

# **ANALYSIS OF MATHEMATICAL COMMUNICATION SKILLS STUDENTS IN MATHEMATICS EDUCATION AT STUDY COURSE JUNIOR HIGH SCHOOL MATHEMATICS**

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## **Abstract**

One of the capabilities that must be owned by a math teacher is a mathematical communication skill. Mathematical communication is the mathematical ability of students to convey ideas, perceptions, and the mathematical solution to others. Mathematical communication in this research refers to the ability to express mathematical ideas through oral, written, and visually demonstrate and describe it; the ability to understand, interpret, and evaluate mathematical ideas, either orally, in writing, or in other visual forms; and the ability to use terms, notations of mathematics and its structures to present ideas and describe relationships with models situation.

This research describes the ability of mathematical communications of Mathematics Education students of Muhammadiyah University of Jember in the material Pythagorean Theorem. Results from this research showed that when expressing mathematical ideas through speech, writing, demonstrating, and describe it visually, S1 express it clearly and completely but often has errors. Whereas when they understand, interpret, and evaluate mathematical ideas, either orally, in writing, or in any other visual form, S1 is doing it right, clear, and complete. When using the term, notation, mathematical structures to present ideas and describe relationships with models other situations, S1 used in full. But not in terms of truth and clarity. On the other hand, when expressing mathematical ideas through word of mouth do the obvious but it is not true and clear. Whereas when they understand, interpret, and evaluate mathematical ideas, either orally, in writing, or in any other visual form, S2 has been doing it right, clear, and complete. Furthermore, when they use the term, notation, mathematic structures to present ideas and describe relationships with another situation models, S2 does not do it correctly, clearly and completely.

**Keywords :** *ability of mathematical communication, students in mathematics education*

## **I. Introduction**

One of the capabilities that must be owned by a math teacher is a mathematical communication skill. According to the NCTM (2000), mathematical communication is a way of sharing ideas and clarifying understanding. So, by mathematical communication skills it is expected for teachers can convey ideas and messages in the materials to the students. If the ideas and messages of material can be well taught, it will help students build knowledge resulted in the increased student learning outcomes.

According to the NCTM (2000), indicator mathematical communication ability of the first students can be seen from the ability to express mathematical ideas through speech, writing, and demonstrate and describe it visually. The second

is the ability to understand, interpret, and evaluate mathematical ideas, either orally, in writing, or in other visual forms. And the third is the ability to use terms, notations of mathematics and its structures to present ideas and describe relationships with models situation. These third capabilities become a benchmark of whether or not the student mathematical communication skills.

In the course Assessing Math junior high students are required to use mathematical communication skills in presenting material to the junior high school students. In this case the student should be able to customize the packaging material, style, and delivery methods with the conditions of junior high school students, so that the material being taught can be received and understood by junior high school students.

One of the subjects of mathematics taught to junior high school students is the material about the Pythagorean Theorem. This material contains a description of a mathematician is Pythagoras who said that "squared length of the hypotenuse of a right triangle is equal to the square of the length of the sides of the other". This material is used as the basis of students' ability to find the length of a right triangle with two long sides are known. Such capabilities can later be applied in other materials such as to find the length apothem a circle, a triangle height line, long diagonal field of a square or rectangular, and so on. Besides being able to be applied in other matter, the Pythagorean Theorem can also be applied in everyday life as in the calculation of one inch ( $1 \text{ inch} = 2,54 \text{ cm}$ ) a long diagonal television. Regarded the importance of the Pythagorean theorem material as the knowledge that needs to be owned by junior high school students, the need for mathematical communication skills are good also from teachers who teach it. So the material can be received and understood by junior high school students.

Based on the background it is expected to describe the ability of mathematical communication students of Mathematics Education University of Muhammadiyah Jember in the material Pythagorean Theorem, to describe problems that arise related to the ability of mathematical communication students of Mathematics Education University of Muhammadiyah Jember in the material Pythagorean Theorem, and to describe the efforts of lecturers to cope with emerging issues related to the ability of mathematical communications of Mathematics

Education student at the University of Muhammadiyah Jember in the material Pythagorean theorem.

## **II. Method**

This study describes the ability of mathematical communications Mathematics Education students Muhammadiyah University of Jember in the material Pythagorean Theorem. In accordance with the focus of the research, this study uses a qualitative approach. While this type of research is a case study, it focuses on mathematical communication skills of students of Mathematics Education, University of Muhammadiyah Jember in the material Pythagorean Theorem. Subjects in this study is the second semester students of Mathematics Education University of Muhammadiyah Jember who take courses Assessing Math junior high school. To meet privacy principles both the research subjects were coded S1 dan S2. Instruments in this study is the observation sheets mathematical communication used to acquire the data communication capabilities of mathematical student study program Mathematics Education as practice teaching junior high school students in the subject of Assessing Math SMP material Pythagorean theorem and questions about the concept of the Pythagorean Theorem is given to obtain data on communication skills mathematically students of Mathematics at the University of Muhammadiyah Jember material Pythagorean theorem.

## **III. Result and Discussion**

When expressing mathematical ideas through speech, writing, demonstrating, and describe it visually, S1 expressed it clearly and completely but often has errors. Error that received is wrong when drawing a square which should be symmetrical. In addition, S1 also experienced an error in showing the name of the hypotenuse of a right triangle. In understanding, interpreting, and evaluating mathematical ideas, either orally, in writing, or in any other visual form, S1 was doing it right, clear, and complete. When using the term, notation, mathematical structures to present ideas and describe relationships with models other situations, S1 used in full. But not in terms of truth and clarity. This was seen when S1 uses

the term "crossed" to describe the natural numbers with fractional multiplication. When it should be is S1 mention the word "multiplied" to avoid wrong concept. In addition, S1 also provides a strikethrough on the two numbers are multiplied. Meanwhile, when answering questions given S1've been working with a correct, clear, and complete.

When expressing mathematical ideas through word of mouth, S2 frequent mentions of vertices and edges in pointing angle. This led to the concept submitted become less clear. When understand, interpret, and evaluate mathematical ideas, either orally, in writing, or in any other visual form, S2 has been doing it right, clear, and complete. It is strengthened by the use of origami media to describe the origin of the Pythagorean Theorem. When using the term, notation, mathematical structures to present ideas and describe relationships with models other situations, S2 having an error in determining the outcome of the roots of  $\sqrt{72} = 3\sqrt{8}$ . The correct result is  $6\sqrt{2}$ .

The problems that arise related to mathematical communication skills gained from the observation is (1) S1 is weak in describing mathematical ideas visually. It was seen as S1 square describe to explain the formation of the Pythagorean Theorem. In addition, S1 also made a mistake in demonstrating mathematical ideas through word of mouth, which is one mentions the name of one side of the triangle; (2) S1 experiencing errors when using mathematical terms, that is, when explaining multiplication of natural numbers and fractions. S1 uses the word crossed out to explain the multiplication; (3) S2 is having problems in expressing mathematical ideas verbally, i.e S2 mentions of vertices and edges in pointing angle. It resulted in the obscurity of concepts that are presented; and (4) S2 experience problems using mathematical structure to present mathematical ideas. This was seen when S2 experienced an error in determining the outcome of  $\sqrt{72}$ .

The efforts made by the lecturer to cope with emerging issues related to the ability of the student mathematical communication is (1) to address the problem of S1 weakness in describing visual mathematical ideas, professor's advice to use tools when draw the square. Besides lecturers also reminded to examine and re-examine whether the name of one of the sides of the triangle mentioned is the side of the

triangle in question. The way it is done in order not to cause wrong understanding of the concepts that are presented. This is in line with the opinion of Ramellan (2012: 1) that by using mathematical language is expected to communicate the ideas obtained. So with the correct mathematical language will impact on mathematical ideas conveyed correctly and clearly; (2) In coping with the issue of S1 error in using mathematical terms, the lecturer explained again about the process of multiplying natural numbers with fractions, which occurs subsequent process operations division between the natural numbers and the denominator of a fraction because the numerator of the fraction is one. Indeed, in general there are streaks on the two numbers that can be divided. But in explaining should still use the term split is not "crossed" because it can lead to wrong understanding of the concept of division. This is in line with the opinion of Darkasyi (2014) that one form of mathematical communication is to understand mathematics. Therefore, when it is communicated not correct it will cause an error in understanding mathematics and of course along with the concepts;(3) In order to overcome the problems faced S2 is about expressing mathematical ideas orally, the lecturer asked back to S2 what is mentioned it is correct or not. Lecturers also recalls the definition of a point, sides, and corners. So S2 can understand and do not hesitate to understanding of the concept of appointment naming the name of the angle for the side in front of him. Due to the mathematical ideas conveyed correctly and clearly will allow the recipient to understand the concept of mathematical ideas well without the confusion over the definition of a term or mathematical idea presented. This is in accordance with the opinion of Rachmayani (2014) that through communication, students can apply mathematical and express their understanding of mathematical concepts and processes they study. So if a student's understanding of an idea is not mathematically precise impact on misconceptions expressed by means of mathematical ideas by the listener; and (4) Meanwhile, to overcome the problems of error S2 in presenting mathematical ideas, the lecturer asks S2 to recalculate the results of the answer. S2 then recalculate the results of  $\sqrt{72}$  and get the correct result is  $6\sqrt{2}$ . Furthermore, the lecturer gives any other matter that is about finding the root of a number, and S2 can obtain the results correctly. Based on the observations made, the S2 is not understand the concept of rooting and how to determine the

outcome of the roots. S2 but less scrupulous and too hasty in doing so resulted in obtaining the question wrong answer. Therefore, lecturer asks S2 to be conscientious in solving a given problem in order to avoid similar mistakes.

#### **IV. Conclusions**

The conclusions on mathematical communication skills student of mathematics education in the University of MuhammadiyahJember Pythagorean theorem material on junior high school Mathematics subjects the study are as follows.

1. When expressing mathematical ideas through speech, writing, demonstrating, and describe it visually, S1 express it clearly and completely but often has errors. Whereas when understand, interpret, and evaluate mathematical ideas, either orally, in writing, or in any other visual form, S1 was doing it right, clear, and complete. When using the term, notation, mathematical structures to present ideas and describe relationships with models other situations, S1 used in full. But not in terms of truth and clarity. On the other hand, when expressing mathematical ideas through word of mouth do the obvious but it is not true and clear. Whereas when understand, interpret, and evaluate mathematical ideas, either orally, in writing, or in any other visual form, S2 has been doing it right, clear, and complete. Furthermore, when using the term, notation, mathematical structures to present ideas and describe relationships with another situation models S2 does not do it correctly, clearly and completely.
2. The problems that arise related to student mathematical communication, namely (1) S1 is weak in describing mathematical ideas visually, making mistakes in demonstrating mathematical ideas through word of mouth, and experiencing errors when using mathematical terms; (2) S2 is having problems in expressing mathematical ideas are and experience problems using mathematical structure to present mathematical ideas.
3. To overcome the problem of weak S1 in describing mathematical ideas visually, professors advise to use tools when drawing the square. Besides lecturers also reminded to check and re-examine whether the name of one of the sides of the triangle mentioned is the side of the triangle in question.

Meanwhile, in addressing the issue of the fault S1 in using mathematical terms, the lecturer explained again about the process of multiplying natural numbers with fractions. On the other hand to cope problems faced S2 is about expressing mathematical ideas orally, the lecturer asked back to S2 what is mentioned it is correct or not. Lecturers also recalls the definition of a point, sides, and corners. Meanwhile, to overcome the problems of error S2 in presenting mathematical ideas, the lecturer asks S2 to recalculate the results of the answer and more careful in solving a given problem in order to avoid similar mistakes.

Based on the results of the study the researchers gave the following advice (1) for students of mathematics education, should always develop mathematical communication skills. The ability is very useful for what is delivered can be received well by the audience in this case the students remember later students of mathematics would be a math teacher; (2) for further research, should be more thorough and in-depth when conducting research related to mathematical communication skills student of mathematics to produce a proper solution in improving the communication skills of students in the program mathematical study of mathematics.

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