The Analysis of Mathematical Communication Ability for Students in Quadrilateral at 8th grade on Islamic Junior High School

N. Barizah1*, Al Jupri2

1Departemen Pendidikan Matematika, Universitas Pendidikan Indonesia, Jl. Dr. Setia Budhi No. 229, Bandung 40154, Indonesia
2Departemen Pendidikan Matematika, Universitas Pendidikan Indonesia, Jl. Dr. Setia Budhi No. 229, Bandung 40154, Indonesia

*nurbarizah14@gmail.com

Abstract. The purpose of the research is about to analyze the level of mathematical communication skills of students in one of the Private Islamic Junior High School in Jakarta. This research is a qualitative research. The research took 6 students for the subjects from 8th grade at the Private Islamic Junior High School based on PMA (Prior Mathematical Ability) from the students with the high, medium, and low capability that taken from the mathematics daily exam scores on the previous chapter. The way to retrieve the data is taken by the essay that suitable with the indicators of mathematical communication, i.e: Made a mathematical role model from the mathematical situation; Has a mind explanation about mathematical ideas and situations into a picture, graphics, and algebraic expressions; Representing daily situations into a sketches of images and completing them. As the results of the analysis shows that the students who have the high ability, has a good mathematical communication skills on each indicator. Students with the moderate abilities also has a good mathematical communication skills but not to all the indicators. And the low-ability students has a poor mathematical communication skills right on the each indicator.

I. Introduction

Mathematics is one compulsory subject in school which has important role in education. Therefore, mathematics lesson exists in each level, whether in elementary school, secondary school and higher education level. The importance of mathematics in education also mentioned in The Regulation of National Education Minister of The Republic of Indonesia No.69 of 2013 about The Content Standard of general aim of mathematics lesson, one of them to communicate idea and able to use completed sentence, symbol, table, diagram, or another media to clarify the problem [1]. National Council of Teachers of Mathematics also mention that one of five standards for mathematical ability that should be possessed by students in learning mathematics is mathematical communication ability [2].

Stacey express that communication ability is one factor which give contribution in solving the problem [3]. With good communication ability, a problem can be represented through mathematical model, graphic, idea which can be used as mediator in solving the problem. Teacher
can find out how students process the information from what they acquire from learning mathematics and applying it in the form of mathematical ideas both verbal and in written. Teacher also can find out to what extent to students understanding in learning and students also have opportunity to review the information gained and use it to asses their own understanding. Baroody assert that the importance of communication in learning mathematics because mathematics as language and mathematics learning as social activity. It means that mathematics not merely as a tool to aid thinking, to find pattern, solve the problem or draw conclusion, but mathematics also as a language to communicate various ideas clearly, precisely and carefully. In addition, mathematics also as social activity in learning, as means of interaction among students. and also communication between teacher and student [4]. Mathematical communication is students’ ability in explaining an algorithm and the unique way to solve the problem, construct and explain the display of real world phenomena in graphic, sentence, table, equation, and physical display [5]. The use of communication correctly and effectively very depends on mathematical language, namely notation and mathematical sentence used to represent its abstract ideas [6]. Mathematical communication according to Prayitno, et al, is a way to express and interpret mathematical ideas both in verbal and non verbal, whether in the form of drawing, table, diagram, or demonstration [7]. Based on the experts’ opinion which had been explained, it can be concluded that mathematical communication ability is ability to express or state the abstract ideas, thinking, information and ideas both verbal and non verbal by using various mathematical expression (symbol, drawing, table, diagram, notation, pattern and another mathematical language) so it can give meaning, it can be understood by many people, and it can be used to give solution in solving the problem.

Certainly, students ability in learning mathematics is vary, whether low ability, medium and high. It is because student ability is normal distributed and the difference in this initial ability not merely as innate, but also influenced by environment [8]. In addition, the internal factor can also influence student ability among others mental ability, communication ability, ability in expressing idea and self confident. Prior mathematical ability is students’ early cognitive ability that play important role in order to master new concept in mathematics learning. It means that Prior Mathematical Ability (PMA) very influences students’ mathematical communication ability to master the concept and subsequently to understand the material. Based on phenomena above, the author is interested to conduct the analysis about students’ mathematical communication ability in quadrilateral topic based on Prior Mathematical Ability (PMA).

2. Method
This study is qualitative descriptive research by using case study methodology. Case study is a technique to study a situation and development of individual in depth with aim to achieve better self adjustment. In this study, students’ communication ability is analyzed in depth based on Prior Mathematical Ability (PMA) by using written test that fulfill the indicators of mathematical communication, namely: make mathematical model from a mathematical situation; explain thinking about ideas and mathematical situation into drawing, graphic, and algebraic expression; and represent daily situation into drawing sketch and solve it. This study aims to analyze the level of students’ mathematical communication ability.

This study was conducted in SMP Islam Al Azhar Jakarta. The subject of study are 6 students of class VIII-B SMP Islam Al Azhar Jakarta, each consist of 2 students with high, medium, and low initial mathematical ability based on mathematics daily test score in earlier chapter, that is, triangle.
3. Result and Discussion

This section will present students’ answer based on high, medium and low PMA. Subsequently, their communication ability will be analyzed in accord with the indicators of mathematical communication ability. To protect their privacy, the subjects in this study use students’ full name code. Students with high PMA will be coded NN and AC, students with medium PMA will be coded NA and MRF, and students with low MIA will be coded SMA and AK.

a. Mathematical communication ability of students with high PMA

Based on the answer of student NN and student AC, they possessed good communication ability in solving communication ability problem in the topic of square. However, in expressing mathematical ideas, student AC was better than student NN. It is indicated by the answer no.2 in indicator of explaining thinking about ideas and mathematical situation into drawing, graphic sketch.

From figure 1.a and 1.b, it is seen that student AC could draw sketch well, that is, trapezoid as house’s roof and the numbers of roof tile in each row in accord what he knew in the problem. Whereas student NN only drew the figure of trapezoid but the numbers of its roof tile was not in accord with what he knew in the problem. It is seen that student NN used directly the area formula of trapezoid to count the numbers of roof tile in total. Subsequently, for the answer no.3 about the indicator of making mathematical model from a mathematical situation, student NN and student AC had mastered it well. The answer result was in accord with mathematical model questioned. Both of them had been able to model the word problem or mathematical situation into algebraic form which is showed in figure 2.a and 2.b.
For indicator of representing daily situation in the form of drawing sketch and solve it based on the analysis of the results of the answers obtained, both students have been able to answer well and precisely as obtained in figure 3.a and 3.b.

![Figure 3.a](image1.png)
Figure 3.a
Answer No. 1 from NN student

![Figure 3.b](image2.png)
Figure 3.b
Answer No. 3 from AC student

The drawing sketch made by student NN and student AC can be seen clearly and can be understood when the others see it. As written by Clark that communication process also help to build the meaning and set the ideas and make these ideas can be understood by many people [9]. Modeling and the way to solve it also had been very good and precise so the answer also correct.

b. Mathematical communication ability of students with medium PMA

Based on the result of written test, it can be known in a whole that student with medium PMA in average had not been achieved perfect result for each indicator even though they could answer the problem systematically. Thinking and idea of student NA and student MRF had not been seen clearly. The answer result of no.1 from MRF student (indicator of representing daily situation in the form of drawing sketch and solve it) and no.2 from NA student (indicator of explaining thinking about ideas and mathematical situation into drawing, graphic sketch) they could draw sketch or drawing with the figure of square only and it had not been completed in accord with what he knows in the problem seen in figure 4.a and 4.b.
From the drawing, we cannot know the idea/meaning conveyed by student NA and student MRF. They answered directly by using related formula so their answers are not all correct. Calculations in algebraic manipulation for answer no.1 that are answered by MRF students have errors so that the answer in the end becomes wrong. Meanwhile, in the problem no.3 with indicator of making mathematical model from mathematical situation, student NA was better than student MRF even though both of them had not answered it perfectly. Student NA wrote the model in algebraic form in accord with what he knew in problem. From the total answer result, it can be concluded that student NA and student MRF are categorized good enough in answering mathematical communication ability problems. They have been skillful in using the formula to solve the problem and write the mathematical symbols even though their idea in the form of sketches had not been seen perfectly. There are two possible reasons namely, firstly they lazy to draw. Secondly, they feel confuse how to draw it because indeed they have not mastered that indicator well.

c. Mathematical communication ability of students with low PMA
In all indicators of mathematical communication given, student SMHH and student AK less able to express mathematical idea well. The answer result of students with low PMA in average they did not show idea, mathematical model and drew sketch in their solution. Student SMH only rewrote the problem given, whereas student AK was still wrote his mathematical model even though only
in one problem. Student AK has written his mathematical model in algebraic form but in doing
calculation he made mistake so the answer obtained was wrong. The had not able to understand
well the problems so they could not solve the problems given. It can be categorized that
mathematical communication ability of students with low PMA is still low.

4. Conclusion
Based on the result and discussion in a whole, it can be concluded that students’ mathematical
communication ability in solving mathematical problems in the topic of square in class VIII SMP
Islam Al Azhar for students with high PMA in general they have communication ability which is
better than students with medium and low PMA. Students are able to solve the problem well and
correctly. Students are able to explain idea of their mathematical thinking well, model it into
algebraic form and draw the sketch well. All indicators for students with high PMA can be achieved
well. Subsequently, students with medium PMA almost able to solve the problem well even though
not fulfill good and perfect criteria in all indicators. Students with low PMA in general are still lack
in mathematical communication ability in each indicator. Students have not been able to model
algebraically and draw sketch in accord with what is known and questioned.

5. Acknowledgments
Alhamdulillahirabbil'alamni, thanks to Allahu Subhanahu Wata’ala who ease everything so this
article can be finished well. I would like also to thank my parents and my family who always pray for
me and support my activity. Thank to The Principal of SMP Islam Al Azhar who had given permission
to conduct this study.

6. References
Tahun 2014 Jakarta: Depdikbud
The Future of Mathematics Education Washington DC: National Academy
Press
Think Mathematically. New York: Macmillan Publishing Company
The Curriculum. In P. C. Elliot & M. J. Kenney (Eds), Communication In Mathematics: K- 12
and Beyond, 1996 yearbook (pp. 170-179). Reston, VA: National Council of Teacher of Mathematics
Grade. Journal for Research in Mathematics Education (JRME). Vol. 7 No. 2: 337-353
Matematis Siswa dalam Menyelesaikan Soal Matematika Berjenjang pada Tiap-Tiap
Jenjangnya. Konferensi Nasional Pendidikan Matematika V. Universitas Negeri Malang
Tanggal 27-30 Juni 2013
dalam Pengajaran Matematika Untuk Meningkatkan CBSA (Edisi Revisi) Bandung: Tarsito