KnE Social Sciences

PVJ-ISHESSH 2021
2nd Paris Van Java International Seminar on Health, Economics, Social Science and Humanities
Volume 2023

Research Article

Analysis of Students' Mathematical Communication Ability With Relistic Mathematics Education

Lisna Agustina[1*], Delima[2], Ali Nurdin[2], Rajab Ansari[2] and Yani Sukriyah[2]

[1]Mathematics Education Study Program, Universitas Muhammadiyah Tapanuli Selatan, Indonesia.
[2]Economic Education Study Program, Universitas Muhammadiyah Tapanuli Selatan, Indonesia.

Corresponding Author: Lisna Agustina; email: lisna.agustina@um-tapsel.ac.id

Published 03 March 2023

Publishing services provided by Knowledge E

Selection and Peer-review under the responsibility of the PVJ-ISHESSH 2021 Conference Committee.

Abstract.
Communication skills are skills in conveying meaning in the form of ideas or information from one person to another through certain media and providing rational reasons for a statement, changing forms from verbal language into mathematical language, and illustrating mathematical ideas into descriptions. which is relevant.This study aims to describe students' communication skills with Realistik Mathematic Education (RME). Data collection techniques are (1) validation, (2) RME, (3) pre-test and post-test of mathematics communication skills, (4) analysis of mathematics communication skills tests, and (5) observation of student activities. This research finally resulted in the identification of students' communication skills based on indicators of mathematical communication skills, namely (a) Connecting real objects, pictures and diagrams into mathematical ideas, (b) Explaining ideas, situations and mathematical relations, in writing, (c) Stating everyday events. day in language or mathematical symbols. The identification stage is clarified in the category Very good, good, enough, not enough, not very bad. This research was conducted at SMP Negeri 1 Sipirok. To identify the increase in students' mathematical communication skills in every aspect, the t test was carried out. Based on the students' answers. The results showed that the students' mathematical communication skills with RME increased significantly by the value of t = 3.896 while t table = 1.685 so it could be concluded that the students' mathematical communication skills with RME were better.

Keywords: Mathematical communication; RME; communication ability

1. Introduction

The Industrial Revolution 4.0 is one of the implementations of the projection of modern German technology 2020 which is implemented through improving manufacturing technology, creating a strategic policy framework, and so on. It is marked by the presence of robots, artificial intelligence, machine learning, biotechnology, blockchain, internet of things (IoT), and driverless vehicles. The field of education is closely related to the 4.0 Industrial Revolution which can be used to support learning patterns and thinking patterns and develop creative and innovative innovations from students, in order to produce the next generation who are superior and able to compete. Educational theorists often call Education in the Industrial Revolution Era 4.0 to describe the various ways to integrate cyber technology both physically and non-physically in learning. Education in the Industrial Revolution Era 4.0 is a phenomenon that responds to the needs of the industrial revolution by adjusting a new curriculum according to the current situation. The curriculum is able to open a window to the world through your hands, for example by using the internet of things (IOT). On the other hand, teachers also get more references and teaching methods [1].

However, this is not free from challenges for teachers to implement. Quoted from Kompasiana [2] there are at least 4 competencies that are expected to be possessed by teachers. First, critical thinking and problem solving skills. Is the ability to understand a problem, get as much information as possible so that it can be elaborated and bring up various perspectives to solve the problem. Teachers are expected to be able to concoct learning and export these competencies to students. Both communication and collaboration skills. These skills cannot be separated from information technology-based abilities, so that teachers can apply collaboration in the teaching process. Third, the ability to think creatively and innovatively. It is hoped that new ideas can be applied by teachers in the learning process so as to spur students to think creatively and innovatively. For example, in doing assignments by utilizing technology and information. Fourth, technology and information literacy. Teachers are expected to be able to obtain many references in the use of technology and information to support the teaching and learning process.

Communication skills are the skills to connect real objects, pictures, and diagrams into mathematical ideas, explain mathematical ideas, situations and relations orally or in writing with real objects, pictures, graphics and algebra, express everyday events in language or mathematical symbols, read with understanding a written mathematical presentation, explaining and making statements about the mathematics that has been learned. In addition, mathematical communication skills are abilities that can include, contain various opportunities to provide rational reasons for a statement, change the form from verbal language into mathematical language, and illustrate mathematical ideas into the form of relevant descriptions. The indicators of mathematical communication used in this study are: (1) the ability to express mathematical ideas; (2) the ability to understand and evaluate mathematical ideas; and (3) the ability to use mathematical notations and structures to present mathematical ideas. Mathematical communication skills are also one of the abilities measured in the Survey Program for International Student Assessment (PISA) study. From the survey results of the PISA Program for International Student Assessment Survey study, a study conducted by the Organization for Economic Cooperation and Development [3] on 15-year-olds in 2015, put Indonesian students' math skills at 63rd out of 72 countries. Recently, students' mathematical communication skills have also received attention from educational researchers in Indonesia. The low level of communication skills of students in Indonesia is a classic problem that has not been resolved. In overcoming this, the researcher wants to offer innovative learning solutions to solve student communication problems, especially students of SMP Negeri 1 Sipirok. There are several learning models that are suitable to be applied in the 2013 curriculum such as those currently being applied in schools in Indonesia, one of which is the Realistic Mathematical Approach.

Realistic Mathematical Approach is a realistic mathematics approach is learning that focuses on learning activities on the environment, teaching materials that are arranged in such a way that students are more active in constructing or building their own knowledge [4]. PMR does not start with definitions, theorems or characteristics and then continues with a discussion of examples, such as those that have been implemented in schools. However, it is hoped that the students will rediscover the characteristics, definitions, methods, principles, and theorems through the contextual solutions given by the teacher at the beginning of the lesson. so that students' mathematics communication skills are expected to be better in the future. The reason for choosing a realistic mathematics learning model is because the learning activities start with contextual problems and give students the freedom to describe, interpret, and solve problems in their own way according to their initial knowledge. For this reason, researchers want to analyze students' communication skills through the Realistic Mathematics learning model.

2. Methods

This type of research is a descriptive study that aims to analyze mathematical communication skills with a realistic mathematics approach. Mathematical communication skills in this study were measured using an instrument in the form of a test of students' mathematical communication skills, which consisted of a pretest and posttest. The mathematics communication ability test of the students is arranged based on the grid of the mathematics communication ability test and is guided by the indicators of mathematics communication skills and indicators of learning material.

The design used in the study included four stages, namely: (1) the research instrument preparation stage, (2) the instrument validation stage (3) the instrument testing stage, and (4) the experiment implementation stage. The research design used in this study is the Time Series Design. So, the design uses only one group, so there is no need for a control group (Sugiyono, 2015). The experimental design is presented in the following table:

Class Pretest Perlakuan Postest

Experiment O1 X O2 (1)

Descriptive Statistics The data from the pretest and posttest students' mathematics communication skills were analyzed descriptively with the aim of describing the level of communication skills after the implementation of Realistic Mathematics Learning (PMR). With the criteria, namely: "very poor, insufficient, sufficient, good, very good" which refers to [5], while the determination of the minimum standard of mathematics communication skills of students is based on the Minimum Completeness Criteria (KKM) of SMP N 1 Sipirok $\geq$ 65.

3. Results and Discussion

3.1. Description of Pre-Test Identification of Students' Mathematical Communication Ability

To describe the mathematics communication skills of students of SMP N 1 grade VII on the SPLDV material before learning with the Realistic Mathematical Approach, pre-test was given to students. For data on the value acquisition of students' mathematics communication skills, it can be seen, it is explained that the pre test given to students in the form of a mathematics communication test shows that learning outcomes in the "very good" category are only 10% or 2 students, in the "good" category only 20% or 4 students, in the category "Enough" there are 15% or 3 students and unfortunately in the "very less" category there are 50% or 10 students. For more details, it can be seen in figure below:

The following will explain the answers of students based on indicators of students' mathematical communication skills.

3.1.1. Linking Real Objects, Pictures and Diagrams Into Mathematical Ideas

Item number 1 answered the question very well, namely 3 students (18.75%). And the majority of those students did well (Establishing relevant solutions with reasons). The total score obtained from all students reached 70 with an average score of 4, Item

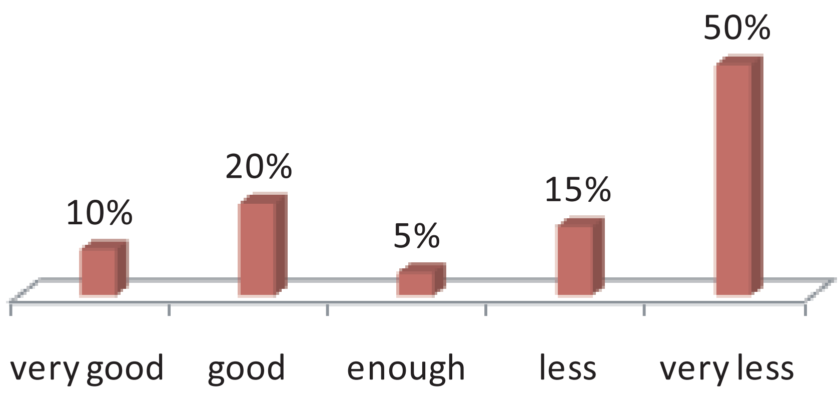

Figure 1: Results of Students' Mathematical Communication Ability Pretest.

number 2 answered the question very well, namely 5 students (31.25%). The majority of those students did well (Establishing relevant solutions with reasons). And only 1 person who answered sufficiently (Solving problems / mathematical models with reasons). The total score obtained from all students reached 72 with an average score of 4.5.

The majority of the item number 3 answered the questions very well as many as students (43.75%). And 7 students or (43.75%). And 2 people who answered well (Solving problems / mathematical models with reasons) The total score obtained from all students reached 74 with an average score of 4.6. Item number 4 answered the question very well, as many as 4 students (25%). The majority of those students who achieved well or (62.5). And 2 students (12.5%) who answered sufficiently (Solving problems / mathematical models with reasons). The total score obtained from all students reached 68 with an average score of 4.3. Item 5 students answered the questions very well, as many as 6 students (37.5%). And 8 students answered well or (50%). 1 student answered sufficiently or (6.25%). And 1 student did not answer at all. The total score obtained from all students reached 70 with an average score of 4.3.

3.1.2. Explain Ideas, Situations and Mathematical Relations, in Writing.

Item 1 the student answered the question very well, as many as 6 students (37.5%). And 4 students answered well or (25%). 8 students answered sufficiently or (56.25%). The total score obtained from all students reached 96 with an average score of 6. In item number 2, there were no students who answered the questions very well. 6 students (35%) who answered the questions well. And 2 (12.5%) students answered sufficiently.

The total score obtained from all students reached 72 with an average score of 4.5. Item number 3 was only 1 student (6.25%) who got the maximum score (answered the questions very well). 5 students (31.25%) answered the questions well. 7 students (43.75%). And 2 students (12.5%) answered enough questions. And 2 students (12.5%) answered sufficiently. The total score obtained from all students reached 72 with an average score of 4.5. No student answered item number 4 very well. The majority of students answered questions well, namely 9 students (56.25%). 5 students (31.25%) who answered the questions sufficiently. 2 students answered enough. The total score obtained from all students reached 78 with an average score of 4.9.

Item number 5 the majority of students answered questions well, namely (68%). And 4 students (25%) who answered enough questions. And 1 student did not answer the questions at all. The total score obtained from all students reached 82 with an average score of 5.1.

3.1.3. Declare Everyday Events in Language or Mathematical Symbols

Item number 1 was only 1 student (6.25%) who answered the questions very well. The majority of students answered questions well, namely 15 or (93.75%). The total score obtained from all students reached 66 with an average score of 4.1. Item number 2 only 2 students (12.5%) answered questions well. The majority of students answered questions well, namely 14 people or (87.5%). The total score obtained from all students reached 68 with an average score of 4.3. Item number 3 only 1 student (6.25%) answered the question well. The majority of students answered questions well, namely 14 or (87.5%). And 1 student (6.25%) answered sufficiently. The total score obtained from all students reached 64 with an average score of 4. Item number 4 contained 2 students (12.5%) who got the maximum score very well. And the majority of students (87.5%) who answered the questions well. The total score obtained from all students reached 66 with an average score of 4. Item number 5 contained 4 students who answered the questions very well (25%). 10 students (62.5%) answered the questions well. 1 student (6.25%) answered with a sufficient score. And 1 student did not answer at all. The total score obtained from all students reached 66 with an average score of 4.

3.2. Description of Post-Test Identification of Students' Mathematical Communication Ability

Post test of students' mathematics communication skills is given after students are given learning with the Realistic Mathematical Approach. From the results of the post-test communication skills provided, it can be identified data on student learning outcomes. The number of posttest scores of students 'mathematics communication skills using PMR with an average score of 80, the highest score is 90 and the lowest score is 68. In the posttest, students' mathematical communication skills found that of the 20 students who took the test, the students who were in the category Very well there is 1 person or 5%, in the good category as many as 12 people or 60%, in the sufficient category 6 people or 30%, and in the less category as many as 1 person or 5%, while in the very category 0%. For more details, it can be seen in the chart below:

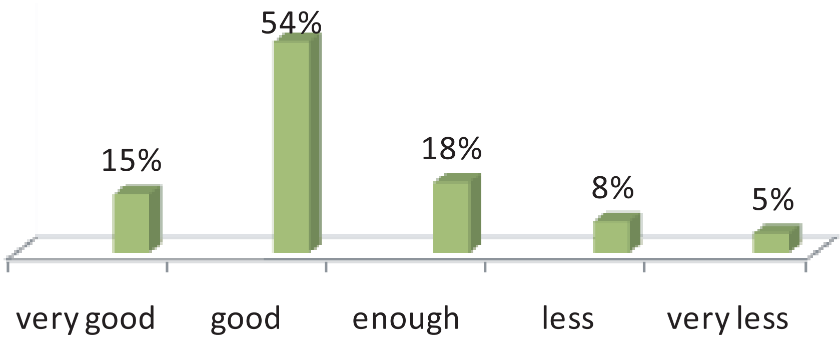

Figure 2: Post-Test Results of Students' Mathematication Ability.

Furthermore, below will be identified descriptively based on the aspects of students' mathematical communication skills.

3.2.1. Linking Real Objects, Pictures and Diagrams Into Mathematical Ideas

Item number 1 answered the question very well, namely 3 students (18.75%). And the majority of those students did well (Establishing relevant solutions with reasons). The total score obtained from all students reached 70 with an average score of 4.4. Item number 2 answered the question very well, namely 5 students (31.25%). The majority of those students did well (Establishing relevant solutions with reasons). And only 1 person who answered sufficiently (Solving problems / mathematical models with reasons). The total score obtained from all students reached 72 with an average score of 4.5.The majority of the item number 3 answered the questions very well as many as students (43.75%). And 7 students or (43.75%). And 2 people who answered well (Solving problems / mathematical models with reasons) The total score obtained from all students reached 74 with an average score of 4.6. Item number 4 answered the question very well, as many as 4 students (25%). The majority of those students who achieved well or (62.5). And 2 students (12.5%) who answered sufficiently (Solving problems / mathematical models with reasons). The total score obtained from all students reached 68 with an average score of 4.3. Item 5 students answered the questions very well, namely as many as 6 students (37.5%). And 8 students answered well or (50%). 1 student answered sufficiently or (6.25%). And 1 student did not answer at all. The total score obtained from all students reached 70 with an average score of 4.3.

3.2.2. Explain Ideas, Situations and Mathematical Relations, in Writing.

Item 1 the student answered the question very well, as many as 6 students (37.5%). And 4 students answered well or (25%). 8 students answered sufficiently or (56.25%). The total score obtained from all students reached 96 with an average score of 6. In item number 2, there were no students who answered the questions very well. 6 students (35%) who answered the questions well. And 2 (12.5%) students answered sufficiently. The total score obtained from all students reached 72 with an average score of 4.5. Item number 3 was only 1 student (6.25%) who got the maximum score (answered the questions very well). 5 students (31.25%) answered the questions well. 7 students (43.75%). And 2 students (12.5%) answered enough questions. And 2 students (12.5%) answered sufficiently. The total score obtained from all students reached 72 with an average score of 4.5.No student answered item number 4 very well. The majority of students answered questions well, namely 9 students (56.25%). 5 students (31.25%) who answered the questions sufficiently. 2 students answered enough. The total score obtained from all students reached 78 with an average score of 4.9. Item number 5 the majority of students answered questions well (68%). And 4 students (25%) who answered enough questions. And 1 student did not answer the questions at all. The total score obtained from all students reached 82 with an average score of 5.1.

3.2.3. Declare everyday events in language or mathematical symbols

Item number 1 was only 1 student (6.25%) who answered the questions very well. The majority of students answered questions well, namely 15 or (93.75%). The total score obtained from all students reached 66 with an average score of 4.1. Item number 2 only 2 students (12.5%) answered questions well. The majority of students answered questions well, namely 14 people or (87.5%). The total score obtained from all students reached 68 with an average score of 4.3. Item number 3 only 1 student (6.25%) answered the question well. The majority of students answered questions well, namely 14 or (87.5%). And 1 student (6.25%) answered sufficiently. The total score obtained from all students reached 64 with an average score of 4. Item number 4 contained 2 students (12.5%) who got the maximum score very well. And the majority of students (87.5%) who answered the questions well. The total score obtained from all students reached 66 with an average score of 4. Item number 5 contained 4 students who answered the questions very well (25%). 10 students (62.5%) answered the questions well. 1 student (6.25%) answered with a sufficient score. And 1 student did not answer at all. The total score obtained from all students reached 66 with an average score of 4.

4. Conclusions

Based on that the students of SMP Negeri 1 Sipirok TP.2019/2020 class VIII which consisted of 20 students who took the test of communication skills, analyzed the data obtained, it was concluded that 5% of students had mathematical communication skills in the very poor category, 8% of students who had the ability Mathematics communication is in the poor category, 18% of students who have mathematics communication skills are in the sufficient category, and 54% of students who have mathematics communication skills are in the Good category. The novelty that can be obtained from this research is that all indicators of student mathematics communication appear in every stage of mathematics learning, namely realistic mathematics learning. In general, most students are able to achieve all indicators of mathematical communication. Students who are in the good category are more likely to be able to achieve all of these indicators, while students who are in the sufficient and poor category are only able to achieve part of the indicators of mathematical communication skills.

Acknowledgments

The author thanked Muhammadiyah University of Tapanuli Selatan on basic research through an internal APB grant of research and devotion to the community in 2019-2020.

References

[1] Theffidy SGA. Pendidikan era revolusi di tengah covid-19. Ombudsman.go.id. Available from: https://ombudsman.go.id/artikel/r/artikel--pendidikan-era-revolusi-industri-40-di-tengah-covid-19#:$\sim$:text=Ahli%20teori%20pendidikan%20sering%20menyebut,maupun%20non%20fisik%20dalam%20pembelajaran.&text=Pengajar%20diharapkan%20mampu%20meramu%20pembelajaran%20dan%20mengekspor%20kompetensi%20ini%20kepada%20peserta%20didik. Diakses31Maret2020.

[2] 2020. Kompasiana. Available from: https://www.kompasiana.com/andemapa/5fa2aa5bd541df36730c00c2/pendidikan-era-revolusi-industri-4-0-di-tengah-covid-19?page=all.

[3] OECD. What students know and can do – student performance in mathematics, reading and science. Pisa, OECD Publishing; 2014. http://dx.doi.org/10.1787/9789264201118-en

[4] Budi RRS. Penerapan pendidikan matematika realistik indonesia melalui alat peraga praktek miniatur tandon air terhadap hasil belajar siswa kelas X SMA negeri 3 kota manna. Jurnal Pendidikan Matematika. 2013;2(1):. DOI 10.22342/jpm.2.1.299.

[5] Sugiyono. Metode penelitian pendidikan. Bandung: Alfabeta; 2015.