

Analysis Of Mathematic Communication Difficulties And Student Mathematics Problem-Solving In The Application Of Realistic Mathematics Education Approach In 10th Grade Sultan Iskandar Muda Senior High School

Gomgom Sibarani¹, Mangaratua M. Simanjorang², Mukhtar³

{gomgom.sibarani@gmail.com}

Education Mathematics, State University of Medan, Medan, Sumatera Utara, Indonesia ^{1,2,3}

Abstract. This study aims to describe: (1) student's mathematics communication skills in the application of Realistic Mathematics Education (RME), (2) student's mathematics problem-solving abilities in the application of RME, (3) student's difficulties in mathematics communication, and mathematics problem-solving in solving mathematics problems. with the RME approach. This research is qualitative research with a descriptive approach. Based on the research data, it was obtained that: (1) The level of student's mathematics communication skills in the trigonometric comparison material in a right triangle, student's who had the ability of the medium category had the highest proportion, while for the ability of the low and high categories had the same proportion, (2) The level of student's mathematics problem-solving ability in trigonometric comparison material in right triangles, student's who have the ability in the low category have the highest proportion followed by the proportion in the medium category, and the ability in the high category has the lowest proportion, (3) Difficulty in mathematics communication and solving student's mathematics problems in the material of trigonometric comparisons on right triangles in the application of Realistic Mathematics Education are the difficulties of facts, concepts, operations, and principles.

Keywords: Mathematics Communication Ability, Mathematics Problem-Solving Ability, Realistic Mathematics Education.

1 . Introduction

Mathematics need to be taught to student's because: (1) It is always used in all aspect's of life, (2) All field of study require appropriate mathematics skills, (3) It is a mean of strong , concise, and clear communication, (4) Can be used to present information in various ways, (5) Improve logical thinking skills, accuracy, and spatial awareness, (6) Give satisfaction to next problem-solving efforts [1]. In learning mathematics, a student who already can understand mathematics is also required to be able to communicate it, so that his understanding can be understood by others.

According to Wahid, communication ability is a mathematics skill that includes the ability to represent, listen, read, discuss, and write, as well as the ability to express mathematics ideas coherently to friends, teachers, and others, solve problems or do reasoning and express

mathematics ideas well. in writing or orally [2]. Furthermore, Harianja added that mathematics communication is the ability of student's to convey something they know through events in the form of dialogue or mutual relationships that occur in the classroom environment, there is a transfer of message. The message sent contains the mathematics material that student's learn, for example in the form of concepts, formulas or strategies for solving a problem. The parties involved in communication events in the classroom are teachers and student's. How transfer the message can be orally or in writing [3].

Mathematics communication skills are very important in learning mathematics because one of the functions of mathematics lessons is as a way of communicating ideas practically, systematically, and efficiently [4]. With good communication skills, a problem can be represented more quickly and this will support problem-solving [5]. In addition, communication can support student's in learning new mathematics concepts, which can be seen in real situations, pictures, use of objects, explanations, use of diagrams, writing, and use of mathematics symbols. Misunderstandings can be found and resolved. Another advantage is that it reminds student's that they share responsibility with the teacher in learning [6].

However, the reality on the ground shows that the majority of student's have not mastered mathematics communication skills, both oral and written mathematics abilities. Student's find it difficult to distinguish the use of mathematics symbols and symbols, change real problems into mathematics language, and transfer mathematics forms into real problems, student's rarely ask questions or give their opinions in the mathematics learning process [4]. In addition, Puspita explained that student's communication skills in interpreting story problems into mathematics symbols were still low and there were still many student's who were confused in interpreting questions [7].

In addition to mathematics communication skills, another ability that is considered important in learning mathematics is problem-solving ability. Problem-solving ability is a skill or skill that a person has in himself in finding solutions to solve a problem or problem at hand. Solving a problem involves knowledge and skills to reach the correct and appropriate solution.

Problem-solving is seen as process to find combination of many rule that can be applied to overcome a new situation. Problem-solving is not just a form of the ability to apply the rules that have been mastered through previous learning activity, but a process to get rules at a higher level.

Problem-solving ability is one of the important components of developing student's thinking skills because in the teaching and learning process mathematics is basically problem-solving and it is very necessary to link the material being studied with problems that exist in everyday life to explore the potential and ideas of student's. in determining solutions to problems given by educators.

Through mathematics problem-solving, student's are guided to develop their ability to build new mathematics knowledge, solve problems in various contexts related to mathematics, apply the necessary strategies, and reflect on the mathematics problem-solving process. All these abilities can be obtained if student's are accustomed to carrying out problem-solving according to appropriate procedures, so that the knowledge gained by student's is not limited

to one problem being solved, but can cover various other problems as well as broader aspects of knowledge.

Many factors cause the low mathematics communication skills and problem-solving of student's in the learning process. One of them is teacher-centered learning (conventional) which does not provide opportunities for student's to develop their opinions [8]. Student's find it difficult to use mathematics symbols/notations correctly, describe information from a discourse, provide conclusions at the end of answers, present contextual problems in the form of mathematics models and are less able to convey mathematics ideas with algebra and solve problems coherently.

The above is also supported by the results of the initial observations that the researchers found on student's at SMA Sultan Iskandar Muda class X on the material for the System of Two Variable Linear Equations (SPLDV) as basic knowledge for the material for the Three Variable Linear Equation System (SPLTV). Based on the test results, information was obtained that student's were still unable to explain or state problems in language or mathematics symbols. The process of determining the answers to questions is also not following clear steps. This shows mathematics communication skills and problem-solving skills are very low.

Based on this, in overcoming the problem of student's lack of ability in mathematics communication and problem-solving, educators who in this case are subject teachers are required to understand and be able to place appropriate learning approaches for the material to be taught to student's. One of them is the Realistic Mathematics Education (RME) approach. The realistic mathematics Education approach begins with contextual problems that apply student-centered learning so that student's are more active while the teacher acts as a facilitator. In this learning approach student's can express and communicate their ideas with their classmates and the teacher can help support to compare ideas from student's and make decisions from the ideas given by student's [9]. Furthermore, Tarigan & Sinaga explained that realistic mathematics education is an approach to learning mathematics that focuses on contextual problems as its main aspect in introducing mathematics concepts and procedures [10].

Some of the advantages of the Realistic Mathematics Education approach are that this learning emphasizes the importance of real contexts that are known to student's and the process of constructing mathematics knowledge by the student's themselves, this learning emphasizes the activities of student's to seek, find and build their knowledge that they need so that learning becomes student-centered. [11]. Not much different, Wangge said that this learning emphasizes more on "student-oriented" or "problem-oriented" so that it will reduce a lot of teacher domination [12].

However, this theory is inversely proportional to reality, where the use of learning approaches in learning mathematics has not been carried out optimally. The learning process carried out by the teacher is that student's do not participate in finding extensive information about the learning topic being studied so when learning takes place student's are just silent because they are afraid to give their answers [13]. The lecture model commonly used by teachers in teaching is one-way learning, so it tends to make student's passive in learning.

This also happened in 10th grade at Sultan Iskandar Muda Senior High School, in learning mathematics in the class, the participation of student's who are contributive and initiative in learning is still very lacking. Student's are less involved in learning. When learning takes place student's often do not pay attention to the teacher's teaching and student's often do not complete assignments in class. In doing homework, many student's do not do it. Teachers delivering mathematics learning always use lectures and assignments. Giving exercises or assignments to student's can hone their abilities. However, if it's only lectures and assignments, student's will get bored and they don't like math because the learning is the same.

2. Research Method

This research uses descriptive qualitative research. This type of qualitative research means a type of research that aims to describe how the mathematics communication skills and mathematics problem-solving abilities of student's in the application of the Realistic Mathematics Education (RME) approach in class X SMA Sultan Iskandar Muda Medan. The resulting data will be in the form of words or utterances obtained from interviews and writings or numbers obtained from interviews. Based on the qualitative approach in this study, facts, written and oral, from observed human data source and other related document that were described as they were, were then reviewed as briefly as possible as to answer the problem. This research will be carried out with the implementation schedule coordinated with school activities. The subjects in the study involved student's of class X IPA 1 SMA Sultan Iskandar Muda, who were treated through a Realistic Mathematics Education approach in first semester of the 2021/2022 academic year, totaling 30 student's. While the subject matter given is a comparison of trigonometry.

Analysis data in this study uses qualitative data analysis where data analysis is carried out after giving learning action. According to Trianto [14] that qualitative data analysis is the process of systematic searching and compiling data obtained from interview, field note, and other material so that they are easy to understand that they can be informed to others. The data analysis is carried out by organizing the data, breaking it down into units, synthesizing, compiling it into patterns, and choosing which ones are important and which will be studied so that conclusions can be made and conveyed to others. Activities in data analysis use the Miles and Huberman model which includes data reduction, data display, and conclusion drawing/verification data.

3. Results and Discussion.

3.1. Description of Student's Mathematics Communication Ability Data

After the Realistic Mathematics Education with Trigonometry Comparison material, a test was carried out on the student's who had been selected as samples and a score was carried out on the student answer sheets. From the results of the scoring, the results of the student's mathematics communication skills are shown in table 1 below.

Table 1. Student's Mathematics Communication Ability Test Results

Interval SKKM	Total students	%	Level
$0 \leq SKKM < 75$	9	30%	Low
$75 \leq SKKM < 84$	12	40%	Currently
$84 \leq SKKM < 100$	9	30%	High

Table 1 above represents the composition of student's according to the level of test results, from 30 student's who took the test it turned out that student's with low levels of mathematics communication skills were 9 student's (30%), student's who had moderate levels of mathematics communication skills were 12 student's (40%) and student's who have a high level of mathematics communication skills are 9 student's (30%). Because there are still many student's who have low and moderate levels of mathematics communication skills, this shows that there are still many student's who make mistakes in solving problems related to student's mathematics communication skills. So it is necessary to investigate the difficulties experienced by student's in solving mathematics problems related to student's mathematics communication skills and see the mistakes made by student's when solving mathematics communication problems.

3.2. Data Description of Student's Mathematics Problem-Solving Ability

After testing the student's mathematics problem-solving abilities, then scoring is done on the student's work on the student worksheets. The score of the student's mathematics problem-solving ability test is given based on the scoring guidelines that have been prepared previously, thus the results of the student's mathematics problem-solving ability tests are obtained after applying Realistic Mathematics Education in table 2.

Table 2. Results of Student's Mathematics Problem-Solving Ability Test

Interval SKPM	Total students	%	Level
$0 \leq SKPM < 75$	20	67%	Low
$75 \leq SKPM < 84$	6	20%	Currently
$84 \leq SKPM < 100$	4	13%	High

Table 2 above shows that of the 30 student's who took the mathematics problem-solving ability test, student's obtained a low level of mathematics problem-solving ability 20 student's (67%), student's had a moderate level of mathematics problem-solving ability 6 student's (20%) and student's who have mathematics problem-solving skills with a high category are 4 student's (13%). Because there are still many student's who have low levels of student's mathematics problem-solving abilities, this shows that there are still many student's who make mistakes in the process of solving problems in the questions given. For this reason, it is necessary to explore the difficulties experienced by student's who make these mistakes.

3.3. Data Analysis of Student's Mathematics Communication Difficulties

After taking the test, the results of student work are assessed according to the alternative answers that have been prepared. P-1 scored 35 or included in the low category in mathematics communication skills. Based on the results of P-1's work to answer all points in question number 1, there is an inaccurate use of the formula in point a, then to determine the

value of the trigonometric ratio at points b and c, P-1 does not show in the sketch the location of angle and angle, as well as at point d in determining the conclusion from the results of his work, P-1 still does not understand to determine the conclusion.

In question number 2, P-1 can sketch the problems given in the problem but it is not neat and not precise. Points b and c can be answered well but cannot draw conclusions from the results of their work. In question number 3, P-1 can sketch the problem, answer point b, and make trigonometric comparisons of one of the angles of the triangle but does not make trigonometric comparisons of other angles and cannot make the right conclusions on his work.

After analyzing the results of the student's mathematics communication ability test and analysis of answers during interviews, the results obtained that in problem 1, problem 2, and problem 3, P-1 had difficulty in sketching out a fairly complex problem and difficulty in determining the position of the student or the location of an angle in a right triangle and difficulty in expressing statements in mathematics problems into mathematics models. In addition, in problem 4 and problem 5, P-1 cannot solve the problem correctly, where P-1 is not able to get the information in the problem and cannot determine ways to solve the problem. So in this case it can be concluded that P-1 has difficulties at the level of facts, concepts, operations, and principles.

3.4. Data Analysis of Student Mathematics Problem-Solving

The purpose of analyzing student's difficulties in completing math problem-solving tests is to describe the criteria for difficulty experienced by research subjects in the form of a core summary of the difficulty experienced by the research subjects. Below is a description of the mathematics problem-solving difficulties experienced by the research at each level of student's mathematics problem-solving abilities, as follows.

After being assessed according to the alternative answers that have been prepared previously, P-1 gets a value of 31.25 or belongs to the level of mathematics problem-solving ability with a low category.

In problem number 1, P-1 is able to present known information and sketches, but in making a mathematics model the solution is still incomplete and unclear and does not provide conclusions from solving the problem. In question number 2, P-1 is able to sketch and make known information and calculations. However, the sketch has not stated the angle and some of the information that is known is written down. The plan for completion and the conclusion were not made by P-1. Furthermore, for question number 3, P-1 has not been able to provide an answer.

After analyzing the result of the student's mathematics problem-solving ability test and interview analysis, the results obtained that P-1 had difficulties with facts, concepts, and principles in problem 1, experienced difficulties in facts, concepts, operations, and principles in problem 2 while in problem 3, P-1 has not been able to provide an answer. With this, it is concluded that P-1 has difficulties in facts, concepts, operations, and principles.

4. Conclusion

- a. The level of student's mathematics communication skills in trigonometric comparison material in right triangles, student's who have the ability of the medium category have the highest proportion, while the ability of the low and high categories have the same proportion.
- b. The level of student's mathematics problem-solving ability in trigonometric comparison material in right triangles, student's with low category abilities have the highest proportion followed by moderate proportions, and high category abilities have the lowest proportions.
- c. The 6 research subjects for student's mathematics communication skills, P-1 has difficulties in facts, concepts, operations, and principles. The P-2 has difficulties in facts, concepts, operations, and principles. The P-3 has conceptual, operating, and principle difficulties. The P-4 had concept, operation, and principle difficulties. The P-5 had concept, operation, and principle difficulties. The P-6 had operating and principle difficulties.
- d. The 6 research subjects for student's mathematics problem-solving abilities, P-1 had difficulty with facts, concepts, operations, and principles. The P-2 had difficulty with facts, concepts, operations, and principles. P-3 has difficulty with facts and principles. P-4 is having a hard time with facts. The P-5 had fact and concept difficulties. P-6 is having fact difficulties

Reference

- [1] Abdurrahman, M. (2012). *Pendidikan Bagi Anak Berkesulitan Belajar*. Jakarta: Rineka Cipta
- [2] Wahid, Umar. (2012). Membangun Kemampuan Komunikasi Matematis Dalam pembelajaran Matematika. *Infinity Journal*. 1 (1). 1-9
- [3] Harianja, Joko Krismono. (2019). Implementasi Cooperative Learning dengan Menggunakan Strategi Rally Coach untuk Mengembangkan Keterampilan Komunikasi Matematis. *Jurnal Riset Pedagogik*. 3 (2). 179-182
- [4] Jurotun. (2015). Meningkatkan Komunikasi Matematis Peserta Didik Melalui Disco LeMPer Berbantuan Software Geogebra. *Jurnal Kreano*. 6 (1). 1-6
- [5] Arista, Dhian. (2014). Upaya Meningkatkan Kemampuan Komunikasi Matematis Siswa Dengan Model Pembelajaran Kooperatif Di SMP N 2 Sedayu Yogyakarta. *Jurnal Aksioma*. 3 (2). 65-76
- [6] Suparsih. (2018). Pengembangan Perangkat Pembelajaran Penemuan Terbimbing Untuk Meningkatkan Kemampuan Berpikir Kritis dan Komunikasi Matematis. *Jurnal Pythagoras*. 13 (2). 214-224
- [7] Puspita, Irmawan & Pratiwi. (2018). Pengaruh Aktivitas Siswa Dalam Model Pembelajaran Cooperative Script Terhadap Kemampuan Komunikasi Matematis Siswa. *Jurnal JES-MAT*. 4(1). 57-66
- [8] Mahmuzah, R. dan Aklimawati. (2016). Pembelajaran Probem Posing Untuk Mengembangkan Kemampuan Komunikasi Matematis Siswa SMP. *Jurnal Didaktik Matematika*. 3 (2). 67-74
- [9] Tarigan, Daitin dan Esther M. Sinaga. (2015). Perbedaan Hasil Belajar Siswa dalam pendekatan Realistik dengan Pendekatan Ekspositori Pada Mata Pelajaran Matematika Kelas IV SDN No 1880 Tanjung Morawa. *Jurnal Kreano*. 6 (1). 7-11

- [10] Hutasuhut, Hasratuddin, dan Napitupulu. (2018). Development of Learning Devices Based on Realistic Mathematic Education to Improve Mathematics Communication of Students at Senior High School. *AISTEEL Proceeding of The 4th*. eISSN: 2548-4613. 83-86
- [11] Nasriyah. (2019). Penerapan Pembelajaran Matematika Realistik Untuk Meningkatkan Hasil Belajar Matematika Pada Siswa Kelas VI SDN Parung Panjang 02 Kecamatan Parung Panjang. *Jurnal Pedagogiana*. 5 (8). 7-8
- [12] Wangge, M.C.T. 2019. Pengembangan Perangkat Pembelajaran Matematika Realistik Untuk Meningkatkan Hasil Belajar Pada Materi Persegi Panjang dan Persegi Kelas VII SMP. *Jurnal Ilmiah Pendidikan Citra Bakti*. 5 (1). 45-54.
- [13] Yuli dan Eliza. (2019). Model Pembelajaran Student Teams Achievement Divission (STAD) Pada Pembelajaran Matematika Di SMPN 46 Situnjung. *Jurnal Math Educa*. 3 (1). 32-43
- [14] Trianto. (2011). *Mendesain Model Pembelajaran Inovatif-Progresif*. Jakarta: Prestasi Pustaka.