23 (4), 2022, 1665-1672

Jurnal Pendidikan MIPA

e-ISSN: 2550-1313 | p-ISSN: 2087-9849

http://jurnal.fkip.unila.ac.id/index.php/jpmipa/

Mathematical Communication Ability of Junior High School Students Across Gender

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Abstract: The purpose of this study was to describe students' mathematical communication skills in terms of gender differences in class VII-1 of SMP Negeri 1 Dawarblandong. This type of research is quantitative with a descriptive approach. This research was conducted in the even semester of the 2021/2022 academic year at SMP Negeri 1 Dawarblandong. The subjects in this study were class VII-1 students, as many as 32 students consisting of 26 female students and 6 male students. The data in this study were obtained from tests. The test results are used to determine the mathematical communication skills of male and female students in writing. The results of the research showed that mathematical communication skills of male students are included in the poor category with an average value of 29.17 with poor category and female studentss are included in the fairly good category with an average value of by 43.51.

Keywords: mathematical communication ability, junior high school students, gender.

Abstrak: *Tujuan penelitian ini adalah untuk menganalisis kemampuan komunikasi matematis peserta didik ditinjau dari perbedaan jenis kelamin di kelas VII-1 SMP Negeri 1 Dawarblandong. Jenis penelitian ini adalah kuantitatif dengan pendekatan deskriptif. Penelitian ini dilaksanakan pada semester genap tahun pelajaran 2021/2022 di SMP Negeri 1 Dawarblandong. Subjek dalam penelitian ini adalah peserta didik kelas VII-1 sebanyak 32 peserta didik yang teridiri dari 26 peserta didik perempuan dan 6 peserta didik laki-laki. Data dalam penelitian ini diperoleh dari tes. Hasil tes digunakan untuk mengetahui kemampuan komunikasi matematis peserta didik laki-laki dan perempuan secara tertulis. Hasil penelitian menunjukkan bahwa kemampuan komunikasi matematis tertulis peserta didik laki-laki termasuk dalam kategori kurang baik dengan nilai rata-rata sebesar 29,17 dan peserta didik perempuan termasuk dalam kategori cukup baik dengan nilai rata-rata sebesar 43,51.*

Kata kunci: *kemampuan komunikasi matematis, siswa SMP, jenis kelamin.*

▪ INTRODUCTION

Humans are social beings who cannot live separately, and this is necessary so that humans can communicate with each other (Hodiyanto, 2017). Communication is the process of conveying information, ideas, emotions, abilities through symbols, words, pictures, numbers, etc. (Septiana, 2018; Berelson in Tinungki, 2015). Mathematics is a science that is accurate, systematic, logical and based on human rationale. Mathematics is an important skill and must be well mastered by students (Sundayana, 2017). Therefore, indirectly mathematics helps effectively, systematically and practically in shaping ways of thinking, solving problems and communicating ideas or it can be said as a thorough and clear way of communication. When students communicate their thoughts to others verbally or in writing it helps increase understanding, make connections and develop language to express mathematical ideas. (Kamid, 2020).

Mathematical communication is one of the skills needed for students. This ability allows students to understand mathematics through the process of thinking, discussing

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DOI: http://dx.doi.org/10.23960/jpmipa/v23i4.pp1665-1672
Received: 26 October 2022
Accepted: 12 December 2022
Published: 16 December 2022

and making decisions (Viseu & Oliveira, 2012). Through mathematical communication, students can learn mathematical patterns and mathematical ideas (Tiffany, 2017). The process of mathematical communication can also provide opportunities for students to share ideas (Chung, 2016). Mathematical communication ability is the ability to express mathematical ideas, understand, interpret, assess or respond to mathematical ideas and use terms, notations, and symbols to present mathematical ideas (Rohid, 2019).

Mathematical communication skills can be in the form of oral and written. Mathematical communication in oral form, for example, can be seen when students express ideas or thoughts about mathematics to friends or teachers in class. Meanwhile, mathematical communication in written form can be seen when students can make tables, pictures, diagrams, or mathematical symbols, which they put into writing about mathematical problems (Sari, 2017). To improve mathematical communication skills indicated by, (1) Students are able to express mathematical ideas or ideas with verbal sentences, (2) Students are actively involved in discussions about mathematics, (3) Students can formulate definitions and generalizations about mathematics, (4) Students can formulate a definition of mathematics using their own language (Nartani, 2015).

Mathematical communication skills can also affect many things, including everyday life (Yaniawati, 2019). Therefore, mathematical communication skills play an important role in learning mathematics because through mathematical communication students can organize and strengthen their mathematical thinking. As stated by NCTM in Hendriana (2017) which confirms that mathematical communication skills are an essential competency of mathematics and mathematics education. Without good communication, the development of mathematics will be hampered. Scientific communication symbols can be tables, charts, graphs, pictures of mathematical equations.

The importance of aspects of mathematical communication skills is not in line with the mastery of these aspects in Indonesia. In fact, students' mathematical communication skills are still not as expected. The lack of students' mathematical communication skills is a significant problem that requires attention and solutions (Aliyah, 2019). Several studies have shown that students' mathematical communication skills in Indonesia are still low (Sundayana, 2017). Several studies have found that students are unable to answer the questions asked. In addition, students still have weaknesses in using mathematical symbols/notations correctly and have not been able to provide visual representations that contain known images or graphs. (Primayanti, 2018; Sari, 2017; Nurjanah, 2019)

From the results of the 2015 Trends in International Mathematics Science Study (TIMSS), Indonesia was ranked 36th out of 48 countries (Mullis in Chasanah, 2020). In addition, the results of the Program for International Student Assessment (PISA) regarding students' mathematical communication abilities, Indonesia is also ranked 69th out of 76 countries (OECD, 2015). There are several factors that affect a person's mathematical communication, one of which is gender (Taqwa, 2019). Gender is the difference between men and women including shape, nature, and biological functions that have been seen since birth. Gender is a difference that appears in several aspects such as physical growth, brain development and speaking ability (Tahir, 2018). Meanwhile, Pambudi (2021) revealed that gender is a differentiator between men and women biologically from birth.

In general, women have higher mathematical communication than men. Some say that there are no male or female gender roles that outperform each other in mathematics, but it turns out that women can excel in mathematics (Indrawati & Tasni, 2016). Gender in education is rarely discussed. Knowledge of gender can help share roles based on reality in society (Jager, 2015). However, according to Lubienski, girls are believed to have better math skills than boys (Lubienski, 2013). Women have higher mathematical communication skills than men (Suswigi, 2019). Several other studies have also shown that there are differences in mathematical communication skills between male and female students. In general, the mathematical communication ability of female students is higher than that of male students, with an average score of 71.6 for female students and an average score of 53 for male students (Babys, 2029). Other research shows that female subjects are clearer in giving their answers orally and male subjects are better at giving their answers in writing (Prayitno, 2013). There are differences in mathematical communication abilities between male and female students. Male students tend to write answers that are incorrect and not detailed in expressing their mathematical ideas, they rarely write down what they know without writing down the purpose of the solution. Whereas female students tend to write down their answers in detail in expressing their mathematical ideas, using coherent steps, writing down what is known and writing down the objectives on the questions, even though the calculations are still not quite right (Azhari, 2018).

Based on the description above, mathematical communication ability is an important ability to be developed and mastered by students. Gender is one of the factors that influence the ability of mathematical communication. So that researchers are interested in analyzing students' mathematical communication abilities in terms of gender differences.

▪ METHOD

Research was conducted at SMP Negeri 1 Dawarblandong for academic year 2021/2022. The main subjects in this study were 32 students in class VII-1 and the test subjects were class VII-2 with 31 students. Selection of the sample in the study with purposive sampling technique. This type of research is descriptive with a quantitative approach to analyze mathematical communication skills in terms of gender. The procedure in this study consisted of preparing research instruments; conduct trials of test questions to students of class VII-2; conduct validity and reliability tests; giving valid test questions to students of class VII-1; analyzing data on mathematical communication ability test results in terms of gender. The research was conducted from June 3 2022 to June 18 2022.

The instrument used was a test to determine written mathematical communication skills. The test instrument in this study was a written test which was compiled based on indicators of mathematical communication skills which were done individually. The test questions consist of 5 items in the form of descriptions prepared by the researcher and adjusted to the indicators. The indicators of mathematical communication ability in this study refer to the indicators put forward by (Ansari, 2016). The following are indicators of mathematical communication skills in this study: 1) understand and express mathematical ideas by depicting them in visual form (drawings); 2) interpreting images into symbols or mathematical language; 3) Using vocabulary or language, notation and

mathematical structures to express ideas, describe relationships, and make models (written text).

The questions have been consulted in advance with the supervising lecturers and mathematics educators of SMP Negeri 1 Dawarblandong. Then the test questions were tried out to class VII-2. The results of the students' work were calculated for each item score, then tested the validity and reliability of the five items. This validity and reliability test calculation uses a computer program, namely SPSS. The instrument is valid if the correlation coefficient (Pearson) is greater than 0.355. The instrument that was tested for validity was a test of mathematical communication skills. The calculation results show that one item has invalid criteria because the correlation coefficient (Pearson) is less than 0.355 and the other four questions have valid criteria because it meets the requirements for a correlation coefficient (Pearson) value of more than 0.355. A variable is said to be reliable if it gives a Cronbach α (Ghozali, 2018). From the results of the calculation of the reliability test about the mathematical communication ability, the value is obtained. Because of Cronbach's Alpha value, the instrument is said to be reliable. Because the instrument was said to be reliable and from the results of the validity test it was found that 1 item was invalid, the invalid questions were not used to measure students' mathematical communication abilities and were given to the main subject of the study, namely class VII-1, totaling four questions.

After getting the data from the test results, then analyzed by calculating the value of students' mathematical communication abilities on each indicator with the following formula.

$$P_k = \frac{r}{n} \times 100$$

which P_k: score of mathematical communication ability for each indicator, r: sum of score for each indicator, and n: maximum score for each indicator. Calculating the value of students' mathematical communication abilities with the formula:

$$Score = \frac{Students' score}{sum\ of\ maximum\ score} \times 100$$

After obtaining the score, then critique the value of the mathematical communication ability of male and female students according to the criteria for assessing mathematical communication ability quoted from Arikunto (2010), namely: 1) students who obtain scores between 81-100 are included in the communication ability criteria excellent math; 2) students who score between 61-80 are included in the criteria of good mathematical communication skills; 3) students who score between 41-60 are included in the criteria of fairly good mathematical communication skills; 4) students who score between 21-40 are included in the criteria for poor mathematical communication ability; and 5) students who score less than 21 are included in the criteria for very poor mathematical communication skills. After calculationing the mathematical communication ability data, then an analysis was performed by considering gender.

▪ RESULT AND DISSCUSSION

Following are the results of the analysis of data on mathematical communication skills based on gender for each indicator

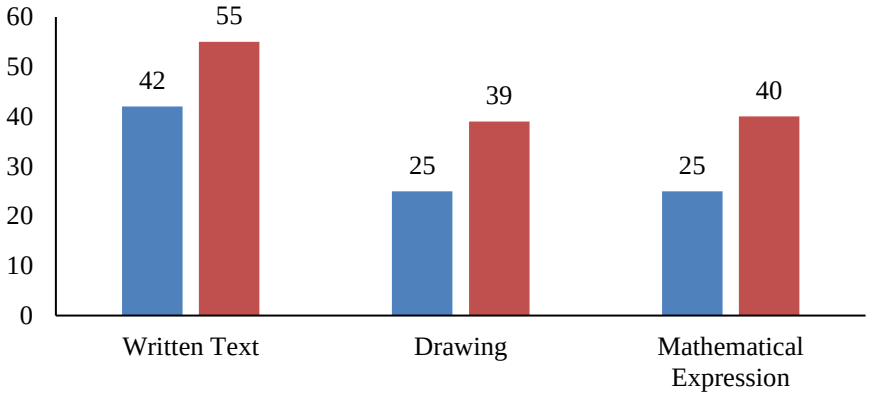

Figure 1. The average value for each indicator across gender. Male and female are presented in the blue and red color

From the data in Figure 1, the results of the mathematical communication skills of male and female students on each indicator are the same, namely on the written text, drawing, and mathematical expression female students get higher scores than male students. Indicator written text (writing) male and female students in class VII-1 have fairly good mathematical communication skills with a value of 55 for female students and 42 for male students. Moreover, it can be interpreted that participants female and male students on the written text are quite capable of writing mathematical ideas from a problem in their own language. It's just that female students are more detailed in writing mathematical ideas in their own language compared to male students.

Drawing indicator, male and female students in class VII-1 have poor mathematical communication skills with a value of 39 for female students and 25 for male students. Moreover, it can be interpreted that women and men are less able to write down a mathematical situation or idea in the form of a picture. It's just that female students are better at writing mathematical ideas into pictures compared to male students. Mathematical expression indicator, male and female students in class VII-1 have poor mathematical communication skills, with a value of 40 for female students and 25 for male students. So it can be interpreted that female and male students on the mathematical expression are less able to write a mathematical situation or idea into a mathematical model. It's just that female students are more capable of writing mathematical ideas into mathematical models compared to male students.

It can be seen in Figure 1 that the best value for the mathematical communication ability of female students is in the first indicator, namely written text with a value of 55 for female students' mathematical communication skills and 42 for male students. This is because male students -both boys and girls have understood the commands given so that students are able to name and show the characteristics of angles. This is not in accordance with the results of research conducted by Nugraha (2019) which shows that female students in the aspect of drawing are higher than aspects of writing and mathematical expression. Meanwhile, the best value of the mathematical communication ability of male students is in the first indicator, namely written text with the value of the mathematical communication ability of male students of 42. This is in accordance with the results of research conducted by Nugraha (2019) which shows that

male students in the aspect of writing is higher than the aspect of drawing and mathematical expression.

The lowest value of the mathematical communication ability of male and female students is in the second indicator, namely drawing, with the value of the mathematical communication ability of female students of 39 and male students obtaining a value of 25. This is because most of the male students -both men and women do not understand the problem or questions given so they are confused in expressing the problem in the form of an image. This is not in accordance with the results of research conducted by Nugraha (2019) which shows that male students in the aspect of mathematical expression are lower than the aspects of drawing and writing. Meanwhile, female students in the writing aspect were lower than the drawing and mathematical expression aspects. The results of data analysis for each item between male and female students are presented in the following bar chart.

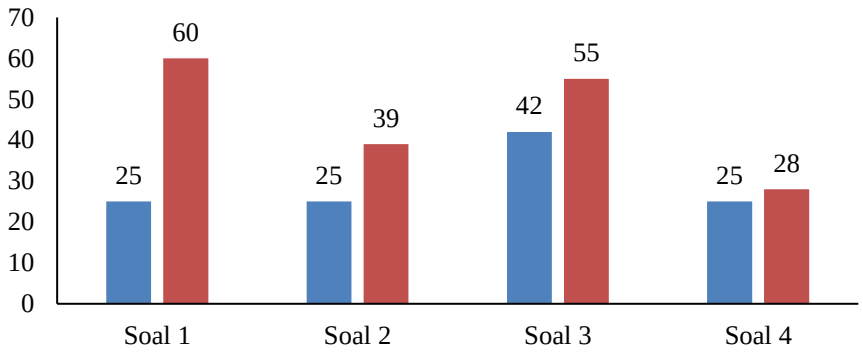

Figure 2. The average score for each question across gender. Male and female are presented in the blue and red color

The data in Figure 2 shows that in questions number 1 to number 4 the average score of female subjects is higher than that of male subjects. Moreover, it can be interpreted that female students are better at writing mathematical ideas from a problem in their own language, writing a mathematical situation or idea in the form of an image, and writing a mathematical situation or idea into a mathematical model. This is in line with the results of Babys' research (2020) which shows that the value of the mathematical communication ability of female students is higher than that of male students. This is also consistent with the results of Suswigi's research (2019) which shows that the mathematical communication skills of female students are relatively high compared to male students.

▪ CONCLUSION

Based on the results of data analysis of mathematical communication skills, it can be concluded that students' written mathematical communication skills were obtained by 6 male students (19%) who had poor mathematical communication skills and 26 female students (81%) have good mathematical communication skills. Mathematical communication skills for each indicator for male students in the first indicator, namely written text (writing) earned a score of 42 in the category of fairly good mathematical communication abilities, in the second indicator, namely drawing (drawing) earned a

value of 25 in the category of mathematical communication skills which is not good, and on the third indicator, namely mathematical expression (mathematical expression) obtains a value of 25 in the category of unfavorable mathematical communication abilities. Meanwhile, for female students, the first indicator, namely written text (writing), received a score of 55 in the category of fairly good mathematical communication skills, in the second indicator, namely drawing, obtained a value of 39 in the category of poor mathematical communication skills, and in the third indicator, namely mathematical expression, obtained a value of 40 in the category of poor mathematical communication ability.

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