Students' mathematical abilities in statistics

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Abstract
Basically, every student must master mathematics taught in school because mathematics is a science that is always used in everyday life, but in fact, many students think that mathematics is a difficult subject that makes them feel dizzy in learning mathematics. The purpose of this study was to analyze students' mathematical communication skills in statistics material. The subjects used were junior high school class IX students who had studied statistics material with a sample of two people. The method used is a descriptive qualitative research method, and the instruments used consist of a test instrument for mathematical communication skills, interviews, and field notes. Based on the results of the research conducted, it shows that most of them have mastered mathematical communication skills and are included in the good criteria with a percentage of 79.85%.
Keywords: mathematic communication ability; statistics; descriptive qualitative

Abstrak
Pada dasarnya setiap siswa harus menguasai matematika yang diajarkan di sekolah karena matematika adalah ilmu yang selalu di pakai dalam kehidupan sehari-hari, tapi pada kenyataannya banyak siswa berpendapat bahwa matematika adalah pelajaran yang sulit sehingga membuat mereka merasa pusing dalam mempelajari matematika. Tujuan dari penelitian ini adalah untuk menganalisis kemampuan komunikasi matematis siswa pada materi statistika. Subjek yang digunakan yaitu siswa SMP kelas IX yang sudah mempelajari materi statistika dengan sampel sebanyak dua orang. Metode yang digunakan adalah metode penelitian deskriptif kualitatif dan instrumen yang digunakan teridiri atas instrumen tes kemampuan komunikasi matematis, wawancara dan catatan lapangan. Berdasarkan hasil penelitian yang dilakukan menunjukkan bahwa kemampuan komunikasi matematis sebagian besar mereka sudah menguasai kemampuan komunikasi matematis dan termasuk ke dalam kriteria baik dengan persentase sebesar 79.85%.
Kata Kunci: kemampuan komunikasi matematis; statistika; kualitatif deskriptif

Introduction

The development of a nation is influenced by several factors, one of which is education. In building good education, teachers and students must be able to communicate well. Communication as we know it is the process of conveying information to others so that the person knows the information conveyed (Kusnadi & Mardiani, 2022). In mathematics, there is also something called mathematical communication. Students are required to be able to communicate in good and correct mathematical language (Sulastri, 2023). The lack of abilities possessed by students makes it difficult for them to work on math problems, one of the abilities that students must have is communication skills (Muslihah & Suryaningrat, 2021). Where this communication skill is very important for every student so that students can understand the questions given so that they know what the purpose of the question is and can work on it well.

The National Council of Teachers of Mathematics (Susannti, Kurnia, Nurfauziah, & Hendriana, 2018) states that "mathematics education from elementary school to grade XII requires educational standards that play a role in creating students who have thinking skills, mathematical reasoning skills, have useful basic knowledge and skills". Mathematical communication is found in the objectives of mathematics learning stated in the Permendikbud. "Starting from elementary school, all students must be equipped with mathematics subjects so that they have the ability to think logically, analytically, systematically, critically, innovate and creatively, and work together." (Permendikbud, 2014). To fulfill this, mathematics learning needs to realize the objectives of mathematics learning.

The objectives of mathematics learning according to Permendikbud Number 58 of 2014 are so that students have the ability (Sriwahyuni & Maryati, 2022): 1. Understanding mathematical concepts, is a competency in explaining the relationship between concepts and using concepts and algorithms, flexibly, accurately, efficiently, and precisely, in problem solving; 2. Using patterns as assumptions in problem solving, and being able to make generalizations based on existing phenomena or data; 3. Using reasoning on properties, performing mathematical manipulations both in simplification, and analyzing components in problem solving in the context of mathematics and outside mathematics (real life, science, and technology) which includes the ability to understand problems, build mathematical models, solve models and interpret solutions obtained including in order to solve problems in everyday life (real world); 4. Communicating ideas, reasoning and being able to compile mathematical evidence using complete sentences, symbols, tables, diagrams, or other media to clarify situations or problems; 5. Having an attitude of appreciating the usefulness of mathematics in life, namely having curiosity, attention, and interest in studying mathematics, as well as a persistent and confident attitude in problem

solving; 6. Having attitudes and behaviors that are in accordance with the values in mathematics and its learning; 7. Performing motor activities that use mathematical knowledge; and 8. Using simple teaching aids and technological results to perform mathematical activities.

Other research results conducted by Osterholm (Pratiwi, 2015) stated that it seems difficult for students to explain the reasons for understanding a reading text. There are still many students who have not written down the solution, making interpersonal communication (message symbol processing) and interpersonal (message delivery process) important in explaining terms to solve a mathematical problem. Many students have not been able to read mathematical symbols, and often students do not understand the existence of graphs in mathematics. Madio (2016), in his research also reported that the average score of students' mathematical communication skills in the subject matter of algebra was 1.14 from an ideal score of 4. In terms of percentage, the average score of students' mathematical communication skills only reached 28.59% of the ideal score. According to Lacoe (Rifal, Sudia, & Masi, 2017) One of the mathematical communications is written communication. Written communication is a communication process that organizes, summarizes and exchanges ideas in written form. Through writing, students can improve their memory of concepts, and students have the opportunity to reflect on their own ideas. The results of Aulia's research (2018) reported that the average score of students' mathematical communication skills obtained only reached 3.9 out of the ideal maximum score of 10, on the subject of algebra. Baroody Nisa (2019), mathematical communication is interpreted as an asset for solving, exploring and researching mathematics, as well as a forum for social activities with friends, sharing ideas and discoveries, exchanging ideas, evaluating and perfecting ideas to convince others. In the process of learning mathematics with mathematical communication, students can solve problems and explore the knowledge gained to share findings and opinions with other students. The communication known is oral communication and written communication. Students' communication skills are still very low because they cannot communicate mathematical ideas when studying mathematics, this is one of the causes of low mathematical communication skills (Hendriana & Kadarisma, 2019). From several opinions and research results above, it can be said that mathematical communication skills are very important for every student, because through mathematical communication students can communicate verbally and in writing, communicate mathematical ideas/concepts in the form of symbols, tables, diagrams/graphs, and clarify problems through the form of: mathematical grammar and vocabulary structure (mathematical grammar), mathematical discourse, social/contextual mathematical problems (social language) and codes/codes in mathematical messages, all of which are summarized in four aspects of mathematical communication skills.

The importance of mathematical communication skills possessed by every student makes me want to research mathematical communication skills in students, besides considering the importance of mathematical communication skills possessed by every student, also based on previous studies that I have explained above, it states that the mathematical communication skills possessed by students are still low so that further research is needed to determine students' current communication skills.

The difference between the research that I will do and previous studies is that the research conducted focuses more on students' communication skills in statistical material, because statistical material is important for life so it needs to be understood well by students. And the purpose of this study is to determine the students' mathematical communication skills at this time, whether they are low, sufficient or high. In this study, what is studied is the students' communication skills in the form of written skills. To measure mathematical communication skills, researchers take the indicators proposed by Sumarmo as follows: (1) Connecting real objects, images, and diagrams into mathematical ideas; (2) Explaining mathematical ideas, situations, and relations orally or in writing, with real objects, images, graphs, and algebra.

Method

The type of research conducted in this study is qualitative descriptive research. Qualitative descriptive research method is a research that uses a naturalistic approach to seek and find an understanding of the phenomenon of what is experienced by the research subjects (Moleong, 2011). The purpose of this study is to analyze the level of students' mathematical communication skills. The subjects of this study were three students from grade IX who had taken or received statistics material at their school located in Bebedahan Village RW 02, this research was conducted in December 2020. The technique for selecting subjects in this study used the Purposive Sampling technique.

To collect data obtained from the subjects, triangulation or combined techniques were used, namely between test instruments, interviews, and field observation notes. The mathematical communication test given was in the form of questions that were adjusted to the selected communication ability indicators, interviews and field notes to produce more accurate data.

Result

After the students were given the test, the researcher analyzed the results of each student's answers using the limitations found. The data on the results of the students' mathematical communication skills test were based on existing indicators. The data were

then analyzed and interpreted in the form of descriptions as a picture of the research results.

Table 1. Student Score Acquisition on Each Indicator of Mathematical Communication Ability.

Number	Indicator	Average	
		Scala 4	%
1	Expressing everyday events in mathematical language or symbols	4,00	100%
2	Connecting real objects, pictures, and diagrams into mathematical ideas	4,00	100%
3	Explain mathematical ideas, situations, and relationships orally or in writing, using real objects, pictures, graphs, and algebra	2,78	69,5%
4	Expressing or explaining a mathematical model of an image form in ordinary language	2,00	50%
	Total Mathematical Communication Ability	13,78	79.85%

After scoring the students' answers based on the indicators achieved. Furthermore, the indicator scores and the students' overall scores are converted into scale values (1-100) and interpreting the data according to the understanding criteria based on Arikunto (Khadijah, Maya, & Setiawan, 2018). The data is categorized using the following limitations:

Table 2. Data Criteria

Percentage	Criteria
81% - 100%	Very Good
61% - 80%	Good
41% - 60%	Satisfy
21% - 40%	Less
0% - 20%	Very Less

Based on Table 2, of the 4 indicators of mathematical communication skills, there are 2 indicators that fall into the very good criteria, namely; the indicator stating daily events in mathematical language or symbols is 100% (Very Good) and the indicator connecting real objects, images, and diagrams into mathematical ideas is 100% (Very Good). There is 1 indicator that falls into the good criteria, namely the indicator explaining mathematical ideas, situations, and relations verbally or in writing, with real objects, images, graphs, and algebra is 69.5% (Good) and there is 1 indicator that falls into the less criteria, namely the indicator stating or explaining mathematical models in the form of images into ordinary language is 50% (Fair). And it can be seen from the table above from the average overall score of questions from all students included in the good criteria, namely 79.85%. The following is a discussion of each question on the students' mathematical communication skills test.

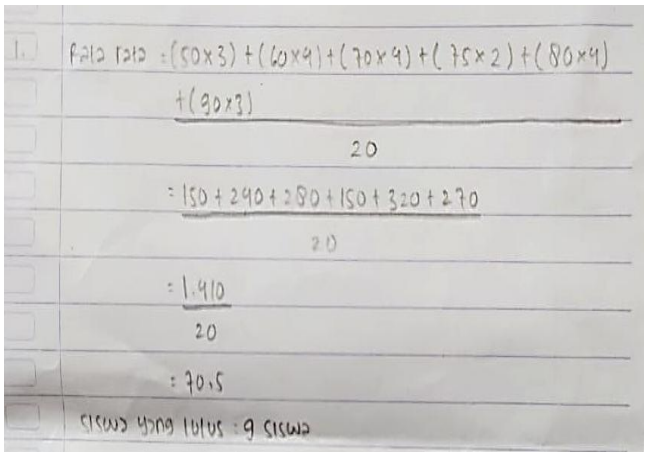

Figure 1. Example of student answer no. 1

Based on Figure 1, students are able to correctly solve the problems in the questions. S-1 and S-2 are able to present the results of their work from the beginning by writing the correct answer to determining the final result. When viewed from the indicators, S-1 and S-2 did not experience difficulties in solving communication skills questions on the indicator of connecting real objects, images, and diagrams, tables into mathematical ideas. The results of the researcher's interview with S-1 and S-2 regarding the answer to question number 1 are as follows:

Results of researcher interviews with S-1

Q: Do you find it difficult to do this problem?
S-1: No
Q: Have you ever done a problem like this before?
S-1: Yes
Q: How do you determine the number of students who pass?
S-1: By determining the average first, after getting the average value, count how many have a value above the average value, then you get the number of students who passed.
Q: Are you sure about the answer to number 1?
S-1: Yes
Q: So how many people got a passing score?
S-1: There are 9 people

Results of researcher interviews with S-2

Q: Have you ever worked on a problem like this before?
S-2: Yes
Q: Do you find it difficult to work on this problem?
S-2: No
Q: How do you determine the number of students who pass?
S-2: By determining the average first, then after getting the average value, then calculate how many have values above the average value, then you get the number of students who pass.
Q: Are you sure about this answer?
S-2: Yes, I am sure about the answer I wrote

From the interview results above, S-1 and S-2 are able to understand the questions well, and are serious in working on them. So they can answer the questions from start to finish correctly.

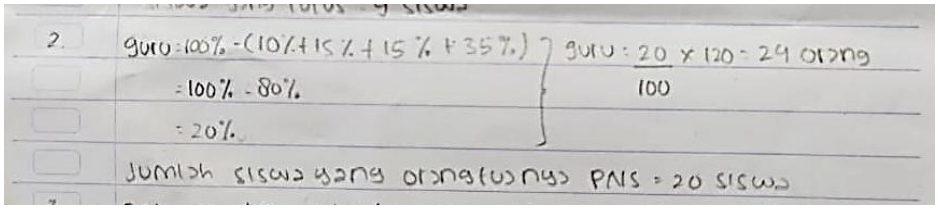

Figure 2. Example of student answer no. 2

Based on Figure 2, students are able to correctly solve the problems in question number 2. S-1 and S-2 present the results of their work from the beginning by writing the correct answer until determining the final result. When viewed from the indicators, S-1 and S-2 did not experience difficulties in solving communication skills questions on the indicator of connecting real objects, images, tables and diagrams into mathematical ideas. The results of the researcher's interview with S-1 and S-2 regarding the answer to question number 2 are as follows:

Results of researcher interviews with S-1

Q: Do you find it difficult to do this problem?
S-1: No
Q: Have you ever done a problem like this before?
S-1: Yes
Q: How do you find the amount of data asked in the problem?
S-1: By finding the percentage first in the profession section. Then after knowing the number of teachers, find the number of students by multiplying the number of students known.
Q: Are you sure about the answer?
S-1: Sure

Results of researcher interviews with S-2

Q: Do you find it difficult to do the problem? If so, where is the difficulty?
S-2: No
Q: Have you ever done a problem like this before?
S-2: No
Q: Have you ever done a problem like this before?
S-2: Yes
Q: What is asked in the problem?
S-2: What is asked is the number of parents who work as teachers.
Q: How do you find the amount of data asked in the problem?
S-2: Find the percentage for the teacher section by subtracting 100% from the percentage of fishermen, businessmen, farmers, and traders, after getting the value of the teacher percentage then multiplying the percentage of the teacher section by the number of students.

From the interview results above, S-1 and S-2 did not experience any difficulties in working on question number 2, then the students understood what the question meant so that they were able to answer the questions well and correctly.

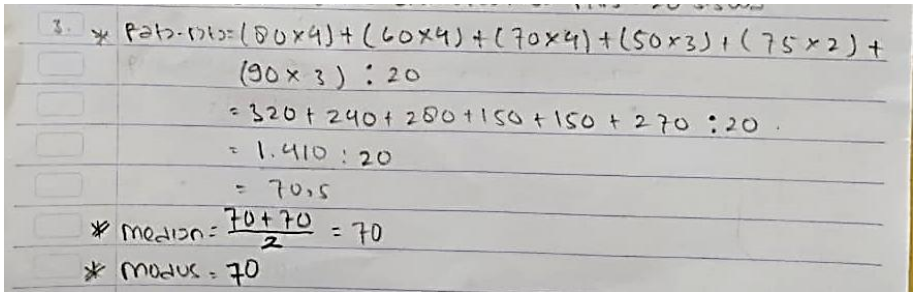

Figure 3. Example of student answer no. 3

Based on Figure 3, students are unable to solve the problems in question number 3. S-1 explains the results of his work from the beginning by writing the correct answer but S-1 is less careful in working on the median section, because the data is not sorted first and filling in the median section is like guessing, but the answer is correct, it's just that the data is not sorted first to determine the median. But for S-2 is able to solve the problems in question number 3 and is able to explain the results of his work from beginning to end correctly and correctly. When viewed from the indicators S-1 and S-2 do not have difficulty in solving communication skills questions on the indicator of explaining ideas, situations, and mathematical relations orally or in writing, with real objects, pictures, graphs, and algebra. The results of the researcher's interview with S-1 and S-2 regarding the answer to question number 3 are as follows:

Results of researcher interviews with S-1

Q: Do you find it difficult to find information from the data provided?
S-1: Hm, yes I have a little difficulty in working on this problem
Q: Where is the difficulty?
S-1: I forgot again how to determine the median value?
Q: Then where can you fill in the median value?
S-1: I just guessed.
Q: Have you ever worked on a problem like this before?
S-1: Yes, but I forgot again to determine the median value.

Results of researcher interviews with S-2

Q: Do you find it difficult to find information from the data provided?
S-2: No
Q: Try to mention what is known from this question?
S-2: What is known is that there are 20 values from the mid-term math test scores
Q: Then what is the question?
S-1: The value of the average, median and mode
Q: How to determine the average, median and mode values

S-2: To find the average by adding up all the data and then dividing it by the number of data available. While for the median, the middle value is sought and for the mode, the value that appears most often is sought

Based on the interview results above, S-1 experienced a slight problem, namely S-1 forgot how to determine the median value. So in determining the median value, S-1 only guessed. However, unlike S-2, S-2 was able to understand the meaning of the problem in number 3. S-2 was able to work on and explain how to work on it sequentially well until the results were obtained correctly.

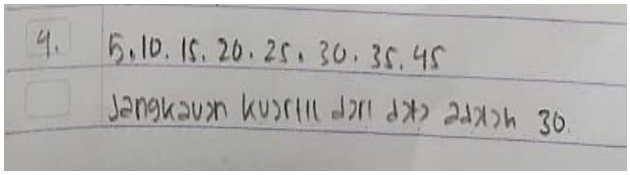

Figure 4. Example of student answer no. 4

Based on Figure 4, students are unable to solve the problems in question number 4. S-1 is unable to explain the answers requested in the question. When viewed from the indicator, S-1 has difficulty in solving communication skills questions on the indicator of explaining ideas, situations, and mathematical relations orally or in writing, with real objects, pictures, graphs, and algebra. However, S-2 is able to solve the problem in number 4 and explain the answer correctly until getting the results. The results of the researcher's interview with S-1 and S-2 regarding the answer to question number 4 are as follows:

Results of researcher interviews with S-1

Q: Do you find it difficult to solve the problem?
S-1: Yes
Q: Do you understand the meaning of this problem?
S-1: Understand
Q: What is being asked in the problem?
S-1: Determine the interquartile range
Q: Have you ever worked on a problem like this before?
S-1: No
Q: Where is the difficulty?
S-1: I forgot the formula and how to do it again
Q: What are the first steps to working on this problem?
S-1: Don't know.

Results of researcher interviews with S-2

Q: Do you find it difficult to solve this problem?
S-2: No
Q: Are you sure about this answer?
S-2: Sure or not
Q: What makes you doubt the results of this work?
S-2: Afraid of making a mistake in calculating it.

Q: How do you determine the interquartile range?
S-2: By sorting the data first from smallest to largest then finding the values of Q1, Q2, and Q3 then after that subtracting between
Q3 minus Q1 then the result is obtained, the result is the interquartile range.
Q: What result did you get?
S-2: 17.5

From the interview results above, S-1 understands what this question means, but has difficulty in working on it because he forgot the formula and how to work on it so that S-1 is unable to work on question number 4. In contrast to S-2, S-2 is able to understand the problem in number 4 well, is able to explain how to work on it sequentially and work on it well so that the results he gets are correct.

Based on Field Notes Results

S-1

When working on the questions, S-1 focused on his own work, did not glance at or look at his friend's answers, but there was a slight difficulty in working on the questions.

Based on the results of field notes and his work, it turned out that S-1 had difficulty in working on questions number 3 and 4. The obstacle was forgetting the formula that had to be used in working on the questions and not knowing how to work on them, so S-1 was unable to answer all the questions correctly.

S-2

When working on the questions, S-2 was very focused on his own work, did not make many suspicious movements such as glancing or looking at his friend's answers, did not daydream much and was able to calmly work on the questions.

Based on the results of field notes and his work, S-2 was able to understand each problem given and was able to explain and work on it well and correctly.

Discussion

Based on the results of the research that has been conducted, it was found that students' communication skills are included in the good category, which means that students' mathematical communication skills based on the selected indicators are quite good.

Conclusion

Based on the results of the research that has been conducted, it can be concluded that the average overall score of all students' questions is included in the good criteria, namely with a percentage of 79.85%. The benefits of the research that I conducted are: (1) it can be used as encouragement for students to develop their mathematical

communication skills, so that they can achieve achievements; (2) it can be used as reference material for further researchers.

Conflict of Interest

The authors declare that no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely by the authors.

Reference

Aulia, L. (2018). Peningkatan Kemampuan Komunikasi Dan Self Efficacy Matematik Siswa SMP Melalui Strategi Think Talk Write. *Jurnnal Numeracy*, *5*(2), 204–216.

Hendriana, H., & Kadarisma, G. (2019). Self-Efficacy dan Kemampuan Komunikasi Matematis Siswa SMP. *Jurnal Nasional Pendidikan Matematika*, *3*(1), 153–164.

Kusnadi, R. M., & Mardiani, D. (2022). Kemampuan pemecahan masalah matematis siswa sekolah menengah pertama negeri 3 tarogong kidul dalam masalah statistika. *Jurnal Inovasi Pembelajaran Matematika: PowerMathEdu*, *1*(2), 173-182.

Madio, S. S. (2016). Pengaruh Pembelajaran Berbasis Masalah Terhadap Kemampuan Penalaran dan Komunikasi Matematis Siswa SMP dalam Matematika. *Jurnal Pendidikan Matematika Sriwijaya*, *10*(2), 93–108.

Moleong, L. J. (2011). *Metodologi Penelitian Kualitatif*. Bandung: Remaja Rosda Karya.

Muslihah, N. N., & Suryaningrat, E. F. (2021). Model Pembelajaran Contextual Teaching and Learning terhadap Kemampuan Pemecahan Masalah Matematis. *Plusminus: Jurnal Pendidikan Matematika*, *1*(3), 553-564.

Nisa, U. (2019). Analisis Kemampuan Komunikasi Matematis Siswa SMP Dalam Menyelesaikan Soal Lingkaran. *Apotema*, *5*(2), 103–113.

Permendikbud. (2014). *Kurikulum Tingkat Satuan Pendidikan*. Jakarta: Depdiknas.

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.

Rifal, M., Sudia, M., & Masi, L. (2017). Meningkatkan Kemampuan Komunikasi Matematik Siswa Kelas Vii-F Smp Negeri 7 Kendari Melalui Penerapan Model Pembelajaran Conceptual Understanding Procedures (CUPs). *Jurnal Penelitian Pendidikan Matematika*, *5*(1), 85–98.

Sriwahyuni, K., & Maryati, I. (2022). Kemampuan pemecahan masalah matematis siswa pada materi statistika. *Plusminus: Jurnal Pendidikan Matematika*, *2*(2), 335-344.

Sulastri, E. (2023). Mathematical communication skills of junior high school students based on statistics. *Jurnal Inovasi Pembelajaran Matematika: PowerMathEdu*, 2(3), 373-384.

Susannti, M., Kurnia, H. I., Nurfauziah, P., & Hendriana, H. (2018). Analisis Kemampuan Komunikasi Matematis Siswa SMP di Tinjau dari Self-Concept. *Jurnal LP3M*, *4*(2).