Student's Mathematical Communication Skills in Class VII Sets Materials Through HOTS-Based Learning

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ABSTRACT
Students need to have good mathematical communication skills when studying set material. The use of HOTS-based learning can be applied in learning activities so that students have good mathematical communication skills. This study aims to determine and describe mathematical communication skills after the learning process using HOTS-based learning in class VII set material is carried out. This study uses a descriptive type of research. The subjects of this study were students of class VII-3 SMP IT Al-Fatah Mekar Jaya, totaling 27 students. Data collection techniques are observation, a written test consisting of 3 test questions, and interviews. The data analysis technique is data reduction, data presentation and conclusion drawing. The results obtained from this study are students' mathematical communication skills after the learning process using HOTS learning on the set material for class VII-3 SMP IT Al-Fatah Mekar Jaya is in the medium category, with the average percentage is 39.19%. The indicator that appears the most is "explaining ideas, situations, and mathematical relations, orally and in writing with real objects, pictures, graphs, and algebra and indicators stating everyday events in mathematical language or symbols", while the indicators that appear the least is "connecting real objects, pictures, and diagrams into mathematical ideas". The use of HOTS-based learning can make students have good mathematical communication skills.

***Keywords**: HOTS Learning, Mathematical Communication, Set.*

1. INTRODUCTION

The Minister of National Education Regulation Number 21 of 2016 explains the purpose of learning mathematics which is then stated in the appendix about the content standards in the communication skills section. This is what later turned out to be in accordance with the existing concepts in NCTM, namely, the purpose of learning mathematics, namely, developing students' abilities in solving mathematical problems (mathematical problem solving), mathematical reasoning (mathematical reasoning), and mathematical communication (mathematical communication) [1]. The development of mathematical communication is very necessary in learning mathematics with the aim of supporting understanding of the material and supporting their mathematical communication skills, so that they can build their understanding and knowledge until an idea or idea emerges in solving a problem [2]. In addition, in order to improve the quality of education and the quality of the nation's generation according to the 2013 curriculum, the Government has provided solutions by prioritizing learning with high-level thinking skills competence or commonly known as Higher Order Thinking Skills (HOTS). In other words, learning must be HOTS-based by focusing on the learning process that occurs in students [3]. Two important things are the big reasons why mathematical communication is so important. First, mathematics is a language in the form of abstract symbols and secondly, mathematics and learning mathematics in its heart is a social activity [4].

NCTM states that the standard of mathematical communication is the emphasis of teaching mathematics on students' abilities, including:

a. Through communication, it is hoped that they can structure and strengthen their mathematical thinking
b. Communicate every problem in detail and easily accepted to everyone (teachers, friends, etc.).
c. Can perform an analysis and evaluation of mathematical thinking and the methods or tactics used by others;
d. Can express mathematical ideas correctly using mathematical language

The concept of HOTS-based learning is a concept that requires students to be able to formulate problems by making students active in thinking. HOTS-based learning makes students accustomed to thinking critically when facing a problem. Still not used to solving problems at the HOTS level and difficulties in solving them in the form of story questions, compiling mathematical models, and identifying an error in a mathematical equation or in a diagram [5] require teachers to be creative in presenting ways-ways to stimulate students' higher order thinking skills. One of them is HOTS-based learning.

However, the reality on the ground shows that mathematical communication is still low [6]. It can be seen in 2018 based on the average math score, in PISA Indonesia got a score of 379.0 and was ranked 71st out of 77 PISA participating countries, which in this case a small part of students in Indonesia who can only solve problems or problems at level 2 or above (OECD, 2019). This shows that students are not familiar with questions that require to reason, think, and communicating mathematically [7]. This is also due to HOTS-based learning which is still very difficult to implement or the lack of HOTS-based teaching [8].

Based on these facts, the right strategy is needed to improve communication skills in dealing with various problems with the HOTS level. With this the need for a learning that makes active learning to students or known as HOTS-based learning [3]. The learning model that is in line with this is PBL where this model is student-centered, and can foster more interactive activities in the classroom from communicating ideas to presenting the results of what they have learned using the PBL model HOTS was chosen to train students' mathematical communication skills, related to how to communicate ideas to problems. One of the materials that requires good communication skills is the set material. In several senses, one of which is [9], stating that there are 3 kinds of learning difficulties experienced by students when studying set material, namely starting from difficulty understanding/understanding the meaning of the problem, then transforming the problem or making a mathematical model of a problem, and in solving the problem. mathematics. All these difficulties lead to indicators of one of the mathematical abilities, namely mathematical communication skills [10], where according to him one form of mathematical communication is the activity of understanding mathematics.

2. METHODS

The preparation stage is preparing the necessary instruments, the implementation stage is learning with instruments that have been validated by collecting data using observations, interviews and also mathematical communication tests. At the data analysis stage, three stages are also carried out, namely, data reduction, data presentation and conclusion drawing.

The following are indicators and descriptors of completion of mathematical communication.

Table 1. Mathematical communication skills indicators

No.	Mathematical Communication Skills Indicator	Description
1.	Explain ideas, situations, and mathematical relations, orally and in writing with real objects, Picture, dam graphs and algebra	Students are expected to be able to explain ideas, situations, and mathematical relations, orally and in writing with real objects, pictures, graphs and algebra (steps required)
2.	Connect real objects, picture, and diagram into mathematical idea	Students are expected to be able to connect real objects, pictures, and diagrams into mathematical ideas (making mathematical models)
3.	Express everyday events in mathematical language or single	Students are expected to be able to explain the purpose of the problem orally and in writing using language or symbols

3. RESULT AND DISCUSSIONS

Figure 1 shows the result of the work of one of the meeting groups 1. At the time of learning when students work on the worksheet with the PBL HOTS model with the problem being the initial orientation, students are seen to write down what they know with the notes given in the worksheet about how to present the set. From the answers of each group, it can be seen that there are differences that arise from the opinions of their respective preferences. Then they started to discuss and during the discussion it was seen that there were 2 different opinions and this is where the learning of HOTS related to analyzing friends' answers was carried out from the characteristics of HOTS learning, the researcher as a teacher became a facilitator to take the middle path from the discussion. At the end of the discussion, the teacher invites students to state the

conclusions of the discussion, and conclusions are drawn from what is the definition of an association.

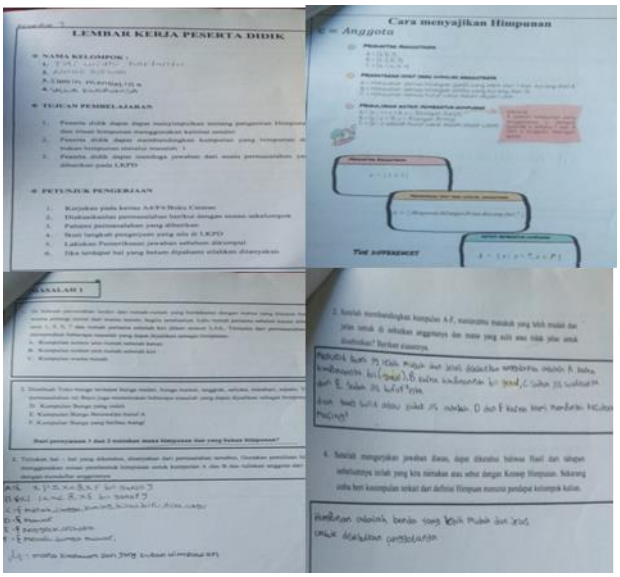

Figure 1 Results of work on students' worksheet in the meeting 1

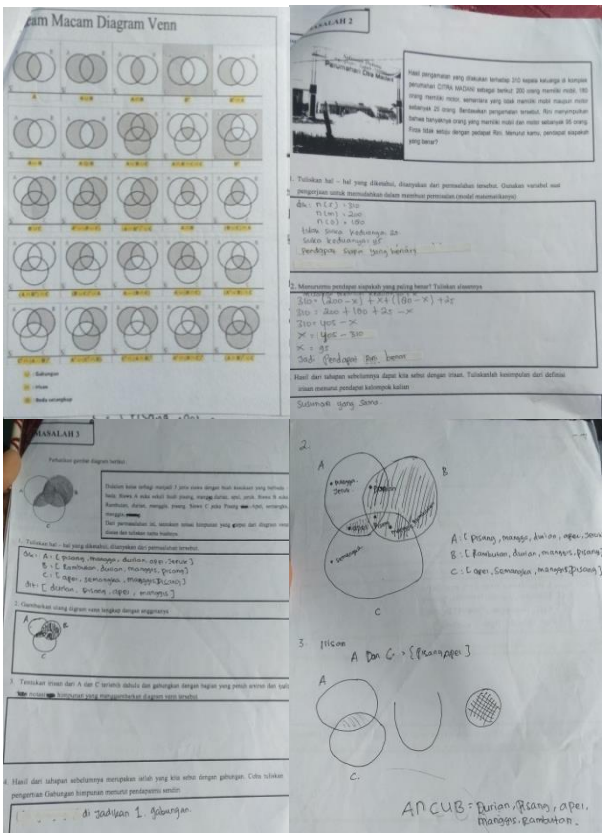

Figure 2 Results of work on students' worksheet in the meeting 2.

Figure 2 shows the result of the work of one of the meeting groups 2. At the time of learning when students work on the worksheet with the PBL HOTS model with the problem being the initial orientation, students are seen to write down what they know with the notes given in the worksheet regarding various Venn diagrams. With the guidance of the teacher they begin to assume a problem with the variable X and with the direction of the teacher they are also able to develop a mathematical model so that they can find an answer that is requested from the problem in the worksheet. Then they were led to be able to list each member of the Venn diagram given, slowly and carefully they made and found each member. Then after working on the worksheets on problems 2 and 3 they were asked to determine what the concept of combination, slice, and how to symbolize. Some of them found the meaning of combinations and sets and their symbols but not in general terms, finally together with the teacher came to a complete conclusion regarding the sets.

Test (Second meeting test with different time)

At the time of doing the final test to see the mathematical communication skills of students on the material set individually. The test questions consist of 3 descriptive questions based on indicators of mathematical communication skills. The researcher asked students to work on the questions individually for 50 minutes. Each question has a score of 4 each so that a maximum score of 12 is obtained. The students' mathematical reasoning abilities from the results that have been analyzed by researchers and converted are as follows.

Based on the **Table 1** shows the acquisition of scores on students' mathematical communication skills. It can be seen that question no. 1 with a percentage of 67% for indicators Explaining ideas, situations, and mathematical relations, orally and in writing with real objects, pictures, graphs and algebra. Question no. 2 with a percentage of 37.96% for indicators stating everyday events in mathematical language. Question no. 3 with a percentage of 27.77% for indicators Connecting real objects, pictures, and diagrams into mathematical ideas. The average ability of students as a whole is at 42.58% or is in the moderate category according to Sumarmo's indicator.

The following is a description of student's answer to the mathematical communication skills.

1. Explain ideas, situations, and mathematical relations, orally and in writing with real objects, Picture, dam graphs and algebra. From the picture above, it can be seen that EP is able to write answers but has not been able to explain ideas, situations, and mathematical relations, orally and in writing with real objects, pictures, graphs and algebra so that an answer can be asked of the question, the points obtained in this question are 2.

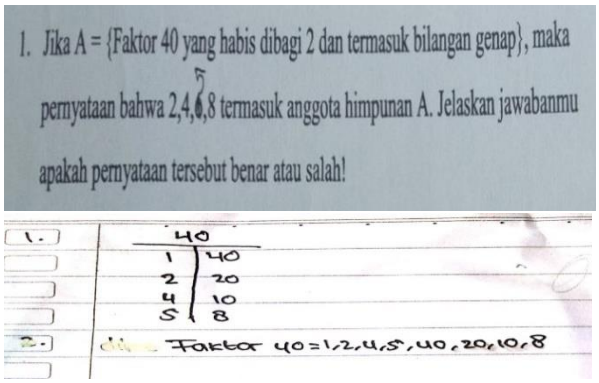

Figure 3 The results of EP's answer to question 1

2. Express everyday events in mathematical language or single

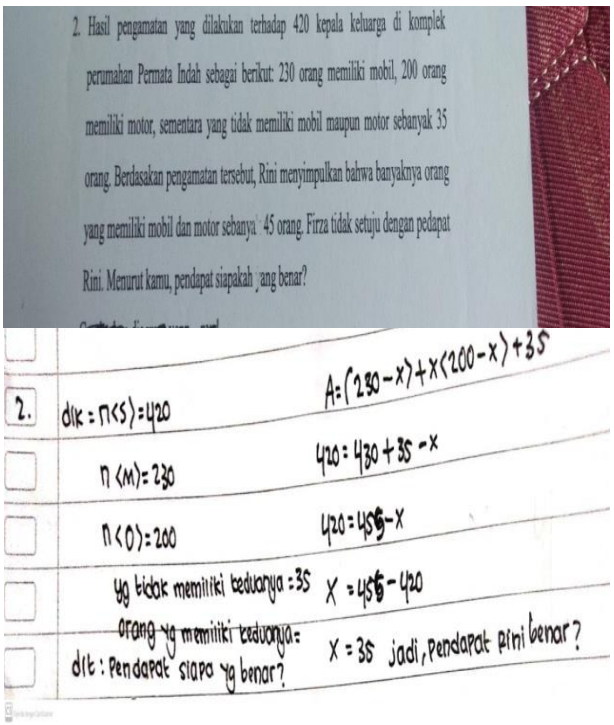

Figure 4 The results of EP's answer to question 2

From the picture above, it can be seen that the EP is able to state the events contained in the problem using symbols properly so that students get a score of 4 clearly writing down known, asked and then assuming the variable x, then in this case getting a score of 4 or full points.

3. Connect real objects, picture, and diagram into mathematical idea

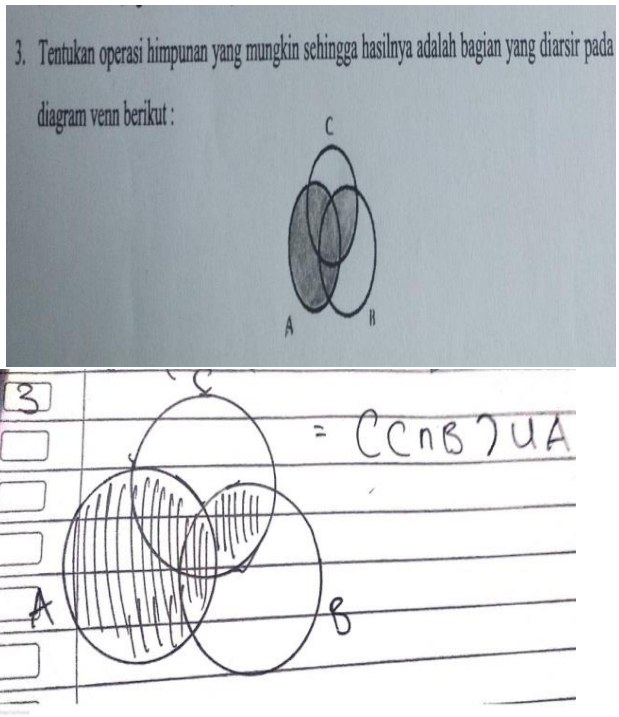

Figure 5 The results of FA's answer to question 3

From the picture above, it can be seen that EP is able to relate the problem by finding how the notation of the set requested from the problem by using the symbols of slices and struts is good so that students get a score of 4.

Table 2. Results for mathematical communication skills test

Mathematical Communication Skills Indicator	Explain ideas, situations, and mathematical relations, orally and in writing with real objects, picture graphs and algebra	Express everyday events in mathematical language or single	Connect real objects, picture, and diagram into mathematical idea
Total Score	60	37	30
Many students x Maximum Score	108	108	108
Percentage	55,55 % (High)	34,25 % (Medium)	27,77 % (Low)
Mean	39,19 (Medium)		

4. CONCLUSION

Based on the results of the research and discussion that have been described, the following conclusions can be drawn:

1. Students' mathematical communication ability for indicators that most often appear are indicators Explaining or explaining ideas, situations or circumstances and mathematical relationships or relationships, both verbal and written with real objects, pictures and others, namely 55,55% which means that they are in in the high category, then the indicator states daily events in mathematical language, namely 34,25% in the medium category, and indicator 3 Connecting real objects, pictures, and diagrams into mathematical ideas, namely 27,77% in the low category.
2. Students' mathematical communication skills in class VII set material through HOTS-based learning are good enough or in the moderate category with details for the indicators that most often appear are indicators Explaining or explaining ideas, situations or circumstances and mathematical relationships or relationships, both verbal and written with real objects, pictures and others and express events into mathematical language or symbols, while indicators that rarely appear are indicators connecting real objects, pictures and diagrams into mathematical ideas.
3. HOTS learning can be used as an alternative in bringing up indicators of students' mathematical communication skills in the Class VII set of materials.

AUTHORS' CONTRIBUTIONS

AY Composes and designs research, M as validator and checks on what is prepared and designed by AY, JA, S, and MY as research team.

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