

# Leveling Of J Unior High School Student Mathematical Communication In Solving Open Ended Problem

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**Abstract:** This research aims to describe the leveling of students' mathematical communication in solving open ended problem on geometrical problem. This qualitative research took 2 students of VIII MTS Maslakul Huda Sluke, Rembang municipal as the subjects. The subjects were selected based on varieties of students in communicating mathematical ideas both written and spoken. The steps to select subjects were: (1) providing open ended problem solving questions with geometrical material, (2) conducting interview based on task to confirm students answers revealed in written, and (3) categorizing the subjects into 4 levels. The data collection techniques were problem solving task and interview. The data analysis used qualitative data analysis. The findings showed that: (1) students' mathematical communications both written and spoken were at level one. It was students' explanations in solving open ended problems of geometrical materials were limited only on several concepts, (2) students' explanations in solving the problem were partially correct.

**Index Terms:** Mathematical Communication, Junior High School Students, Problem Solving, Open Ended

## 1. INTRODUCTION

Mathematics communication holds important roles in mathematical learning. [1] explained that mathematical communication could develop conceptual understanding, problem solving, and mathematical reasoning. Good mathematical communication influences meaning of learning mathematical so it facilitates students in solving problem. It also influences conceptual understanding and mathematical reasoning of students. [2] found that mathematical communication provides opportunity for students to understand the discussed concepts. Furthermore, [3] stated that through mathematical communication would provide chance for students to discuss problem solving strategy. Mathematical communication could be realized both written and spoken [4] & [5]. Written communication is individual's way to explain certain mathematical ideas in detail in written [4]. It is also in line with [6] that to find out written communication in mathematical could be seen from three aspects: (1) mathematical idea revealed in the form of written communication, such as written text, (2) mathematical ideas revealed through drawing, such as drawing table, graph, diagram, and (3) mathematical ideas revealed through written communication in the form of mathematical expression (creating model/equation to be calculated). It is in line with [7] explaining that written mathematical communication could be seen from several aspects: (1) explaining mathematical ideas in drawing diagram, (2) in the form of words, and (3) revealing the situations into mathematical expressions or symbols. Spoken communication is student activity to explain problem solving procedure which has been done previously and is explained orally [5]. Agreeing with the notion, spoken communication could be also defined as situation where students understand a certain problem and could provide

reason or arguments orally [8]. Thus, based on the argument, [9] explained that spoken communication covered: speaking, listening, explaining, questioning, and broadening assumption. It is different with [10]. They explained that spoken communication indicators are: 1) students' activities to ask, 2) to answer question, 3) to explore ideas, and 4) present the answers. [11] and [2] explained that to encourage student mathematical communication could be done by giving challenge, such as opened problem. It would give them chance to have many ideas so they could develop their mathematical communication [12]. Opened problem could encourage mathematical communication by asking students to show the process of solving the problem and explaining their reasons [6].

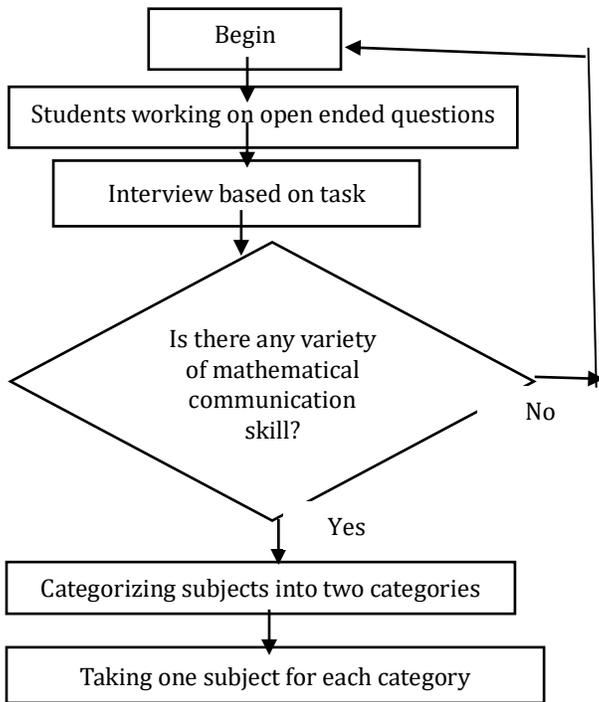
[13] explained that open ended is possibility for students to face mathematical problem which has transparency in its process, answers, and problem's development with personal ways. [14] stated several benefits of open ended, such as: to provide appropriate learning environment for students to develop and express their mathematical understanding, to respond the problems with personal ways, to use the knowledge and mathematical skill comprehensively with various solutions, to select favorite strategy to answer the problem, and to make them sharing their reason to other students as solution. Related studies with leveling of mathematical communication had been done by [15]. Her focus was written mathematical communication. Therefore, this research investigated leveling of mathematical communication both in written and spoken on open ended problems of geometrical materials.

## 2 METHODOLOGY

The subjects were selected based on their skills in communicating mathematical ideas both written and spoken. The data collection used problem solving task and interview. The data analysis was qualitative through several stages: (1) providing open ended problems, (2) interviewing based on task to confirm the students' answers in written, and (3) categorizing the subjects into 4 levels of mathematical communication. Those levels are (4) complete and correct explanation both written and spoken, (3) explanation of problem solving solution stages in written and spoken correctly

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with little mistake, (2) explaining problem solving in written and spoken partially correct, (1) explaining the problems both written and spoken only with several concepts, and (0) explaining the problems written and spoken incorrectly. Based on explanation about stages of selecting subjects could be seen in Diagram 1 below.



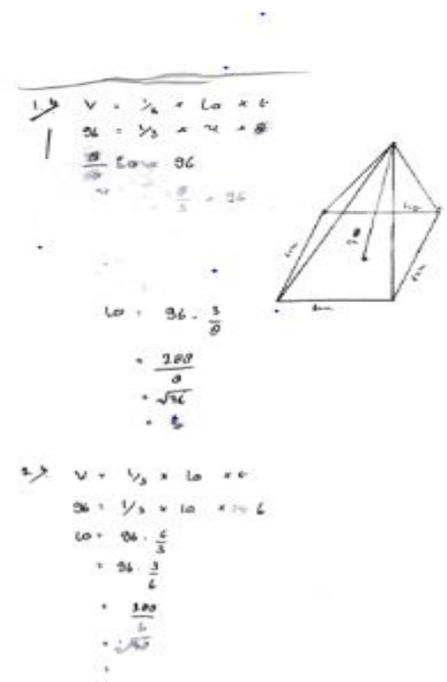
subjects

**Instrument**  
 Mr. Joko build a house which has pyramid roof. Draw at least 3 possibilities of the pyramid which has volume 96 m<sup>3</sup>. Is the base always in the form of square? Explain!

ended problem solving on geometrical material. S2 was a subject which had his answer of open ended problem partially correct.

**3.1 S1 Subject's Explanation in Open Ended Problem Solving on Geometrical Material with Only Several Concepts**

Here is the work of S1 as revealed in the written communication.



**Fig 1. Mathematical problem explanation with only several concepts**

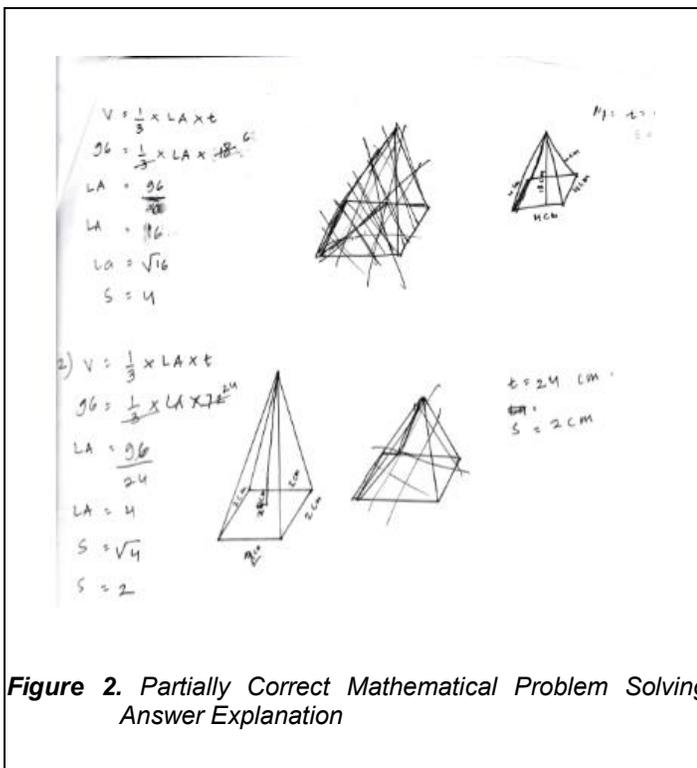
Based on S1's work, it could be revealed that in his written communication was only consisted the base area of pyramid. He could not determine the size of each edge of the base. He also incorrectly drew the pyramid. To reveal it clearly, the result of the student's written communication could be seen on this interview excerpt with S1 dealing with mathematical problem explanation.

- A : How did you find the size of base area and height of the pyramid if its volume is known?
- S1 : By supposing
- A : How do you suppose it?
- S1 : I don't know
- A : Is the base of the pyramid a square?
- S1 : No idea
- A : How many sides of a pyramid?
- S1 : I don't know

Based on the explanations, in solving open ended problem of geometrical material, S1 only wrote several concepts.

**3.1 S2 Subject's Explanation of Open Ended Problem on Geometrical Material with Partially Correct Answers**

Here is S2's work in written communication.



**Figure 2.** Partially Correct Mathematical Problem Solving Answer Explanation

Based on S2's works, it could be revealed that the subject could only determine the area of pyramid and measure the size of edge on the base. S1 could also draw a pyramid although there were several mistakes. To reveal clearly, the result of student's written mathematical communication, the researcher conducted interview with S2. Here is the excerpt of the interview.

A : How did you determine the area and height of a pyramid meanwhile the only one known was the pyramid volume?

S2 : Supposing the height of the pyramid.

A : How did you find the length of the base area?

S2 : I used root

A : How did you need root?

S1 : I don't know

A : Is the base of pyramid a square?

S1 : I don't know.

Based on the explanation, S2 only wrote several concepts in solving open ended problem on geometrical materials.

## DISCUSSION

S1 had supposed or analogized the height of pyramid but he could not explain it. He had not understood that the base of a pyramid was a square so he could not determine the length of the pyramid. He also had not understood the numbers of the sides of the square. It made the subject could not draw pyramid correctly. It was in line with [15] stating that some students in explaining written problem solving were only sharing several concepts. S2 could analogize or suppose the height of the pyramid. He also could determine the sides of the base but could not provide the reason to explain why length of the base side should be rooted. Thus, S2 had not understood that the base of pyramid was a square. S2 had been able to draw a pyramid but it was partially correct. It was in line with [15] stating that most of students correctly explained the problem solutions.

## CONCLUSION

Based on the research, students' mathematical communication both written and spoken were at level 1 and 2. Level 1 consisted of students' explanation in solving open ended problems on geometrical material. They only used several concepts. Level 2 explained that the students could partially correct in answering open ended problem solving of geometrical problems.

## ACKNOWLEDGMENTS

The researchers expressed their thanks to all parties assisting this article: (1) Mathematical lecturer of Universitas Negeri Malang, especially the supervisor, (2) MTs Maslukul Huda, Sluke, whom provided chance for the researchers to conduct research.

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