IOP Conf. Series: Journal of Physics: Conf. Series **1114** (2018) 012112 doi:10.1088/1742-6596/1114/1/012112

Improve The Students' Mathematics Communication Ability Using Realistic Mathematics Education

Arief Aulia Rahman[1*], Dian kristanti[1], Andy Sapta[2], Mustika Fitri Larasati Sibuea[2], Anim[3], Syahriani Sirait[3], Elfira Rahmadani[3], Oktaviana [illegible] Purba[3] and Dahlan Abdullah[4]

[1]Department of Mathematics, STKIP Bina Bangsa Meulaboh, Meulaboh, Indonesia
[2]Department of Mathematics, STMIK Royal, Asahan, Sumatera Utara, Indonesia
[3]Department of Mathematics, Universitas Asahan, Sumatera Utara, Indonesia
[4]Department of Informatics, Universitas Malikussaleh, Aceh Utara, Indonesia

[*] sirariefaulia@gmail.com

Abstract. This study aims to determine differences in students' communication skills taught by Realistic Mathematical Education (RME) and conventional approach. This study is quasi-experimental in design non-equivalent control groups. The population in this study were all students of class VII in SMP at West Aceh who have group study more than 1. By using simple random sampling, selected 2 schools. Then from each school randomly selected 2 classes with the same mathematical ability to assign experiment class and control class. The experimental class was treated RME, while the control class was treated with a conventional approach. The instrument used consists of test of mathematical communication skills. Data analysis was done by using Two Way ANOVA test. The results showed that the improvement of communication skills of students who were given RME significantly better than the students who were given conventional approach. In addition, there is a difference in the improvement of mathematical communication skills between high, medium, and low ability students who are given the RME. The results of this study is expected to be a reference for educators to emphasize more on the RME in every learning process, so that learning is more meaningful and mathematical concepts are well embedded for students. So that impact on the increasing the students intelligence.

1. Introduction

Realistic Mathematical Education (*RME*) is a learning activity that assumes the Mathematics is a human activity that makes students actively think [1]. It is this view that has shifted the notion that mathematics as a collection of concepts and skills to such a way that the acquisition of mathematics should be organized. student engagement is more active in learning and active in giving advice response to peer opinions [2]. This shift requires that learning has been dominated by teachers cultivated. students are actively exploring, asking and developing Mathematical ideas and concepts using *RME* [3].

RME derives from the 'real' things for students, the teaching approach that uses reality as a starting point in the learning and teaching process that aims to support students in building and recreating

IOP Conf. Series: Journal of Physics: Conf. Series **1114** (2018) 012112 doi:10.1088/1742-6596/1114/1/012112

Mathematics through interactive contextual problems [4]. In this approach the teacher's role is nothing more than a facilitator, moderator or evaluator while students think, communicate ideas, train democratic nuances with respect for the opinions of others.

In general, *RME* theory consists of five characteristics: phenomenological exploration, bridging with vertical instruments, student contribution, interactivity and interrelationship [5]. The core characteristic of this *RME* is basically to emphasize that the learning of mathematics starts from realistic problems. Thus these characteristics correspond to the expected learning in the mathematics curriculum, mathematical learning should begin with the introduction of problems appropriate to the situation. By posing contextual problems, learners are gradually guided to master mathematical concepts [6].

Although there is a suitability between the Curriculum and *RME* in terms of the objectives of mathematics learning in schools, this has not yet been used as a benchmark that *RME* can be applied by math teachers. This is because obstacles such as the number of students who are too much, the time required long enough and the difficulty of changing the method of teaching the old way commonly used [7].

This constraint is something that can be facilitated if teachers in schools are willing to change basic paradigms or references to things, such as the role of teachers and the role of learning, reduce the familial processes that are essential to the learning process that are according to the principles of the *RME* and regulate the number of people with 25-30. So that the implementation of *RME* will be effective. If this alternative is implemented, then the implementation of learning with *RME* is expected to be realized well.

Some preliminary studies in some countries show that learning using *RME*, at least can develop students' motor skills, knowledge of student strategies and student attitudes [8]. The results of this study provide a fairly encouraging report. Students become more interesting and enjoy learning math and learning from learning is quite satisfactory. This can be a consideration to use *RME* as an alternative to the many forms of student-centered learning approaches in improving mathematical skills that ultimately are expected to improve student learning outcomes and create positive responses of students in learning mathematics [illegible].

To support the *RME*, it is necessary to undo the students' math skills. Determining what different students should do, different results which are predicted to be different [10]. In the *RME*, the better ones are those with moderate and low ability because the different *RME* steps at the development stage and the cognitive ,affective learning process, can foster excitement in learning and creative potentials [11].

2. Method

This study is in the form of an experiment with the design of "Non-Equivalent Control Group" which is part of the "Quasi Experiment". The sample used in this study consisted of two groups with equal ability, two schools used samples, Class A (Experiment Class) using *RME* and Class B (Control Class) using learning with conventional learning, learning result will be tested with two way anova to see differences in students' mathematical communication skills using different approaches

3. [illegible] Discussion

3.1. *Test Result*

The calculation of the mathematical communication ability's test were collected and analyzed to know the difference of students' mathematical communication skills taught RME and conventional approach. Data obtained from the results of mathematical communication skills from both the experimental and control classes are made in the following table.

Table 1. Data of Mathematical Communication Ability

Statistics	Leaning			
	RME		Conventional	
	Pretes	Postes	Pretes	Postes
N	64	64	66	66
Average	4,23	13,38	4,44	7,58
Standar Deviation	2,474	3,244	2,412	2,487

The average Mathematical communication ability of students who learn using RME got 4.23, while the average value of students' mathematical communication ability using conventional learning got 4.44. After learning, there was a difference in the average of the mathematical communication ability of the two groups of students. Students using RME obtained an average communication skill of 13.38 while students using conventional learning obtained an average mathematical communication ability of 7.58.

Table 2. Average Group Communication Ability

Learning	**Initial ability**	**Communication ability**			
		$\overline{X}$	*S*	*Min*	*Max*
KKA	high (8)	14,88	3,682	[illegible]	20
	medium (43)	13,37	3,295	[illegible]	20
	low (13)	12,46	2,634	9	17
	Total (64)	**13,38**	**3,244**	**7**	**20**
KKB	high (17)	7,71	2,687	3	12
	medium (39)	7,72	2,416	3	12
	low (10)	7,30	1,636	5	10
	Total (66)	**7,58**	**2,487**	**3**	**12**

Mean and standard deviation of KKA communication skill with high student math ability are 14,88 and 3,682, medium 13,37 and 3,295 and low is 12,46 and 2,634. Whereas for communication skill of KKB which have high student math ability mean and standard deviation is 7,71 and 2,687, mean is 7,72 and 2,416 and low is 7,30 and 1,636, it means score of communication skill student of KKA and KKB show difference.

Mean of mathematic communication ability of experiment group student (KKA) is 13,38 higher than mean of mathematic communication ability of control class (KKB) equal to 7,58. While the standard deviation experimental group (KKA) and control group (KKB) is not much different, that is 3,244 and 2,487.

Average of high, medium and low mathematical mathematical communication ability are 14,88, 13,37, and 12,46. While the average score of communication skills of high, medium and low mathematics is 7.71, 7.72 and 7.3. This means that the average ability of mathematical communication on KKA and KKB shows the difference. Descriptively there are some conclusions related to the communication skills that is:

1) In high-ability students, the average of mathematical communication skills given *RME* (KKA) 14,88 is higher than the average of conventional approach given by conventional approach (KKB) 7.71.
2) In medium-skilled students, the average of mathematical communication skills given *RME* (KKA) 13.37 is higher than the average of conventional approach given by conventional approach (KKB) 7.72.

3) In high-ability students, the average of mathematical communication skills given *RME* (KKA) 12,46 is higher than the average of conventional approach given by conventional approach (KKB) 7.3.
4) The students 'mathematical communication ability of experimental group (KKA) is 13[illegible] higher than the average of students' mathematical communication ability of control class (KKB) [illegible]58.
5) While the standard deviation of the experimental group (KKA) and the control group (KK[illegible]) is not much different, that is 3,244 and 2,487.

To know the significance of the above conclusions, statistical test with two way [illegible]ova was performed. This two way anova was used to test the difference of communication abili[illegible] based on learning factor (KKA and KKB) with students 'mathematics ability factor (high, medium, a[illegible] low) on students' mathematical communication ability. statistical analysis used to find [illegible]ether [illegible]here isn't difference of mathematic communication ability between students who ar[illegible] given [illegible] comp[illegible] with students who are given conventional learning, and there is or not the inte[illegible]ction b[illegible]een learning and mathematics ability of students to the ability of math commun[illegible]cation is t[illegible] way [illegible]ava.

3.2. Test of Normality.
one of the requirements in quantitative analysis is the fulfillment of th[illegible] normality [illegible]ption of the distribution of data to be analyzed. The hypothesis formula fo[illegible] data [illegible]mality is:

Ho: the sample is a normally distributed population

Ha: the sample is a not normally distributed populatio[illegible]

The test criteria used is if the significance value ([illegible]) Is greate[illegible] than α = 0.05, then H0 is accepted. Test the normality of data used Kolmogorov-Sm[illegible]v test (K-[illegible]). the value of significance is greater than the significance value level (sig[illegible]05. Th[illegible] at the students' mathematical communication score score data from the [illegible] sam[illegible] groups has homogeneous variance. Output calculation test normality data postes mathe[illegible]atical [illegible]cation ability of students who will learn in the experimental class and control c[illegible]s c[illegible] be s[illegible]n in th[illegible]owing table.

[illegible]able 3. Te[illegible] f N[illegible]mality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Le[illegible]ng	S[illegible]stic	Df	Sig.	Statistic	df	Sig.
POST_Com[illegible]ion	Experi[illegible]t	[illegible]096	64	.200*	.966	64	.074
	[illegible]ontrol	.095	66	.200*	.962	66	.041
a. Lillief[illegible] Sig[illegible]cance [illegible]orrection							
[illegible] This is [illegible]er bound [illegible] the true significance.							

R[illegible] as experimental class and conventional learning as control class has significance value great[illegible]5 that is (0,200> 0,05) then the data of learning of *RME* and conventional are normal di[illegible]ution.

[illegible] Test of Homogeneity.
Te[illegible] the compatibility (homogeneity) of variance to the control group and experimental group with signi[illegible]ce level α = 0,05. Homogeneity test was done by using Homogenity of Variances test. The results of the calculation of communication skills in both groups showed that the variance of both groups had the same variance, meaning that both groups were from the same population.The statistical hypothesis formula for testing the homogeneity of the variance of the two data sets is:

$H_0 : \sigma_1^2 = \sigma_2^2$: both samples come from populations that have homogeneous variance

$H_a : \sigma_1^2 \neq \sigma_2^2$: both samples come from populations that have non-homogeneous variance

The test criteria used is if the significance value (sig.) Is greater than α = 0.05, then H_0 is accepted

Table 4, Test of Homogeneity of Variances

Levene Statistic	df1	df2	Sig.
3.585	1	128	.061

The significance value (sig.) = 0.061 is greater than α = 0.05, then H_0 is accepted thus both samples come from populations that have homogeneous variance. Based on the hypothesis test that has been done, stated that the sample group of research comes from the population of normal distribution and homogeneous variance both by grouping the learning approaches at each school overall. then the requirements have been fulfilled, ie the sample data is normally distributed and homogeneous.

3.4. *Test of Two Way Anova*

The test results showed that the data group of mathematical communication ability comes from the normal distributed population with the variance of each pair of homogeneous data groups, then the two way anova statistical analysis of the path (2x2 factor) is done. Results :

Table 5. Tests of Between-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	1100.991[a]	5	220.198	27.598	.000
Intercept	10002.816	1	10002.816	1253.656	.000
KAM	29.699	2	14.849	1.861	.160
PBM	837.083	1	837.083	104.912	.000
KAM * PBM	13.047	2	6.523	.818	.444
Error	989.386	124	7.979		
Total	16333.000	130			
Corrected Total	2090.377	129			

The test is based on the hypothesis is

Ho : There is no difference in students' mathematical communication skills taught by Realistic Mathematics Education and Conventional Approach)

Ha : There are differences in students' mathematical communication skills taught with Realistic Mathematics Education and Conventional Approach)

Hypothesis in statistical form::

Ho: $\mu_{KKA} = \mu_{KKB}$

Ha: $\mu_{KKA} \neq \mu_{KKB}$

there is difference of students' mathematical communication ability with F_{count} is 104.912 with significance α = 0,000. Because the level of significant value of communication ability is smaller than α = 0.05, it can be concluded that there is no difference in mathematical communication ability of students taught by Realistic Mathematics Education (*RME*) and Conventional Approach is rejected so that the difference of students' mathematical communication ability taught with *RME* and Conventional Approach are accepted.

IOP Conf. Series: Journal of Physics: Conf. Series **1114** (2018) 012112 doi:10.1088/1742-6596/1114/1/012112

4. Conclusion

This research focuses students' mathematical communication through math learning with *RME*. There are differences in students' mathematical communication skills taught by RME and conventional approaches significantly. Judging from the interaction between the learning approach and the students' early math skills, this result can be observed from the learning approaches applied to experimental class students and control class students under the KAM category of students. Some implications that need to be considered for teachers as a result of the implementation of the learning process with RME include:

From the measured aspect, based on the findings in the field, it can be seen that the students' mathematical communication ability is still less satisfactory. This is because students are accustomed to getting questions that directly apply the existing formula in the book, so that when asked to bring up their own ideas students still find it difficult. Viewed on the indicator of mathematical [illegible] into [illegible] own arguments on the mathematical communication is still lacking.

RME can be applied to KAM (High, Medium and Low) categories in students' mathematical communication skills. As for *RME* get bigger advantage to students with high [illegible] category. Related to the process of completion of students in solving problems of mathematical communication skills on *RME*, still looks less tidy and not perfect with sequential steps and correct solution compared with conventional learning. However, the process of solving mathematical problems has varied, this can be found from the work of students both taught with *RME* and conventional approach.

Reference

[1] A. Fauzan, "Traditional Mathematics Ed[illegible]ys . R[illegible]hematics Education : Hoping for Changes," *Learning*, pp. 1–4, 200[illegible].

[2] A. Fauzan, "Applying Realistic Mathematics Education (RME) in Teaching Geometry in Indonesian Primary Schools (Dissertation Doktoral)," p. [illegible], 2002.

[3] R. Lesh, P. L. Galbraith, C. R. Haines, and A. Hurford, "Modeling students' mathematical modeling competencies: ICTMA 13," *Model. Students' Math. Model. Competencies ICTMA 13*, no. November 2010, pp. [illegible]1, 2010.

[4] K. Gravemeijer, "Local Instruction Theories as Means of Support for Teachers in Reform Mathematics Education," *Math. Think. Learn.*, vol. 6, no. 2, pp. 105–128, 2004.

[5] K. P. E. Gravemeijer, "Developing realistic mathematics education," 1994.

[6] M. Van den Heuvel-Panhuizen, "The Didactical Use of Models in Realistic," *Educ. Stud. Math.*, vol. 54, pp. 9–35, 2003.

[7] V. Arsaythamby and C. M. Zubainur, "How a Realistic Mathematics Educational Approach Affect Students' Activities in Primary Schools?," *Procedia - Soc. Behav. Sci.*, vol. 159, pp. [illegible]–313, 2014.

[8] R. Garris, R. Ahlers, and J. E. Driskell, "Games, motivation, and learning: A research and practice model," *Simul. Gaming*, vol. 33, no. 4, pp. 441–467, 2002.

[9] [illegible] Rahman, "Pengembangan Perangkat Pembelajaran Berbasis Kemampuan Pemecahan Masalah Matematis Siswa SMP N 3 Langsa," vol. 4, no. 1, 2017.

[10] A. Tella, "The Impact of Motivation on Student ' s Academic Achievement and Learning Outcomes in Mathematics among Secondary School Students in Nigeria," *Learning*, vol. 3, no. 2, pp. 149–156, 2007.

[11] [illegible] Armanto, "Teaching multiplication and division realistically in Indonesian primary schools : a prototype of local instructional theory," p. 309, 2002.