma, Gida. 2018. Penerapan Pendekatan Open-Ended dalam Meningkatkan Kemampuan Komunikasi Siswa SMP. Anargya: Jurnal Ilmiah Pendidikan Matematika, 1(2): 77-81.
- Lestari, K. E. dan Yudhanegara, M. R. 2017. Penelitian Pendidikan Matematika. Bandung: PT Refika Aditama.
- [3] Nugraha, Tonnie Hari, and Heni Pujiastuti. 2019. "Analisis Kemampuan Komunikasi Matematis Siswa Berdasarkan Perbedaan Gender". *Edumatica : Jurnal Pendidikan Matematika* 9 (1):1-7. <https://doi.org/10.22437/edumatica.v9i1.5880>.
- Putra, Y. A., Susanto, & Suharto. (2019). Analisis komunikasi matematis siswa dalam menyelesaikan soal persamaan linear satu variabel ditinjau dari gaya belajar. Kadikma, 10(1):126–35.
- Pratiwi, D. D. 2015. Analisis Kemampuan Komunikasi Matematis dalam Pemecahan Masalah Matematika Sesuai dengan Gaya Kognitif dan Gender. Al-Jabar: Jurnal Pendidikan Matematika, 6 (2): 131 – 141.
- Prayitno, S., Suwarsono dan Siswono, T. Y. 2013. Identifikasi Indikator Kemampuan Komunikasi Matematis Siswa dalam Menyelesaikan Soal Matematika Berjenjang pada Tiap-Tiap Jenjangnya. Konferensi Nasional Pendidikan Matematika V. Malang: Universitas Negeri Malang.
- [1] Rahmawati, F. (2013). Pengaruh pendekatan pendidikan realistik matematika dalam meningkatkan kemampuan komunikasi matematis siswa sekolah dasar. *Prosiding Semirata 2013*, 1(1).
- Rini, C. P., & Amaliyah, A. (2021). Pengaruh Model Learning Cycle 5e (Engagement, Exploration, Explanation, Elaboration, Evaluation) Terhadap Kecerdasan Naturalis Siswa Kelas IV MI Al Fitroh Cipondoh Kota Tangerang. Indonesian Journal of Elementary Education (IJOEE), 2(2), 1-14.
- Rohid, N., Suryaman dan Rusmawati, R. D. 2019. Students' Mathematical Communication Skill (MCS) in Solving Mathematics Problems. Anatolian Journal of Education, 4 (2): 19-30.

- [4] Sadikin, S., & Kaharuddin, A. (2019, December 23). Identifikasi Kemampuan Komunikasi Matematika Ditinjau Dari *Self-Concept* Matematis Dan Gender. <https://doi.org/10.31227/osf.io/5fybs>.
- Sari, S. M., & Pujiastuti, H. (2020). Analisis kemampuan komunikasi matematis siswa ditinjau dari self-concept. *Jurnal Matematika Kreatif-Inovatif*. doi: 10.15294/kreano.v11i1.22717.
- The National Council Of Teacher Of Mathematics (NCTM). 2000. Principles and Standards For School Of Mathematics. USA: Library of Congress Cataloguing in Publication.
- Ula, I. D., Murtono dan Ulya, H. 2018. Efektivitas Model Pembelajaran Think-Pair-Share (TPS) Terhadap Kemampuan Komunikasi Matematis Siswa. *Anargya: Jurnal Ilmiah Pendidikan Matematika*, 1 (1): 51-58.
- Wijayanti, I. D., Hariastuti, R. M., & Yusuf, F. I. (2019). Kemampuan komunikasi matematis siswa ditinjau dari gaya belajar. *Jurnal Inovasi Pendidikan Matematika*.