Application of Realistic Mathematics Education (RME) To Improve The Students' Mathematical Communication Ability

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Abstract: This article will discuss the communication skills of SMP IT Al Ikhwan students in class VII-1 and VII-2 each with a total of 32 students, after being given learning through RME. Determination of the sample is done by simple random. The research instrument used in this study was a test that was statistically analyzed using N-Gain. After carrying out a series of activities starting from the pretest, treatment and posttest, it can be concluded that the use of RME was apparently good for improving mathematical communication skills as seen from the N-Gain acquisition for each class that was sampled. The learning process that uses RME opens opportunities for students to be able to play a more active role in expressing themselves in solving mathematical problems and realistic mathematics education gets a very good response, students really like it and feel very excited.

Abstrak: Artikel ini akan membahas mengenai kemampuan komunikasi dari peserta didik SMP IT Al Ikhwan pada kelas VII-1 kelas dan kelas VII-2 masing-masing berjumlah 32 siswa, setelah diberikan pembelajaran melalui RME. Penentuan sampel dilakukan secara simple random. Instrument penelitian yang digunakan dalam penelitian ini adalah tes yang di analisis statistika memakai N-Gain. Setelah dilakukan serangkain kegiatan mulai dari pretest, treatment dan postest dapat disimpulkan penggunaan RME ternyata baik untuk meningkatkan kemampuan komunikasi matematis terlihat dari perolehan N-Gain tiap kelas yang menjadi sampel. Proses pembelajaran yang menggunakan RME membuka peluang bagi peserta didik untuk dapat lebih berperan dalam mengekpresikan diri dalam menyelesaikan permasalahan matematika serta pendidikan matematika realistic mendapat respon yang sangat baik, peserta didik sangat menyukai dan merasa sangat bersemangat.

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A. Introduction

New normal is a word that nowadays often sounds very familiar to the public after for more than 2 years all countries, both Indonesia and foreign countries, have experienced a disaster, namely Covid -19 which has brought about various changes in various fields, especially in the field of education. The implementation of the education system is limited, teachers cannot directly talk to students in the classroom. This is what needs to be addressed so that the changing education system does not have a negative impact on students' learning abilities and interests. Education will create a new generation that is able to face problems in the growing real world. Education will be the main key in advancing a nation, because a nation will progress if the population of the country has soft skills and knowledge (Dalyono & Lestariningsih, 2016; Hamdani et al., 2022)

Revolution 4.0 has very tight competitiveness, those who are unable to face it will lose to the times and will continue to be left behind and oppressed. so that the government rushed to improve the education system and provide proper education to the community. It is stated in the fourth paragraph of the 1945 law that the purpose of the Indonesian people is "...to educate the nation's life and participate in carrying out world order...". The meaning of this fragment of the 1945 Constitution implies that people who have weapons education are for the state to fight against everything that arises in life. With education, society and the state can face the changing times. Education is a conscious and planned activity in humanizing humans. In education there are various kinds of learning topics which are all related to human life. Especially learning mathematics.

The mother or queen of all sciences is mathematics (Agustina, 2019; Sari & Armanto, 2022). Mathematics has an abstract nature that makes students experience problems when understanding the material. Mathematics has a role in human life so that learning mathematics has existed since children were in non-formal education and formal education (Mardhiati et al, 2022; Rahman & Hasmanidar, 2019). This is supported by the statement that the primary and secondary education curriculum must contain: religious education, civic education, languages, mathematics, natural sciences, social sciences, arts and culture, physical education and sports, skills/vocationalism, and local content contained in the Article 37 paragraph 1 Law Number 20 of 2003.

According to NCTM (2000) the ability of problem solving, reasoning and proof, communication, connection, and representation will be possessed by students after implementing mathematics learning. Van De Walle (2014) states that NCTM has provided a detailed description of five standard mathematics learning processes including 1) Problem solving, 2) Understanding and evidence, 3) Communication, 4) Relationships, and 5) Presentation. Realizing these five principles can be mastered by students is not an easy thing. Teachers are expected to be able to design a suitable learning system that can develop these five standards. In addition to teachers, students are also required to be more independent in finding information related to the learning process, not necessarily just waiting for what is presented by the teacher, students must be active.

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But the facts on the ground show that the ability of students in Indonesia is less than optimal. As can be seen from the results of the PISA test on 2018, the mathematics achievement ranking of Indonesian students, especially aged 15-16 years, is still in 74th position out of 80 countries. TIMSS in 2013-2015 with an average score of 379 and a world average score for mathematics of 489. It is clear that the ability of students is not at the expected stage. This is because one of them is that students are not able to express ideas in the form of mathematical writing from existing contextual problems. Students find it difficult at the stage of understanding the meaning of each symbol they have. One of the low mathematics learning abilities is mathematical communication skills. Students must be able to master communication because communication is very important in learning (Astuti, 2019; Fauzi & Masrukan, 2018). Because with communication we can see how far students can understand and analyze mathematical concepts. Mathematical communication is a way for students to present their ideas to be conveyed and understood by other students. Mathematical communication ability is the ability of students to read mathematics problems comprehensively, to be able to develop mathematical language and symbols, both written and orally (Nuryanto et al, 2022; Sari et al, 2022).

Baroody & Niskayuna (1993) states that there are 5 aspects of mathematical communication skills, namely 1) Representation, 2) Hearing, 3) Reading, 4) Discuss and 5) Write. These five aspects are indicators that will later become benchmarks for determining students have high, medium or low mathematical communication abilities. In other words, these five aspects must be simultaneously mastered by students if they want to be said to have communication skills. In addition to Baroody's opinion, Ansari (2009) states indicators of mathematical communication skills are 1) Ability to use mathematical ideas (language) appropriately; 2) The ability to connection between mathematical ideas and mathematical problem solving strategies; 3) Ability to multiple representation of mathematical ideas; and 4) The ability to share ideas or strategies for solving mathematics. From this explanation we understand that communication is an aspect that must be considered in learning mathematics and communication is part of contextual learning.

The cause of the low mathematical communication ability is because the teacher is less than optimal in giving non-routine questions, not using contextual learning, more teachers are active in imparting knowledge while students are only accommodating information from educators. This should not continuously occur because it will cause students to be passive, dependent on the teacher and unable to recognize their own abilities. To overcome this problem we need to make new breakthroughs in teaching and learning activities. The ordinary learning process must be given new polishes that will bring students' interest in receiving learning. One way is to use RME.

RME was first developed in the Netherlands based on the thoughts of Hans Freudenthal, a Dutch mathematician, that mathematics must be considered as a human activity (1991). At that time, the Freudenthal Institute, University of Utrecht, was founded in 1971 to bring changes to mathematics teaching and learning activities. established and ready (Dickinson & Hough, 2012). The principles of RME which are based on the ideas of

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the inventors of this approach are 1) guided reinvention; 2) Didactic phenomenology; and 3) Use models (Arsaythamby & Zubainur, 2014). With the principles of RME, it opens wide opportunities for students to be active, to discuss and discover for themselves the mathematical concepts contained in the learning material. Students will be more flexible in learning without feeling dictated by the teacher. Although all their activities will not be separated from the teacher's role in learning. RME will provide learning according to the flow of thinking and based on things that are close to students. For example using the mathematical language they understand by exemplifying it with the real world. The teacher will provide contextual problems to bridge the flow of problem solving thinking.

Many studies have proven that realistic mathematics education is very helpful for developing students' mathematical communication skills. This was confirmed by Sari (2023) stating that using RME with cultural links could improve students' abilities, especially communication. Afsari et al (2021) states that RME is able to boost learning outcomes and can boost many students' mathematical communication skills. Furthermore, research from Rasmiati et al (2018) states that the application of a RME is more effective than the Application of Long-Term Effects of Learning on Mathematics Achievement. RME learning can improve students' communication and performance in mathematics classes more than students who receive conventional learning (Ahmad & Nasution, 2018; Paroqi et al, 2020). The studies above underlie researchers to boost students' abilities by using a RME.

B. Method

Research with pretest-posttest with experimental class using realistic mathematics education method and comparison class using ordinary method. Mathematical communication ability is an object to be observed. Deng et al (2013) said that experimental research used random samples taken from comparison classes. Class VII-1 as an experimental class with 32 students and VII-2 as a comparison class with the same number of students. Communication ability tests and response questionnaires were used to determine student responses about learning. The research step is through 3 steps, namely the preliminary step, the activity implementation step and analyzing the research results. The test was carried out 2 times, namely the test before the treatment (pretest) and after there was a different treatment (posttest).

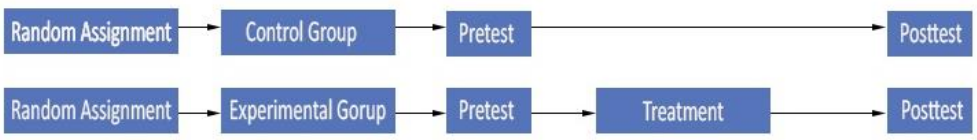

Figure 1. Pretest-Postest group Design.

C. Result and Discussion

Result

Pretest - posttest students from each class to be processed so that it can be seen whether there is an increase that occurs after the learning process takes place. The test was

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carried out twice. Furthermore, the data obtained were analyzed using normality analysis, homogeneity analysis and analysis of the difference between the two averages. The researcher conducted a normalized N-gain test to check whether there was an increase from the pretest results as shown in table 1 below.

Table 1. Mean Difference Test

Class	N	Pretest Average	SB	Normality Test		Homogenity Test		Mean Difference Test	
				Sig.	Int.	Sig.	Int.	Sig.	Int.
Experiment	32	12.50	1.51						
Control	32	10.84	1.25						

There is a gap in the results of students' mathematical communication skills from each group sampled at a significance level of 5%. However, to see how much improvement there is from the class that has a high value of mathematical communication ability after there are different treatments between the two classes, it is necessary to do the N-Gain test as follows:

Table 2. N-Gain Analysis Results

Class	N	N-Gain Average	N-Gain Average	Normality Test		Mean Difference Test (Mann-Whitney Test)	
				Sig.	Int.	Sig.	Int.
Experiment	32	0.57	1.51	0.000	Unnormal		
Control	32	0.25	1.25	0.000	Unnormal		

The results of the N-Gain analysis it appears that the average value of class VII-1 is 0.57 and VII-2 is 0.25. So it can be concluded that the class that received the learning treatment using the RME was higher than the comparison class which only used the usual approach in increasing the ability of students because seen from the significance of the two different test the average was less than 5%.

To see the responses of students after receiving learning with the application of RME, the researchers distributed response questionnaires to the experimental class to work on. After filling in, the data will be processed by the researcher by looking at the overall score which can be distributed with the maximum score of the questionnaire and will be multiplied by 100% to see the presentation of the student's response, it turns out that 83.4% of the students were very happy with the learning that applies RME and during the learning process researchers see firsthand how the activeness of students in the experimental class and control class is significantly different. So we can conclude that learning activities with the application of RME can improve mathematical communication skills and make students more active, relaxed and enthusiastic about participating in mathematics learning.

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Discussion

From the results of the study it was clear that the difference in scores between the experimental class and the comparison class and the responses of students who received treatment with the application of realistic mathematics education. Students who get the treatment feel happy, comfortable and very active in learning and are able to remember the concepts of the material provided and have an impact on students' ability to solve contextual problems correctly and systematically. This all results in obtaining their own concepts from the material being studied so that they are not continuously dependent on the teacher. Thus, initially the learning system was "Teacher-Center" and changed to "Student-Center" so that the role of the teacher is not too dominant. This is supported by research results (Sari et al, 2022; Armania, 2018) which explain that the application of a realistic mathematics education approach will have a positive impact on students, they will be independent in finding concepts and solving problems given.

Analysis of the pretest scores in the previous paragraph shows that there is a significant difference in the mathematical communication skills between sample classes. Then it was continued by conducting a posttest after the treatment of the experimental class was more obvious that the students' mathematical communication skills in the group were better than the comparison group. From the analysis of the results of students' answers, it was found that the reason why students' mathematical communication was low was because students could not reason with the questions given which were different from the examples given by the teacher, in other words, students were not used to working on non-routine questions given. The N-gain analysis shows that there is an increase in the mathematical communication abilities of students who use realistic mathematics education. This is in line with Armania's research (2018) which shows that the increase in mathematical communication skills of junior high school students who receive realistic mathematics education is better than those who receive learning in the conventional way at a significance level of 5%. And from research (Desyana & Sari, 2022) that the development of modules with the application of realistic mathematics education will improve students' abilities and students' responses well to the designed modules. This can be seen from the results of their research that the module was declared effective at 80.67% in the good category and the learning completeness of students before treatment was 18.75% and after receiving treatment it was 68.75% and the n-gain test score was 0.75 which means included in the high category for mathematical communication skills.

During the learning process, observations were made to pay attention to the activities carried out by students in solving problems. Researchers saw that the most dominant activity that occurred was discussions, both discussions with students and teachers, or fellow students. So the researchers concluded that the learning activities carried out had succeeded in raising the enthusiasm of students in discussions. The activity of exchanging opinions will have a positive impact on students. Hidayat & Handayani (2018) saw a spike in the interaction of students in groups causing the emergence of peer tutors among them who would help less intelligent students to improve their reasoning abilities.

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In addition to direct observation, the researcher also conducted an analysis of the answer sheets of students from each sample class. It turned out that they almost had the same difficulties in the process of making mathematical ideas from real objects, pictures and diagrams and difficulties in making language or mathematical symbols from real events. This happens because students are not able to write down the ideas they think into mathematical form and need help with real concepts to be able to write down the results of their thoughts. The application of realistic mathematics education in flat shape material can improve students' mathematical communication abilities. As well as learning activities that use a different approach than usual will make students more interested and enthusiastic in participating in learning activities

D. Conclusion

After all the research series have been carried out, it can be concluded that the answers to the research questions posed are that there is an increase in mathematical communication skills in the experimental class with RME, which is better than the increase in mathematical communication skills in the comparison class. As well as the group that was treated using realistic mathematics education felt more enthusiastic in learning. This can be seen from the enthusiasm of the students in the discussion process and the students giving good or positive responses to the learning process being carried out.

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