Student Research Journal
Volume.1, No.1 Februari 2023
E-ISSN : 2964-3252 dan P-ISSN : 2964-3260, Hal 209-224

Analysis Of Student's Mathematical Communication Ability Through A Realistic Learning Approach Based On Gender At Smpn 3 Satu Atap Silangkitang

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Abstract. *This study aims to analyze learning with a Realistic Mathematics Approach to the mathematical communication abilities of Grade VIII students and studied based on gender which was carried out at SMP Negeri 3 Silangkitang. This research is a quantitative study using the Two Ways Anova test to see the effect of learning variables and gender on students' mathematical communication abilities, as well as to see the interactions between the three variables. This research was conducted for 5 meetings which included pretest and posttest. . The two-way Anava analysis shows that the Realistic Mathematics Approach has a positive and significant effect on students' mathematical communication skills compared to the usual learning approach and there is no interaction between learning and gender on students' mathematical communication abilities.*

Keywords *: Realistic Mathematics Education Approach, Ordinary Learning Approach, Mathematical Communication Skills, Gender*

Abstrak. Penelitian ini bertujuan untuk menganalisis pembelajaran dengan Pendekatan Matematika Realistik terhadap kemampuan komunikasi matematis siswa kelas VIII dan dikaji berdasarkan jenis kelamin yang dilaksanakan di SMP Negeri 3 Silangkitang. Penelitian ini merupakan penelitian kuantitatif dengan menggunakan uji Two Ways Anova untuk melihat pengaruh variabel pembelajaran dan jenis kelamin terhadap kemampuan komunikasi matematis siswa, serta untuk melihat interaksi antara ketiga variabel tersebut. Penelitian ini dilakukan selama 5 kali pertemuan yang meliputi pretest dan posttest. . Analisis Anava dua jalur menunjukkan bahwa Pendekatan Matematika Realistik berpengaruh positif dan signifikan terhadap kemampuan komunikasi matematis siswa dibandingkan dengan pendekatan pembelajaran biasa dan tidak terdapat interaksi antara pembelajaran dan jenis kelamin terhadap kemampuan komunikasi matematis siswa.

Kata kunci : Pendekatan Pendidikan Matematika Realistik, Pembelajaran Biasa, Kemampuan Komunikasi Matematis, Gender

Received Desember 30, 2022; Revised Januari 22, 2023; Accepted Februari 01, 2023
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INTRODUCTION

Mathematics as queen of sciences has a very important role in the development of science and technology. Mathematics was born based on several concepts including the concepts of numbers, quantities, and shapes. Mathematics is widely found in the processes of everyday life, even the basic mathematics of the development of science and technology, so that every human being must realize that mathematics is the queen of knowledge (Siregar, et al., 2020)

However, in reality, the ranking of students' mathematical abilities in Indonesia is still very low. This low mathematical ability is due to the fact that there are still many students who have difficulty in learning mathematics, are less interested, and always regard mathematics as a difficult science, thus creating a fear of learning mathematics, as stated by Abdurrahman (2012), that "from various fields of study taught in schools, mathematics is a field of study that is considered the most difficult by students, both those who do not have learning difficulties, and more so for students who have learning difficulties".

The results of the International Programme for International Student Assessment (PISA) study showed the achievements of reading literacy, mathematical literacy, and scientific literacy achieved by Indonesian students are very low and can only occupy the bottom 10 from 65 countries.

This means that students are still not able to achieve all the standards of mathematical ability which according to the National Council of Teachers of Mathematics (NCTM) there are 5 (five) basic abilities that are used as standards in the mathematics learning process, namely problem solving, reasoning and proof, communication, connections and representation (Armadan, et al., 2017). Communication skills are one of the skills that students need to have in learning mathematics because in mathematics, receiving and conveying information is not an easy thing.

Based on the results of the initial communication ability test given to class VIII-C in SMPN 3 Silangkitang, it was found that the average score obtained was based on indicators of mathematical communication ability, namely: mathematical writing (average score is 56,7), mathematical drawing (percentage score is 58,3) and mathematical expressions (percentage score is 38,3) and the average overall score is

42,5 . Based on this, we can say that the mathematical communication skills of class VIII-C students at SMPN 3 Satu Atap Silangkitang are still relatively low, especially on mathematical expressions indicator. It can be seen from the answers given by students that students have not been able to model the questions into pictures and mathematical language correctly, calculation errors and errors in describing a solution to the given problem.

Alexander & Woods (in Dorisno, 2019) argues that "gender differences are regulated by hormones and behaviors such as aggression, play patterns, and attitudes." In physical characteristics, boys differ from girls. Boys are stronger and more active than girls who are feminine, soulful and gentle. However, gender differences are not the most important differences in schools, as each student is assigned the same amount of time and responsibility. After conducting interviews with Mr. Bati Susanto S.Pd as a mathematics teacher at SMPN 3 Silangkitang, it is known that in learning mathematics, female students are more diligent and active in doing assignments compared to boys, but in the learning process boys are more responsive than girls.

The principle of 21st century learning uses a student-centered learning approach where the teacher acts as a facilitator who guides students towards the formation of students' own knowledge. Therefore, teachers need to understand and determine learning approaches that can encourage and generate student activity in the learning process which in turn can improve students' mathematical communication skills. One approach that can be applied in learning mathematics is a realistic mathematics learning approach.

Realistic mathematics education approaches is a learning approach that uses real world problems. Mathematic realistic education is a learning theory that starts from 'real' matters for students, emphasizes 'process of doing mathematics' skills, discussing and collaborating, arguing with classmates so that they can find themselves ('student inventing' as opposed to 'teacher telling') and ultimately use that math to solve both individual and group problems. Through abstraction and formalization students will develop a more complete concept. Then students can apply mathematical concepts to new fields of the real world (applied mathematization). Therefore, to bridge mathematical concepts with children's daily experiences, it is necessary to pay attention

to mathematics of everyday experience (mathematization of everyday experience) and the application of mathematics in everyday life (Simanjuntak, et al., 2020).

The approach of Realistic Mathematics Education (RME) comes from contextual problems, where in this situation students must be active in learning and teacher acts as a facilitator Concept of RME is in line with the need to improve mathematics education in Indonesia which is dominated by the problem of how to increase students' understanding of mathematics and develop reasoning power". This is an advantage so every math teacher in Indonesia must know that PMR is very feasible to use in the learning process (Putri, et al., 2019).

Realistic mathematic education (RME) approach come from contextual issues, in this situation student a should has the active role in learning activities, while teacher plays as facilitator. Teacher and student has a different role. Students can express and communicate the ideas to each other and teacher will help and support to compare the idea and also to make a decision. Which idea are the best among other. With those kind of characteristics, Indonesian realistic mathematic approach has a good prospect to applied. It is good among structuralism, empiric, or mechanical approach. Expectation and optimism that RME is the answer to the problem of mathematic approach in Indonesia (Safitri, et al., 2017).

The advantages of the RME approach include: (1) providing understanding to students about the relevance of mathematics to everyday life, and (2) providing understanding to students that mathematics is a field of study that is constructed and developed by students themselves, not only by those who are called experts. In that field. While the weaknesses of the RME approach, including: (1) it is not easy for teachers to encourage students to find various ways to solve problems or solve problems, and (2) it is not easy for teachers to provide assistance to students in order to rediscover concepts, mathematics being studied (Susilowati, 2018).

Based on the phenomena and background described above, the researchers felt the need to conduct more in-depth research related to students' mathematical communication skills with the title "Analysis of Students' Mathematical Communication Ability through a Realistic Learning Approach Based on Gender in SMPN 3 Satu Atap Silangkitang".

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LITERATURE REVIEW

Mathematical Communication Ability

Mathematical communication is the ability to use mathematical language (related to mathematical terms and symbols), express mathematical ideas and arguments (related to concepts and procedures) in a precise, concise and logical manner.According to the NCTM (Tiffany, et al., 2017), indicators mathematical communication can be seen from: (1) the ability to express mathematical ideas through speech, writing, and demonstrate and describe it visually, (2) the ability to understand, interpret, and evaluate mathematical ideas both verbally, writing, or in other visual forms, (3) the ability to use terms, notations of mathematical and structures to present ideas, describe relationships with models situation.

Other indicators of mathematical communication ability were put forward by the Ministry of Education of Ontario in 2015 (Sriwahyuni, et al., 2019) as follows: (1) written text, namely providing answers using their own language, modeling situations or problems using oral, written, concrete graphics and algebra, explaining and asking questions about the mathematics being studied, listening, discussing and writing about mathematics, making conjectures, constructing arguments and generalizations; (2) drawing, which reflects real objects, pictures, and diagrams into mathematical ideas; (3) mathematical expressions, namely expressing mathematical concepts by stating everyday events in mathematical language or symbols.

Based on the description above, the indicators of mathematical communication skills that will be used in this study are as follows: (1) Writing mathematically. In this ability, students are required to be able to write an explanation of the answer to the problem mathematically, logically, clearly and logically, and systematically; (2) Drawing mathematically. In this ability, students are required to be able to transform images, diagrams, and tables completely and correctly from a mathematical problem; (3) Mathematical expressions. In this ability students are expected to be able to model mathematics correctly, then perform calculations or get complete and correct solutions.

Gender

The definition of gender according to Mansour (2013), gender is the difference in roles, positions and characteristics attached to men and women through social and cultural construction. Meanwhile, sex is an attribute or division of two biological types that are attached to a particular sex. Rippon G (2019) argues that,

> *"The female brain is predominantly hard-wired for empathy. The male brain is predominantly hard-wired for understanding and building systems."*
>
> Rippom G (2019: 60) also argues that,
>
> *"For decades if not centuries, science has backed up society's simple dictum that men and women are hardwired differently, that the world is divided by two different kinds of brains- male and female".*

This means that for quite a long time, society has had the perception that the human brain is different, between the male brain and also the female brain. This perception has led to thoughts about differences in thinking ability according to gender. However, sex and gender are two different things. In general, gender is defined as individual differences based on biological factors that are present at birth, namely differences in male and female gender. Meanwhile, gender is a psychosocial aspect of men and women.

Therefore, it can be interpreted that gender as a concept is the result of human thought or human engineering, formed by society so that it is dynamic and can be different because of differences in customs, culture, religion, value systems of certain nations, communities and ethnic groups. In addition, gender can change due to historical progress, political, economic, social and cultural changes or due to progress in development.

Realistic Mathematics Education Approach

Since 1971, the Freudenthal Institute of Universiteit Utrecht in the Netherlands has developed a theory of mathematics learning known as Realistic Mathematics Education (RME). The PMR system was initiated by Professor Hans Freudenthal. According to Freudenthal (Gravemeijer, 1994) mathematics is a human activity or mathematics is a human activity. The point is that mathematics is seen as an activity to

solve problems, look for problems, and also an activity in organizing subject matter. Learning math is meant to be doing math, where solving real problems is the main part.

Real problems in PMR are not only problems related to everyday life but can also be problems that students can imagine (can imagine). However, this does not mean that the connection with real-life situations is not important, but the emphasis is that context should not be limited to real-world situations, the fantasy world of a fairy tale or the formal world of mathematics can be very suitable for the context of the problem, as long as it is real in the minds of students

The translation of "to imagine" in Dutch is "zich REALISEren". This word emphasizes the process of making something real in one's mind. This is the basis for the emergence of the name Realistic Mathematics Education (van den Heuvel-Panhuizen and Wijers, 2005). According to this approach, the mathematics classroom is not a place to transfer mathematics from the teacher to students, but a place where students rediscover mathematical ideas and concepts through exploring real problems.

According to Gravemeijer, in general, the characteristics of realistic mathematics education have five characteristics, namely (1) *The use of contexts*, (2) *The use of models,* (3) *The use of students' own productions and constructions,* (4) *The interactive character of teaching process ,* (5) *The intertwintment of various learning strands*

Furthermore, according to Gravemeijer (1994) there are three main principles in learning with a realistic approach. The three principles in question are guided reinvention and progressive mathematization, didactical phenomenology and self-developed models.

RESEARCH METHOD

This type of research is experimental research using a factorial experimental research design. This study involved two selected groups. The first group was given treatment and the other group was not given treatment. The group that was given the treatment was called the experimental group which applied learning using the RME approach and the group that was not given the treatment was called the control group which applied the usual learning model. The population in this study were all students of class VIII SMPN 3 Silangkitang in three classes, namely VIII-A, VIII-B and VIII-C.

The sampling technique in this study was random sampling technique and then two classes were obtained, namely VIII-B and VIII-C with a total sample of 59 students. The data collection technique used in this study was a test of mathematical communication skills and then the data was analyzed using a two-way ANOVA test. In this study there are 3 (three) variables as follows, the RME approach and gender as independent variables and mathematical communication ability as the dependent variable. The data analysis technique uses two-way ANOVA. Before testing with the ANOVA test, the data used must be normally distributed and homogeneous.

RESULTS AND DISCUSSION

The purpose of this test is to investigate the mathematical communication skills of students who study using the RME (Realistic Mathematics Education) approach with students who use the ordinary learning model based on gender. Analysis of statistical tests for data processing is processed using SPSS 26, which includes normality tests, homogeneity tests and two-way ANOVA.

Research result

The pretest of mathematical communication skills was carried out before being given treatment in the experimental class, namely the Realistic Mathematical Approach and after the treatment was given a posttest then the data was analyzed and conclusions were drawn.

Normality and Homogeneity Test

Before proceeding to process the data, the data requirements were first tested, namely the normality test and homogeneity test. The normality test is used to determine whether the data that has been obtained is normally or not normally distributed. For the normality test using SPSS 26 where the decision criteria Ho is accepted or rejected will be decided with a significance value at a significant level of 5%. The test results can be seen through the following table 1:

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Normality Test of Students' Mathematical Communication Ability

Table Pretest in Experiment and Control Class

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
Pretest_Eksperimen	.134	30	.178	.972	30	.586
a. Lilliefors Significance Correction						

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
Pretest_Kontrol	.140	29	.150	.958	29	.301
a. Lilliefors Significance Correction						

Table Postestt in Experiment and Control Class

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
Postest_Eksperimen	.140	30	.140	.957	30	.259
a. Lilliefors Significance Correction						

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
Postest_Kontrol	.117	29	.200*	.956	29	.259
*. This is a lower bound of the true significance.						
a. Lilliefors Significance Correction						

From the two tables above, the normality test results using SPSS show that the significant value

- For Pretest in experiment and control class , Significant value is 0.178 and 0,150 > 0,05, maka data berdistribusi normal
- For Posttest in experiment and control class, Significant value is 0,140 and 0,200 > 0,05, maka data berdistribusi normal

Homogeneity Test of Students' Mathematical Communication Ability

Table Test of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
Pretest_Tes Kemampuan Komunikasi Matematis	Based on Mean	.596	1	57	.443
	Based on Median	.262	1	57	.611
	Based on Median and with adjusted df	.262	1	50.479	.611
	Based on trimmed mean	.512	1	57	.477

Test of Homogeneity of Variances					
		Levene Statistic	df1	df2	Sig.
Posttest_Tes Kemampuan Komunikasi Matematis	Based on Mean	.778	1	57	.381
	Based on Median	.799	1	57	.375
	Based on Median and with adjusted df	.799	1	55.073	.375
	Based on trimmed mean	.784	1	57	.380

From the two tables above, the homogeneity test results using SPSS 26 show that the significant value

- If Sig.value > 0.05 then H_0 is accepted and if Sig.value < 0.05 then H_0 is rejected. The test results above show that the Sig.value > 0.05, i.e. 0.443 > 0.05, then H_0 is accepted, which means that the pretest data is homogeneous or it can also be interpreted that the pretest data on students' mathematical communication ability tests have the same variance.
- If Sig.value > 0.05 then H_0 is accepted and if Sig.value <0.05 then H_0 is rejected. The test results above show that the Sig.value > 0.05, i.e. 0.381 > 0.05, then H_0 is accepted, which means that the posttest data is homogeneous or it can also be interpreted that the posttest data on students' mathematical communication ability tests have the same variance.

Two Way Anova Hypothesis Test

After the data has been analyzed and described, the next step is to test the hypothesis. To test the hypothesis is to use the Two Way Anova test. The results can be seen in the SPSS 26 output below:

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Table Tests of Between-Subjects Effects

Dependent Variable: KemampuanKomunikasi					
Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	2804.701[a]	3	934.900	11.890	.000
Intercept	318295.910	1	318295.910	4048.175	.000
Metode	2714.463	1	2714.463	34.523	.000
Gender	131.574	1	131.574	1.673	.201
Metode * Gender	3.024	1	3.024	.038	.845
Error	4324.485	55	78.627		
Total	332437.000	59			
Corrected Total	7129.186	58			
a. R Squared = .393 (Adjusted R Squared = .360)					

Based on the output table of the two-way analysis of variance (Two Way Anova), the following is obtained:

1. Significance value *(Sig.) Metode Pembelajaran* (α) obtained 0,00 < 0,05 meaning that there is a difference between learning with Realistic Mathematics Approach and ordinary learning on students' mathematical communication abilities.
2. Significance value *(Sig.) gender* (β) obtained 0,201 > 0,05 meaning that there is no gender difference in students' mathematical communication abilities.
3. Significance value *(Sig.)* interaction of learning approaches and gender $(\alpha\beta)$ij obtained 0,845 > 0,05 meaning that there is no interaction between learning approaches and gender on students' mathematical communication skills

To further clarify the third hypothesis, it can be seen from the interaction graph below:

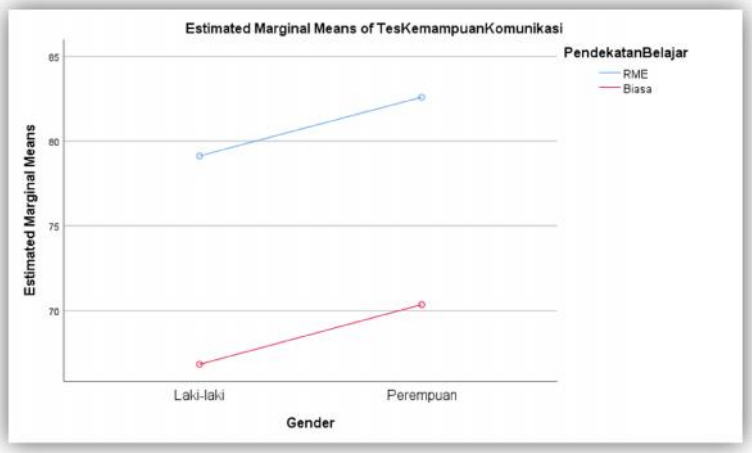

Figure 1. interaction of learning approaches with gender on students' mathematical communication abilities

From figure 1. above shows that there are no intersecting and parallel lines. This means that there is no interaction between the learning approach and the gender of students on students' mathematical communication abilities. Or it can also be interpreted that learning approaches and gender do not mutually influence students' mathematical communication abilities

In other words, the difference between students' mathematical communication abilities taught by RME learning and ordinary learning is consistent for each student's gender category and vice versa, namely students' mathematical communication abilities between each gender category are consistent in each learning approach used, namely the RME Approach and the Learning Approach normal. The point is that students who are taught with RME learning obtain higher mathematical communication ability results than students who are taught with ordinary learning either in general or when viewed from the gender category of students

DISCUSSION

In accordance with the presentation of the research results, there are differences in the application of the RME approach to communication skills based on gender. The existence of this influence shows that the RME approach can be used as an appropriate learning alternative to facilitate students' mathematical communication abilities. This is supported by an increase in learning activities in the experimental class.

Based on the analysis of data on students' mathematical communication abilities on the subject of cubes and cuboid, the mean indicated that the communication skills using the RME approach were higher than students who did not use the RME approach. The results of this analysis support the first hypothesis, namely that there are differences in mathematical communication abilities between students who take learning with the RME approach and students who do not take learning with the RME approach. This is because, in this RME approach, the approach uses real-world contexts that students can imagine or are in students' minds as a starting point for developing mathematical ideas and concepts. This approach provides space for students to communicate with each other in developing strategies and building mathematical concepts and ideas while the teacher's task is to direct students in finding mathematical ideas or concepts.

This is in line with the research of Paroqi, et al., (2020) which states that learning with a Realistic Mathematics Education approach can improve students' mathematical communication skills due to the way students learn by connecting material with the real world such as statistical material regarding height measurements presented in the form diagrams so that students better understand the material that has been studied. Unlike the case with conventional learning, learning activities only rely directly on the teacher who provides the presentation of learning content. The teacher is the only source of information so students only actively listen. Students are not directly involved in learning except when the teacher provides an opportunity to ask questions about learning content that students have not understood by the teaching.

Reviewing the results of data analysis for the category of gender differences using a two-way ANOVA, it can be concluded that there is no significant difference in the mathematical communication skills between female and male students. Even though the results of the post-test for women were higher than the results for the post-test for men, the results were not too significant. This is in line with research conducted by Nugraha & Pujiastuti (2019) which shows that the results of the mathematical communication skills between male and female students only differ by about 9%, although overall the mathematical communication abilities of female students are higher when compared to males, but the difference is not that significant.

According to research by Jasija, et al (2018) that the increase in the mathematical communication skills of students who receive learning with the RME approach is better than those who receive learning with the usual approach. So it was concluded that the RME approach can improve students' mathematical communication skills.

The results of data analysis for the second hypothesis using a two-way ANOVA which shows the P-Value (Sig.0.845 > 0.05). With the conclusion that H_0 is accepted and Ha is rejected, so it can be concluded that there is no interaction between the learning approach and gender on students' mathematical communication skills. Based on this, it can be interpreted that an increase in the mathematical communication skills of students who learn using the RME approach does not affect or depend on the gender of the student. Vice versa, an increase in students' mathematical communication skills based on different genders does not affect or depend on the learning approach used.

Based on the average percentage of mathematics learning activities using the RME approach, from the three meetings that have been held it shows that the average learning activity has progressed significantly from day to day. So it can be concluded that the RME approach can be well received by students and students are able to follow every step of the RME approach well. The improvement from each meeting also indicates that the application of the RME approach from time to time will be able to achieve a perfect score if it continues to be implemented properly and applies each step of the RME approach in accordance with the learning objectives.

Thus, the progress of learning activities in each meeting will certainly have a positive impact as the progress of students' mathematical communication abilities. This is because the application of the RME approach itself is intended to provide opportunities and increase students' mathematical communication skills. So, through the progress of students' mathematical communication later the RME approach can be concluded to be appropriate and appropriate to use in the learning process.

CONCLUSION

Based on research results that have been discussed and described, it can be take some conclusion that :

1. Learning using the RME approach is better than the ordinary learning approach on the mathematical communication abilities of class VIII students of SMPN 3 Silangkitang for the 2021/2022 academic year. The point is that the average posttest of students who are taught using Realistic Mathematics Education learning is 80.87 higher than the average posttest score of students who are taught with ordinary learning, is 68.90
2. There is no interaction between the learning approach and gender on students' mathematical communication abilities. This shows that learning with the RME approach is always better done to improve students' mathematical communication ability than ordinary learning and there is no need to differentiate/group based on gender (both women and men) in SMPN 3 Silangkitang

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