An Analysis of Students' Mathematical Communicative Skills in Solving Sets Problems at SMP Negeri 1 Darul Hikma Aceh Jaya

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Abstract
This study aimed to determine the description of students' mathematical communication skills in solving problems in set material, especially students' written mathematical communication skills. This type of research is descriptive using a qualitative approach. The research subjects were taken from class VII students of SMPN 1 Darul Hikmah. Subject taking was carried out by looking at the value of the report card which was then selected by 3 research subjects based on the existing categories. The instrument used is a written test of mathematical communication skills which contains 3 essay questions with set material and interview guidelines. The interview guide is aimed at subject teachers to find out whether students already know mathematical communication skills. Written mathematical communication skills contain 5 indicators. The results showed that the written mathematical communication skills of the research subjects were good for indicators of ability and in writing the information contained in the questions and determining the main goals to be achieved. However, the research subjects were weak in writing mathematical operations according to the intent of the questions using pictures or scientific notation in solving problems, presenting a comprehensive representation of the concepts used and writing conclusions about answers in everyday language. The results of this study are expected to gain and add insight into the written mathematical communication skills of students of SMP Negeri 1 Darul Hikmah, Aceh Jaya district, on set material, especially in mathematics. So that thus being able to improve the ability to communicate in the language of mathematics in solving problems of everyday life.

Keywords: Mathematical Communication Skills, Solving Problems, Set Material

1. Introduction
Mathematical ability is the ability to deal with problems, both in mathematics and in real life. Mathematical abilities consist of: mathematical reasoning, mathematical communication, mathematical problem solving, conceptual understanding, mathematical understanding, creative thinking and critical thinking.

The importance of learning mathematics cannot be separated from its role in all aspects of life. Communicating ideas using the language of mathematics is even more practical, systematic and efficient. In order to overcome the difficulties of students who do not understand mathematics material, good communication must be built in the learning process. In general, mathematics communication is an expanding collection of resources to incorporate students' methods of writing and speaking about mathematics, either for the purpose of learning mathematics or learning to communicate like mathematicians. Bernard Berelson and Barry A, Stener (Rimilda, 2017: 125) argue that, "Communication skills are the transmission of information, ideas, emotions, skills, and so on, by using the symbols of words, pictures, graphic figures, and so on. The act or process of transmission is what is usually called communication."
According to Ruseffendi in (Ansari, 2017) the biggest part of mathematics that students learn at school is not obtained through mathematical exploration, but through notifications. The reality on the ground also shows this, that the learning conditions that take place in the classroom make students passive (product-oriented education). Furthermore, Ansari (2017) revealed that the results of the study showed that the decline in students' understanding of mathematics in class was partly due to: (1) in teaching the teacher gave an example to students how to solve problems; (2) students learn by listening and watching the teacher perform and solve mathematical problems; (3) when teaching mathematics, the teacher immediately explains the topics to be studied, followed by giving examples and questions for practice. The learning conditions mentioned above also result in the development of students' mathematical communication skills.

The results of a survey conducted by the Program for International Student Assessment (PISA), placed Indonesia in 64th place out of 65 participating countries with an average score of 375. The results of the low PISA survey indicate that Indonesian students are weak in solving math problems on PISA which measure more reasoning, problem solving, argumentation, and communication abilities (Wardhani and Rumiati, 2018: 51). This shows that students' mathematical communication skills Indonesia is still relatively low.

As one of the standards and objectives of learning mathematics, communication skills receive more attention in learning. According to Suhaedi (2017) communication plays the most important role, because by communicating students can exchange ideas both among students themselves as well as teachers and their environment. Thus, it is necessary to know more deeply about students' mathematical communication skills. Measuring and improving students' mathematical communication skills can also be done through learning or applying contextual-based questions. By posing contextual problems, students are gradually guided to master mathematical concepts. Contextual learning engages students in important activities that help students relate academic lessons to the real-life situations they face. By associating the two, students will see the meaning of the assignment given (Johnson, 2017: 35).

Based on initial observations made by researchers at SMP Negeri 1 Darul Hikmah Aceh Jaya, it is known that some students have low scores on set material. The low results obtained by students because students are less active in the learning process. Students tend to passively listen, take notes and pay attention to what the teacher conveys without providing feedback for material that has not been understood. Learning that involves less active students causes students to be less able to use their mathematical abilities optimally in solving the problems they face so that only 50% of students' written mathematical communication skills are still relatively low.

There are two reasons why mathematical communication skills are important in learning mathematics. First, mathematics is an essential language which is not only a tool for thinking, finding formulas, solving problems or making conclusions, but mathematics also has unlimited value for expressing various ideas clearly, thoroughly and precisely. Second, mathematics and learning mathematics is the heart of human social activities, for example interactions between teachers and students, students and students, as well as between students and their learning materials. These two reasons show that mathematics as a science contains reasonable and necessary communication skills to convey ideas to others (Baroody in Sunarmo, 2018).

Mathematical communication was proposed by Romberg and Chair (in Qohar, 2018), namely connecting real objects, pictures, and diagrams into mathematical ideas; explain mathematical ideas, situations and relationships orally or in writing with real objects, pictures, graphics, and algebra, stating everyday events in language or mathematical symbols; reading with understanding a written mathematical presentation,
making conjectures, constructing arguments, formulating definitions and generalizations; explain and make statements about the mathematics that has been learned.

Mathematical communication is divided into two, namely oral mathematical communication and written mathematical communication. In this study the authors emphasize research on written mathematical communication skills. Indicators in written mathematical communication are students can write concepts into mathematical language, students can write problems into mathematical language, students can write calculation operations, students can write mathematical solutions and students can write conclusions of answers.

Indicators that show mathematical communication skills are presenting written statements, pictures, and diagrams. This result, revealed by Sumarmo (2017) that among the indicators of mathematical communication ability, namely:
1) Connecting real objects, pictures, and diagrams into mathematical ideas.
2) Explain ideas, situations, and mathematical relationships in writing with real objects, pictures, and graphics.
3) Expressing everyday events in language or mathematical symbols.
4) Listen, discuss, and write about mathematics.
5) Read with comprehension a written mathematical presentation.
6) Making conjectures, compiling arguments, formulating definitions and generalizations.
7) Explain and make questions about the mathematics that has been studied.

According to LACOE (2004) as quoted by Ruswanto (2018) states that the indicator of mathematical communication ability is
1) Reflect and clarify thinking about mathematical ideas.
2) Connect everyday language by using mathematical symbols.
3) Using the skills of reading, listening, interpreting and evaluating mathematical ideas.
4) Using mathematical ideas to make conjectures and convincing arguments.

Based on the description above, indicators of mathematical communication skills in this study are as follows:
1) The ability of students to express mathematical ideas into writing.
2) The participants' ability to express a mathematical problem in the form of a picture or a mathematical model.
3) Students' ability to present written mathematical problem solving in an organized and structured manner.
4) The ability of students to evaluate mathematical ideas in writing.

According to Pugalee in Qohar (2018) students need to get used to learning to provide arguments for each answer and provide responses to answers given by others, so that what is being learned becomes more meaningful. Mathematical communication skills according to Sumarmo (2017), including the ability to:
1) Describe pictures, diagrams or real objects in the language of symbols or mathematical models.
2) Explain ideas, situations, and mathematical relations in writing

Therefore, it can be concluded that mathematical communication is students' skills in conveying their mathematical ideas both orally and in writing in pictures, diagrams, presenting them in algebraic form, or using mathematical symbols. By having good mathematical communication skills, students can more easily understand concepts and solve mathematical problems.
2. Method

The approach in this research is a qualitative approach. This type of research is a descriptive analysis research that is qualitative in nature which aims to determine students' mathematical communication skills in solving problems on set material. The communication skills referred to in this study are written communication skills. This study took the subject of class VII students. The subjects of this study were students who were given a test to measure their mathematical communication skills. The research instrument used interview guidelines and communication skills tests.

In this study used semi-structured interviews. According to Arikunto (2018), semi-structured interviews are interviews where an outline of the questions is prepared beforehand which is then modified during the interview. Interview guidelines were consulted by supervisors and validated by experts. While the written test once. This test is a description question consisting of 5 numbers. As for the communication ability test carried out to analyze students' mathematical communication skills in solving problems from set questions. This test is given to three subjects. Data analysis techniques were carried out in three activities, namely: (1) Data collection, in this study, the data collected consisted of; first, the results of the student's initial ability test or student's mathematics report card scores, secondly the results of the student's mathematical communication ability test; the three results of the interview with the teacher; (2) Data reduction, reduced data, is expected to provide a better picture and make it easier for researchers to retrieve other necessary data; and (3) Presentation of data, all data that has been obtained from the results of tests of mathematical communication skills to the interview process with teachers are then presented systematically using logical language.

3. Results and Discussions

Research results

Based on the instruments that have been designed in chapter III, the researcher carried out the research according to the design. The results of tests carried out by researchers on class VII students of SMP Negeri 1 Darul Hikmah are listed below.

a. Subject MS

Question number 1 MS subject
S = \{1,2,3,4,6,7,8,9,10\}
A = \{1,2,3,4\}
B = \{2,4,6,7,8\}.
Make a Venn diagram of the set!

Student Answers:

![Figure 1. Answers to Question Number 1 on Subject MS](image-url)
From the answers to the questions above, it can be seen that students already understand how to draw a Venn diagram, but the student's answer is wrong because the Venn diagram has no associations between set A and set B, students do not understand the concept of combinations. From this answer it is known that students have not mastered the indicators of mathematical ability, namely connecting real objects, pictures, and diagrams into mathematical ideas, even though from the results of interviews with teachers it is clear that students have been taught the basic concept of sets. From the student's answers, it is also known that students do not understand the basic concepts in set operations related to Venn diagrams.

b. Question number 2 subject MS
Look at the Venn diagram below!

Define:
- a. Member of A
- b. AC member

Student Answers:

![Venn diagram with set A and B, numbers 1 to 10]

From the student's answers to question number 2, it can be seen that the student was not been able to write the set correctly, the student wrote the set without brackets, and the completion of the complement set was not written in detail. the student incorrectly wrote the set, indicating that the student had not understood yet the indicators of mathematical ability and basic concepts set.

c. Question number 3 MS subject
A class consists of 42 students. In this class there were 20 students participating in sports extracurricular activities, 14 students participating in arts extracurricular activities, 22 students participating in scouting extracurricular activities, 8 students participating in arts and scouting extracurricular activities, 7 students participating in arts and sports
extracurricular activities, 12 students participating in sports and scouting extracurricular activities and 5 students took part in the three extracurriculars.

1) Determine the Venn diagram.
2) Determine the number of students who take part in sports and arts extracurriculars.
3) Determine the number of students who do not attend the three extracurriculars.

Student Answers:

From the answers above, it can be seen that students already understand how to describe a Venn diagram, but it is still incomplete, students do not write the name of the sets in capital letters. Then when solving questions students do not write down descriptions of the members of the set but immediately answer with diagrams. This shows that students do not meet the indicators of mathematical ability, namely expressing everyday events in language or mathematical symbols.

d. Subject RD

Question number 1 subject RD

\[ S = \{1,2,3,4,6,7,8,9,10\} \]
\[ A = \{1,2,3,4\} \]
\[ B = \{2,4,6,7,8\} \]

Make a Venn diagram of the set!

Student answers:

The student's answer to number 1 shows that the student did not write the Venn diagram correctly, the symbols on the diagram were still incomplete, and the diagrams depicted were not in accordance with the questions given. Students did not make shading between set A and set B. From the student's answers it can be seen that students did not
meet the indicators of mathematical ability, namely correctly connecting real objects, pictures, and diagrams to mathematical ideas.

e. Question number 2 subject RD
Look at the Venn diagram below!

Define:
- a. Member of A
- b. AC member

Student Answers:

![Venn diagram]

Figure 5. Answers to Question Number 2 Subject RD

From the students' answers to question number 2, it can be seen that students have not been able to write sets correctly, students have written sets without parentheses, and completion of complementary sets is not written in detail, students have made mistakes in writing indicating that students have not understood the indicators of mathematical ability and the basic concepts of sets.

f. Question Number 3 Subject RD
A class consists of 42 students. In this class there were 20 students participating in sports extracurricular activities, 14 students participating in arts extracurricular activities, 22 students participating in scouting extracurricular activities, 8 students participating in arts and scouting extracurricular activities, 7 students participating in arts and sports extracurricular activities, 12 students participating in sports and scouting extracurricular activities and 5 students took part in the three extracurriculars.

1) Determine the Venn diagram.
2) Determine the number of students who take part in sports and arts extracurriculars.
3) Determine the number of students who do not attend the three extracurriculars.

Student Answers:
From the students' answers to question number 3 above, it can be seen that students could not solve the problem correctly, did not draw a Venn diagram, students also did not write answers using mathematical symbols. This shows that students do not meet the indicators of mathematical ability and the basic concept of sets.

g. Subject FL
Problem number 1 subject FL
S = \{1,2,3,4,6,7,8,9,10\}
A = \{1,2,3,4\}
B = \{2,4,6,7,8\}.
Make a Venn diagram of the set!

Student Answers:

From the answers to the questions above, it can be seen that students already understand how to draw a Venn diagram, but in the student's answers there are streaks on the shading of the Venn diagram, students still seem unsure about their answers. So that students seem to lack mastery of mathematical ability indicators, namely connecting real objects, pictures, and diagrams into mathematical ideas. Hence, from the student's answers, students do not understand the basic concepts in set operations related to the Venn diagram.
h. Problem number 2 subject FL

Look at the Venn diagram below!

![Venn Diagram]

Define:

a. Member of A
b. AC member

Student Answers:

From the students' answers to question no.2, it can be seen that students have not been able to write the sets correctly because there are no initial brackets, and the completion of the complementary sets is not written in detail, just the answers, while the writing of the sets is also wrong. From these answers the students did not understand the indicators of mathematical ability and the basic concept of sets.

i. Question Number 3 Subject FL

A class consists of 42 students. In this class there were 20 students participating in sports extracurricular activities, 14 students participating in arts extracurricular activities, 22 students participating in scouting extracurricular activities, 8 students participating in arts and scouting extracurricular activities, 7 students participating in arts and sports extracurricular activities, 12 students participating in sports and scouting extracurricular activities, and 5 students took part in the three extracurriculars.

1) Determine the Venn diagram.
2) Determine the number of students who take part in sports and arts extracurriculars.
3) Determine the number of students who do not attend the three extracurriculars.

Student Answers to Question No.3:
Figure 9. Answers to Question Number 3 Subject FL

From the students' answers to question number 3 above, it can be seen that students could not solve the problem correctly, did not draw a Venn diagram, students also did not write answers using mathematical symbols correctly. This shows that students do not meet the indicators of mathematical ability and the basic concept of sets.

Discussion

The test used to measure students' mathematical communication skills is in the form of a description. The scoring of student test results is based on the indicators to be achieved. After obtaining the scores from the students' mathematical communication skills test results, then an analysis of students' mathematical communication abilities was carried out with reference to the indicators of mathematical communication abilities.

Indicators of written mathematical communication skills are:
1) Ability to write down what is known and asked in a problem;
2) Write down the calculation operations according to the intent of the problem
3) Interpret the solutions obtained or use overall representations to express mathematical concepts and solutions
4) Using tables, pictures, models and others to convey explanations

a. Discussion Subject MS

From the student's answers above it can be seen that the student already understands how to draw a Venn diagram. But in writing the answers are still incomplete, students do not understand the combined concept, students also cannot write sets correctly, when solving questions students do not write descriptions of the members of the set but immediately answer with diagrams. This means that students are still unable to meet the indicators of mathematical communication ability and the basic concept of sets. In fact, from the results of interviews with teachers, students have been told indicators of mathematical communication ability and learned the basic concepts of sets.

b. Discussion Subject RD

From the student's answers above it can be seen that these students did not understand the questions well, especially on the basic concept of sets. The answers given still contained many errors, students did not write the Venn diagrams correctly, students also could not write sets correctly, students also did not write answers using mathematical symbols. He gave answers in his own language and was still unsure about writing the set. This means that students are not fully able to meet the indicators
of mathematical communication ability and basic competence in the set material. From the results of interviews with teachers, students have been told indicators of mathematical communication ability and learn the basic concepts of sets.

c. Discussion Subject FL
From the answers it can be seen that students already understood how to draw a Venn diagram. However, the answer was still not correct because students had streaks on the shading of the Venn diagram, students still seemed unsure about the answer. Students also could not write the sets correctly. In addition, the students also did not write answers using mathematical symbols correctly. They gave answers in his own language and many of the answers were still wrong because they did not understand the questions and did not understand the basic concept of sets. This means that students had not been able to meet the indicators of mathematical communication ability yet as explained by the teacher at school.

4. Conclusions
This research is a qualitative research. Qualitative research means that this type of research aims to describe mathematical communication abilities. The resulting data are in the form of words or utterances obtained from the results of interviews with the teacher and writing or numbers obtained from the test results. Based on the results of the analysis and discussion and findings during the research, several conclusions were obtained which were answers to the questions posed in the problem formulation. The conclusions are as follows:

a. Students who have a level of mathematical communication skills from the "high" group understand the questions well. He is able to provide answers in his own language and is able to solve problems on these questions. This means that students are able to meet the indicators of mathematical communication ability. Based on the score of communication skills, he gets a score of 80, meaning he has been said to have high communication skills, based on the score obtained by the student, namely 80.

b. Students who have a "moderate" level of mathematical communication ability do not understand the problem well. He gave answers in his own language and was able to give reasons for the answers, but he was still unsure. This means that students are not fully able to meet the indicators of mathematical communication ability. Based on the score of communication skills, he gets a score of 60, meaning he is said to have moderate communication skills, based on the score obtained by the student, namely 60.

c. Students who have a "low" level of mathematical communication ability do not understand the problem. He gave answers in his own language and was unable to give reasons for these answers and many of the answers were still wrong because he did not understand the questions. This means that students have not been able to meet the indicators of mathematical communication ability. Based on the score of communication skills, he gets a score of 30, meaning he is said to have low communication skills, based on the score obtained by the student, which is 30.

References


