Students’ Verbal Representation Abilities in Solving Geometry Problems

Dian Septiani¹, Riyadi¹, and Triyanto¹

¹Universitas Sebelas Maret, Surakarta, Indonesia

*E-mail: diansepti1812@gmail.com, riyadifkipuns@gmail.com, triyanto@fkip.uns.ac.id

Abstract. The research aims to identify the verbal representation ability of students in solving geometry problems. This method uses descriptive qualitative. The subjects of this study were 10 students of 8th grade at Islamic Junior High School 2 Sragen. The data were obtained through a test of mathematical representation abilities and interviews. The validity of the data in this study uses the triangulation method. This data analysis shows that 20% of students have high verbal representation ability, 30% of students have medium verbal representation ability, and 50% of students have low verbal representation ability. The results show that most students have low verbal representation ability. Students are still having trouble writing steps to solve problems using words. It is because students are not accustomed to communicating their ideas with written or verbal words.

1. Introduction

The function of math is disseminating information or communicating ideas orally, in written, and graphs. But in today's modern era, there are still many students who have difficulty to communicate ideas orally, graphs, or written [1]. Therefore, mathematical abilities are needed to perform mathematical functions. Mathematics becomes one of the important knowledge that must be mastered by students from elementary school to college level in achieving mathematical abilities [2]. There are five standard mathematical skills that must be owned by the student: 1) communication, 2) connection, 3) problem-solving, 4) reasoning, 5) representation [3]. Representation skill is one of the basic skills used in mathematics to make the relationship between abstract ideas and logical thinking to understand mathematics [4]. Representation is the process of configuration in presenting something in another situation [5].

Representation is the basic skill needed for students [6]. The representation can help students explaining concepts or ideas and make it easier for them finding strategic solutions [7]. So, the representation plays an important role in determining the student's attitude toward a mathematical problem. If the ability of a representation weak, it will have some impacts on the process of problem-solving. Teachers have an important role to train students so that students can solve problems, especially on geometric material [8]. Geometry is a branch of mathematics that close to everyday life, and geometry is very important for students to learn in developing student problem-solving skills [9]. However, the ability of the students in understanding the concept of geometry is still very low. So students are less able to solve the problem of geometry [10]. This case is seen from the result of a national examination in the Islamic Junior High School 2 Sragen, on the geometry subject only 37.22% of students answered correctly [11].
Therefore, representation plays an important role in helping students solve problems [3]. Representation is not only useful to describe and communicate mathematical objects but also to solve problems in mathematics [12]. The ability of representation can be built when students solve problems [3]. Mathematical representations are necessary for conceptual understanding, solving mathematical problems, and communicating mathematical ideas [12]. Based on the explanation above, the ability of representation becomes one of the skills to be considered.

The ability of verbal representation is the ability to translate problems into a spoken or written language [6]. The verbal representation covers both written and verbal words or sentences [13]. Verbal representation plays an important role in problem-solving [14]. Verbal representation helps learners to solve the problems and helps to fix mistakes in conveying concepts [15]. Besides, verbal representation also helps teachers to understand how students learn and use mathematical language [12]. Students that have low representation ability will show less appearance in generating ideas, asking questions and responding to questions or others’ opinion [4]. Therefore, the purpose of this research is to identify the ability of verbal representation of students in resolving geometry problems in students of Islamic Junior High School 2 Sragen.

2. Methodology
This research was conducted in Islamic Junior High School 2 Sragen. The purpose of this research is to identify the ability of verbal representation of students. The methods used are qualitative descriptive. The subject in this study consist of 10 students of 8th grade with a subject selection using the purposive sampling technique. The data collection techniques in this study used test methods and interview methods. The test used descriptions on the material geometry, while the interview is semi-structured interview. The data obtained is validated using the triangulation method. The indicators used as a reference for analyzing the ability of verbal representation are: 1) writing problem resolution steps with written words or text, 2) answering questions using words or text written.

3. Result and Discussion
Based on the results of data analysis, students’ verbal representation ability presented in Table 1. below.

| Frequency | Percentage(%) | Interval     | Category |
|-----------|---------------|--------------|----------|
| 2         | 20 %          | $X > 4,87$   | High     |
| 3         | 30 %          | $2,13 \leq X \leq 4,87$ | Medium   |
| 5         | 50 %          | $X < 2,13$   | Low      |

As for the questions given are geometry problems in images form. The image is a composite of several plane figures. Students are required to identify the image and explain the completion steps by using words. The following is the result of an analysis of students’ written answers and interviews.

3.1 Problem Analysis number 1
In resolving problem number 1, there are still many students unable to solve the problem well. Students have difficulty writing answers using words to find the land area of Mr. Ali. This is seen from the results of the students’ assignment and interview. Some students do not explain in detail each of the steps they wrote. However, some students are able to write complete and systematic steps of completion. During the interview, the process can provide a logical reason regarding the steps written in the answer sheet. Besides, some students are not able to solve the problem correctly. Below are some of the students’ work, it can be seen in Figure 1, Figure 2 and Figure 3.
The results of the written answer and interview of S1.

Dialog 1st participant (S1)

(1) R : How many steps are you doing to find the land area of Mr. Ali?
(2) S1: There are 4 steps.
(3) R : Can you explain more?
(4) S1: Yes, I can.

In the first step, I divide the image into 2 plane figure, they are the triangle BCD and the parallelogram ABEF. The second step is I determine the side length of the triangle BCD and the parallelogram ABEF. In the third step, I look for the large of the triangle BCD and the parallelogram ABEF. In the fourth step, I sum up the large of the BCD triangle and the ABEF parallelogram. So I know the land area of Mr. Ali.

(5) R : Why do you divide the image into the triangle BCD and the parallelogram ABEF? Why not the other?
(6) S1: I think it is easier to divide it into the Triangle BCD and the parallelogram ABEF to determine the length of its sides.

Based on the results of written answer and interviews, the participant is able to write steps to find the large area of Mr. Ali’s land using words in full and systematic (See Figure 1). S1 divides the image into the triangle BCD and the parallelogram ABEF. Then S1 looks for the lengths of the sides of the triangle and the parallelogram. Next, S1 looked for the area of the triangles BCD and the parallelogram ABEF. Then, S1 adds up the area of the triangle and the parallelogram. In addition, S1 can explain the reasons to divide the image into the triangle BCD and the parallelogram ABEF orally (See Dialogue 6).

The results of written answer and interview of S2.

Figure 1. Results of written answer S1

Figure 2. Results of written answer S2
The following are the results of the interview with S2:

**Dialog 2nd participant (S2)**

1. R: In your opinion, what step do you find the land area of Mr. Ali? Please explain the first step you're doing?
2. S2: I divide the plane figure.
3. R: What does the plane figure about?
4. S2: I divide the image into the triangle BCD and the parallelogram ABEF.
5. R: Why do not you write down completely in your answer sheet?
6. S2: I am sorry, I forget miss.
7. R: After you divide the image into the triangle BCD and the parallelogram ABEF. What do you do next?
8. S2: I was calculating the area of the triangle and the parallelogram.
9. R: Then?
10. S2: I was also summing up the area of the triangle and the parallelogram.
11. R: In your opinion, What the steps are complete enough?
12. S2: Maybe yes.

Based on the results of written answer and interviews, S2 has not been able to solve the problem perfectly. S2 wrote 3 steps to find the land area of Mr. Ali. The error of S2 occurred in the first step. In the first step, S2 was not able to explain well. Besides, S2 was also not looking for a long-length unknown side. Meanwhile, in the third and fourth step, S2 wrote correctly. Overall, S2 was able to solve the problem quite well, although there is one step that is lacking. Besides, S2 experienced obstacles in writing using words on the results of written answer (See Figure 2).

*The results of written work and interview of S3.*

![Figure 3. Results of written answer S3](image)

The following are the results of the interview with S3:

**Dialog 3rd participant S3**

1. R: What steps do you take to find out the land area of Mr. Ali?
2. S3: The first step, I was looking for a basel, the second was looking for the height then calculated by “($\frac{1}{2} \times a \times t$)”
3. R: What do you know which one is the height or the base?
4. S3: I do not know. Maybe this one (CF side).
5. R: Just look back at this image, what is it about?
6. S3: I think triangle, but........
7. R: Is it true?
8. S3: No
9. R: Then?
10. S3: I don't know miss
Based on the results of written answer and interviews, S3 had not been able to answer questions correctly. S3 writes 4 steps to find the land area of Mr. Ali. All of the steps written are incorrect (See Figure 3). Based on the results of the interview, S3 is confused to explain the results of its written answer (See Dialogue 6 and 8). Besides, the words used are too short (See Figure 7).

3.2 Problem Analysis number 2

It is not much different in question number 1. In question number 2, as many as 5 students were unable to answer the question correctly. This is evident in the results of students’ written answer. There are 3 students able to write steps using words quite well, but still not complete. Some of the students’ written answer can be seen in Figure 4 and Figure 5.

Students can write rare steps using words well, but their answer is not perfect yet. The student did not write the last step (Figure 4). During the interview process, S3 says that he forgot. While (Figure 5), the steps that the S5 has written in no way make sense. S5 write down, 1) look for long, 2) look for wide, 3) done. When the S5 interview process can not explain the answer using words orally.

Based on the results of the analysis of question number 1 and question number 2. (Figure 1) Describe the ability of high verbal representation, S1 can explain the steps to use complete words and systematic written or oral (See Figure 1 and Dialog S1). While (Figure 2 and Figure 4) represent the ability of medium verbal representation. S2 was able to write down the steps using the words well in question number 1, but S2 did not write the 2nd step. While in question number 2, S4 did not write the final step to determine the area of the irregular plane figure. Meanwhile, (Figure 3 and Figure 5) describe the ability of low verbal representation. The results of his answers are incorrect, but when the interview process of S3 and S5 is not able to explain the results of his written answers orally.

Students' inability to solve questions using words because students are not accustomed to explaining the problem using words. Besides, students rarely have the opportunity to explain the solution in written or oral in problem-solving [17]. They are only accustomed to memorizing formulas only. So when asked to explain the problem in writing students feel difficulties. We recommend that students also be taught to be able to communicate ideas by making words so that what they understand can be communicated again. The ability of verbal representation is very supportive in the learning process so that it will affect the low level of student learning achievement [14].
4. Conclusion

Based on the results of Analysis 20% students have a high verbal representation ability. While 30% of students have medium verbal representation ability and 50% of students have low verbal representation ability. Students with high verbal representation ability are able to explain the steps of using the words (written text) with complete and systematic. While students with medium verbal representation ability, students are able to explain the steps with words. But the answer is not perfect because there are still some wrong. Then for students with low verbal representation ability, students write incorrect answers or just a few correct answers. Based on the results of the analysis, most of students have a low verbal representation ability. Students have difficulty to solve math problems using words. This is because in learning math students are only required to solve the problem using formulas only. Teachers rarely give students the opportunity to communicate or ask students to contribute their ideas either in writing or orally.

Acknowledgements
In this research, I sincerely say to Islamic Junior High School 2 Sragen.

References
[1] A. Vello and S. Chairhany, “3rd World Conference on Learning, Teaching and Education and Modern Languages”, pp. 59-64, 2013.
[2] Warsito, et al., “IOP Conf. Series: Journal of Physics: Conf. Series”, 948, 2018.
[3] NCTM, “Principles and standards for school mathematics”, Reston: VA NCTM, 2000.
[4] W. A. Widakdo, “International Conference on Mathematics and Science Education”, 895, 2017.
[5] A. P. Bal, “7th World Conference on Educational Sciences”, pp. 528-288, 2015.
[6] A. Nurainy, et al., “International Conference on Mathematics and Science Education”, 3, pp. 2655-2361, 2018.
[7] B. I. Ansari, et al., “2nd International Conference on Statistics, Mathematics, Teaching, and Research”, 1028, 2018.
[8] C. T. M. Utami, et al., “IOP Conf. Series: Earth and Environmental Science”, 234, 2019
[9] R. Mahendra, et al., “International Conference on Mathematics and Science Education”, 895, 2017.
[10] N. Agustiningsih, et al., “IOP Conf. Earth and Environmental Science”, 243, 2019.
[11] BNSP, “Laporan Hasil Ujian Nasional Tahun Pelajaran 2018/2019”, 2019.
[12] E. D. Wulandari, et al., “The 2nd Annual International Conference on Mathematics and Science Education”, 1227, 2019.
[13] Y. R. Yanti, et al., “IOP Conf. Series: Journal of Physics: Conf.”, 947, 2018.
[14] D. A. Oktavia, et al., “International Seminar on Science Education”, 1233, 2019.
[15] A. Fithrathy and Ariswan, “International Seminar on Science Education”, 1233, 2019.
[16] Budiyono, “Pengantar Metodologi Penelitian Pendidikan”, Surakarta: UNS Press, 2017.
[17] W. Y. Hwang, et al., “Educational Technology & Society”, vol. 10, no. 2, pp 191-212, 2007.