Analysis of students mathematical communication ability

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Abstract. This study aims to (1) analyse and describe the difficulties by students in solving problems of mathematical communication test in circle material; (2) analyse the factors that causing the students have difficulty in solving mathematical problems in circle material. The type of research in this study is qualitative descriptive. The data collected in the form of writing, words, and pictures. The research was conducted at SMA Negeri 1 Tualang, Riau. The subjects in this study are 36 students of class XII. Data collected methods used in this study is a test mathematical communication ability indicator in circle material. Based on the research which are found three factors that cause students difficulties in solving problems include: (1) students have not been able to understand the concept of the problem and students have not been able to interpret the sentence about the presented questions; (2) students are less precise in performing calculations on algebraic form operations such as subtraction, multiplication, and division and while working on students in a hurry; (3) students not yet understand the concept of drawing circles from known elements or otherwise resolving questions from the presented images.

1. Introduction
According to Asikin, mathematical communication is an event of interconnection or dialogue that occurs within the classroom, where there is a transfer of messages [1]. Through communication, students can explore and consolidate mathematical thinking and knowledge in solving problems. Based on Osterholm, state that student seems difficult to articulate a reason in understanding a text. There are still many students who did not write solutions in terms of intrapersonal communication (symbol processing messages) and interpersonal (processes information), which important in interpreting the term to solve the mathematical problems [2]. That related to the way students can differ in processing message symbols, storing, and using information to respond to a task.

Sudrajat says that when a student obtains information in the form of mathematical concepts given by the teacher as well as obtained from the reading, then the things that happen is the transformation of mathematical information from the source to the student [3]. Students respond based on their interpretation of the information, resulting in a process of mathematical communication. Within states that communication skills become important when discussion between students is done, where students are expected to be able to express, explain, describe, hear, ask and cooperate so as to bring students to a deep understanding of mathematics [4]. Children given the opportunity to work in groups in collecting and presenting data, they showed good progress as they listened to each other's ideas, discussed together and then drew up the conclusions that the group had to say. It turned out that they learned most from communicating and to construct their own knowledge.
It is inevitable that mathematics is one of the subjects that have the high level of learning difficulties experienced by many students. Therefore, it is necessary to search more deeply about the barriers of what is experienced by students in doing math problems, especially the problems that test the ability of mathematical communication then how to minimize the barriers. In this research will be discussed about some of the difficulties experienced by students on the circle material.

Error students in solving math problems occur because of several things, one of which is that students have learning difficulties. According to Sabri, Learning difficulties are students' difficulties in absorbing and receiving lessons [5]. Ahmadi A and Supriyono learning difficulties can be interpreted as a failure experienced by students in following the learning held by the school [6]. Students do not meet the expectations listed as formal objectives of the curriculum or those in the views or assumptions of the teacher or principal.

Soejono suggests that: Difficulties in mathematics are 3, namely difficulty in concept, principle and verbal [7]. 1. Difficulty in using the concept: a) Student forgot the abbreviation name / technical name of an object; b) Inability to remember one or more sufficient conditions and so on. 2). Difficulties in using the principle: a). Students do not have concepts that can be used to develop principles as new knowledge points; b). Students cannot use the principle because of lack of clarity about the principle and so on. 3). Difficulty solving verbal-shaped questions: a). Not understanding what is read, due to lack of student knowledge about concepts or some unknown term; b). Unable to assign variables to construct equations and so on.

The analysis of difficulty also gives results that there are subjects who perform more than one type of difficulty in solving the SPLDV problem. Another study conducted by Ruhyana also mentions that many mistakes made by students is on aspects of displaying ideas and mathematical concepts [8]. To know the difficulties of students in doing the problem circle, conducted diagnostic test to 36 students in one of high school in Sub Tualang, Riau. From the results of further tests are analyzed what difficulties encountered students in working on the problem.

2. Method
This type of research is descriptive qualitative research. Arikunto explains that descriptive research is a study designed to obtain information about the status of a symptom that occurred in the field at the time of the study [9].

The indicators of mathematical communication ability in this research are: 1) Connecting real objects, drawings, and diagrams into mathematical ideas; 2) Describe ideas, situations and mathematical relations both orally and in writing with real objects, drawings, graphs, and algebra; 3) Stating daily events in language or mathematical symbols.

3. Results and discussion
The following are examples of answers done by the student, after being identified by the type of error will then be identified according to the difficulty that is suspected to be the cause or source of the occurrence of the error.
3.1. Problem number 1

A circle is centered on the point (4, -3) and through the point (2.2).
   a. Determine the radius of the circle
   b. Find the equation of the circle
   c. Draw the circle on the Cartesian.

Solution waned:
   a. \( r = \sqrt{29} \)
   b. \((x - 4)^2 + (y + 3)^2 = 29\) atau \(x^2 + y^2 - 8x + 6y - 4 = 0\)
   c. Draw

![Figure 1. Problem number 1.](image)

Answer from student:

![Figure 2. Student answer for problem no 1.a.](image)

![Figure 3. Student answer for problem no 1.b.](image)
From the student's answer can be seen that on problem no. 1 a and b students can do the problem, but on problem no. 1 c there is a student error in drawing the circle requested. On questions a and b, students are asked to find the radius and the equation of the circle only. This means that if the student memorized formulas looking for radius and equation formula of the circle then the student will be able to answer the question. Another case about no. 3 where the students are asked to describe the circle with known elements of the radius and the point that the circle passes. From the student's answer it appears that the students do not understand the concept of the circle center. This is possible because students are accustomed to memorize the formula and not accustomed to working on problems that require drawing skills. In the material circle there are problems that are actually easier if we sketch the circle first.

3.2. Problem number 2

A circle has the equation \( x^2 + y^2 - Ax - 10y + 4 = 0 \) and alludes to the X axis
a. Determine the value of \( A \)
b. Draw the circle.

The expected answer is:
- A value = ± 4
- for \( A = 4 \), then the equation becomes \( x^2 + y^2 - 4x - 10y + 4 = 0 \), with the center of the circle: (2.5) and radius = 5, then the image:

For \( A = -4 \), then the equation becomes \( x^2 + y^2 + 4x - 10y + 4 = 0 \), with center of circle: (-2,5) and radius = 5, then picture:
Answers that arise from students:

![Image](image1.jpg)

Figure 6. Student answer for problem number 2a.

![Image](image2.jpg)

Figure 7. Student answer for problem number 2a.

From the student's answer seen that on problem no. 2 a formula used by students to work on the problem is correct but when using the formula there are procedural errors. In the student's answer no. 2 b it appears that the student is correct in drawing circle but the circle is made only 1 course, but because the value of A there 2 then the equation of the circle also there 2 and the picture of course also exist 2.

3.3. **Problem number 3**

Look at the image below:

![Image](image3.jpg)

The above circle is a circle centered at O (0,0) and through point A (2,3).

a. Determine the radius of the circle from the picture above
b. Find the equation of the circle.

Expected answer
a. \( r = \sqrt{13} \)
b. the equation of the circle is: \( x^2 + y^2 = 13 \)

Figure 8. Problem number 3.
The answer appears:

![Figure 9](image-url)  
**Figure 9.** Student answer for problem number 3a

![Figure 10](image-url)  
**Figure 10.** Student answer for problem number 3b

4. Conclusion

Based on the results of the analysis and discussion that has been obtained then it can be concluded to the difficulties of students in solving the problem of student circles are as follows:

- There are some difficulties experienced by students in solving circle problems. These difficulties include the difficulty of understanding problems and redrawing from what is known, errors in calculations.
- Factors that cause students to find difficulties in solving problems include:
  a. Students have not been able to understand the concept of the problem and students have not been able to interpret the sentence about the presented questions.
  b. Students are less precise in performing calculations on algebraic form operations such as subtraction, multiplication, and division and while working on students in a hurry.
  c. Students not yet understand the concept of drawing circles from known elements or otherwise resolving questions from the presented images.

Acknowledgments

The Author are thankful to Dwi Maulida, Winda Ayuningtyas, Fauziyah and Aiza for providing the necessary facilities for the preparation of the paper.

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