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LIST OF CONTENTS

Developing Students' Mathematical Connections through Realistic Mathematics Learning

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ABSTRACT

The purpose of this study is to determine the achievement and increase the student mathematical connection ability in city junior high school through realistic mathematics learning. The method used is a quasi-experimental non-equivalent control group design. Results of this study as follows. The realistic mathematics learning is more effective in the achievement and improvement of students' mathematical connection ability than conventional learning. Differences in achievement and increase of students' mathematical connections ability in both groups is significant learning. The magnitude of the achievement of a group of students' mathematical connection ability in realistic mathematics learning and conventional learning group of students are 75.63 and 64.63. Meanwhile, the magnitude of the increase in the students' mathematical connections ability is realistic mathematics learning group is 0.36 and conventional learning group student is 0.26.

KEYWORDS: *Mathematical connection ability, Realistic mathematics learning*

1 INTRODUCTION

1.1 Background

The student's ability to connect between concepts in mathematics, concepts in mathematics, concepts mathematics in other sciences, and mathematical concepts in everyday life is not maximize develop through conventional mathematics learning in junior high schools at Bengkulu city. The conventional mathematics learning focus on developing the arithmetic ability rather than mathematical connection ability. Students are trained to be able to resolve the calculation various problems. Such as calculating the results of operations of addition, subtraction, multiplication, and division on real numbers As a result, students have counting skills but students' have not mathematical connection ability. This causes is most students have difficulty in understanding a mathematical concept. Because the mathematical concept is associated with other concepts. Such students do not understand the concept of prime numbers, because students do not understand the factor concepts.

The Mathematical connection ability is necessary, that students understand various concepts in mathematics. Mathematical Connection ability is one of the processes standard that are developed through the study of mathematics. According to the National Council of Teachers of Mathematics (2000), the standards prosess are solving, reasoning and proof, communination, connection, and representation. In addition, the mathematical connection capability is part of a high-level mathematical thinking skills.

Mathematical connection ability is developed in the mathematics studies are: (1) recognize and use connections among mathematical ideas, (2) understand how mathematical ideas interconnect and build on one another to produce a coherent whole, (3) Recognize and apply mathematics in contexts outside of mathematics (NCTM, 2000).

The mathematical connection ability can be developed through realistic mathematics learning (RML). Because realistic mathematics learning activities intertwinning. This is based on the characteristics of realistic mathematics learning are : (1). Using the context, (2) using the model, (3). Using the contributions of students, (4) interactive, and (5) intertwinning (De Lange

(1987). The linkage is made through RML among others: (1). The link between students' prior knowledge with new knowledge, (2) the relationship between concepts in mathematics, (3) the relationship between mathematics with everyday life, and (4) the relationship of mathematics to other sciences.

Some research indicates that the RML can improve students' mathematics learning outcomes . RML can make students excited in learning mathemtaics. Probowo research results in Suryanto et. al. (2010) found that RML can improve understanding of mathematics concepts. Mathematics student activities generate a variety of ways of calculation in resolving a problem. Similarly, the results of research conducted by Fajrussathi in Suryanto et al. (2010) explains that the problem solving ability of students who are taught by RML better than those taught by conventional learning.

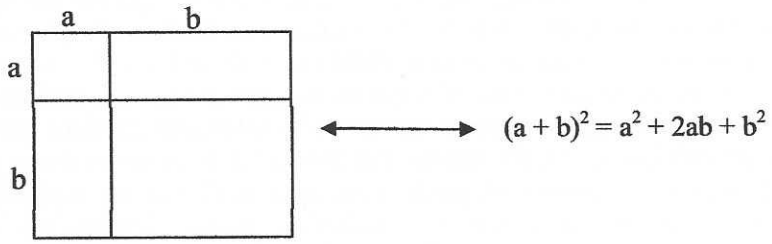
1.2 The Research Problem

1) Is there an increase in students' connection ability is taught through realistic mathematics learning?
2) Is student achievement connection ability is taught through realistic mathematics learning higher than conventional learning?

2 LITERATURE

2.1 Mathematical Connection

Kutz in Yusepa (2002) argues that the mathematical connection is a concept that shows the internal and external relations of mathematics. Because mathematics is an integrated knowledge. As proposed by the NCTM (2000) that mathematics is an integrated field of study. As shown by Al - Cuoco (2005) about the relationship between the operations of addition, multiplicatio , and functions as follows : $33 = 28 + 5 = (23 + 5) + 5 = 23 + 2 . 5 = (18 + 5) + 2 . 5 = (13 + 5) + 3 . 5 = (8 + 5) + 4 . 5 = 8 + 5 . 5 = (3 + 5) + 5 . 5 = 3 + 6 . 5$. Numbers 23 , 18 , 13 , 8 , 3 to form a function $f(n) = 5n + 3$ to n as natural numbers. Ruseffendi (2006) shows the relationship between Algebraic and Geometry with the relations of the square with sides (a + b) by the square of the sum of real numbers (a + b) below.



Sumarmo (2000) explains that the purpose of the connection in learning mathematics are : 1) expanding the horizons of students; 2) show that mathematics as a whole; and 3) demonstrate the benefits of mathematics. Students become more know that mathematical knowledge is knowledge related to other knowledge and relates to everyday life. In addition, students also learn that mathematics is a unity of the various components are interconnected. Another benefit , students feel that mathematics is useful for life.

2.2 Realistic Mathematics Learning (RML)

Realistic mathematics learning (RML) based on the theory of realistic mathematics education (RME) developed by the Freudenthal Institute in the Netherlands. RME view that mathematics is the knowledge that close to humans and the environment. Van den Heuvel-Panhuizen (2001) describes mathematics as u human activity. So that the learning of mathematics featuring learning activities related to human activity. Such activities include are restrictions on the situation, simplifying the problem, communication, interaction, observing, researching, repetition, review, communication, collaboration, and groups.

The principle of the theory of realistic mathematics education (RME) are: 1) guided reinvention and progressive mathematization; 2) didactical phenomenology; and 3) self-developed models (Gravemeijer, 1994). The first principle, underlying the realistic mathematics learning activities that lead students to conduct the rediscovery of the things that have been found by previous mathematicians. Such as, students rediscover the circumference of a circle $2\pi r$ through student activity measuring the circumference circular objects. The second principle underlying the activities of students and teachers that are educational. As used in the context of delivering students' thoughts on a studied. A third principle, the need for the significance of a thing. Meaningfulness will make students' memories can last a long time , and can motivate students to learn mathematics. Moreover, the principle of the three, pay attention to students' attitudes toward mathematics and the environment.

These principles provide the characteristics of RME (De Lange, 1987) are: 1) the use of Contexts; 2) the use of models; 3) the use of students own productions and constructions; 4) the interactive character of the teaching process; and 5) the intertwinement of various learning strands.

Based on these characteristics, realistic mathematics learning use: 1) a context for the learning condition in order to focus on the concepts that will be studied; 2) a model, as a means of simplifying the problem; 3) a contribution of the students, to come up with new ideas; 4) interactive, as a means of exchange of ideas; and 5) a linkage, as an effort to show relationships between concepts in mathematics and mathematical relationships with other sciences as well as the daily life.

Based on the principles and characteristics of the RME , realistic mathematics learning (RML) is a mathematics learning which views mathematics as a human activity and provide opportunities for students to solve problems and contextual or rediscover the mathematical concept based on its initial capabilities by using the model, the contribution of students, linking between topics, and interact with the environment (Haji and Abdullah , 2014).

The initial activity of the RML is a students complete activities contextual problem with the guidance of teachers. According Saragih (2007), contextual issues are issues related to the early experiences student, it is easy to imagine the students, according to the student's readiness, and close to real life students. Examples of contextual issues, among others : the problem of buying and selling goods in the market, the sick in hospitals, electricity monthly payments, and traffic problems. Students conduct discussions in resolving the contextual problem. In addition to the discussion, the students conduct reflection in revisiting the things he had done. In addition, students conduct a re-invention to find a variety of concepts as well as a means of solving a problem.

3 METHODOLOGY

3.1 The Sample and Population

The sample is students of class VIIA SMPN 15 Bengkulu City consisting of 21 students. The sample comes from a population of students of class VII SMP 15 Bengkulu City consisting of 90 students (Haji dan Abdullah, 2014).

3.2 Instrument Validity and Realibility

The connection ability test consists of 5 items. The results of the analysis of connection ability tests using software Anates as follows (Haji dan Abdullah, 2014):
Mean = 60,24
Deviation standard = 19,07.
Correlation XY = 0,75
Reliability test = 0,85
Item test = 4
The number of subjects = 21

Table 1: Results of Validity and Realibility Connection Instrument

No.	Different Index		Difficulty		Validity		Conclusion
	Index (%)	Interpretation	Index (%)	Interpretation	T Hint	Interpretation	
1	33,33	enough	46,67	medium	0,918	Valid	Received
2	46,67	good	63,33	medium	0,782	Valid	Received
3	53,33	good	53,33	medium	0,787	Valid	Rejected
4	40,00	enough	66,67	medium	0,829	Valid	Received

T Table ($\alpha = 0,05$) = 0,482 + 0,4 (0,423 - 0,482) = 0,458 (Haji dan Abdullah, 2014)

3.3 Research Design

This study use a quasi-experimental design by the non-equivalent control group (Cohen, Manion and Morrison, 2000):

Experimental O_1 X O_2
Control O_3 O_4

X is a treatment as realistic mathematics learnining.

3.4 Data Analysis

The analysis of achievement connection skills using Mann Whitney test, while the analysis of the increase in the ability of connection using the test N-Gain. The result of the requirements of normality and homogeneity of the data presented in Table 2 and Table 3 below.

Table 2 : Results of Normality Test Data Pretest, Posttest, and N-gain Students Mathematical Connection Ability

Data Group	*N*	Average	Standard Devision	*Kolmogorov-Smirnov Z*	*Sig.* (2-tail)	H_0
Pretest RML Experiment	27	13,00	6,78	1,333	0,057	Received
Pretest CL Control	24	13,25	10,78	1,073	0,200	Received
Postes RML Experiment	27	44,22	9,89	1,905	0,001	Rejected
Postes CL Control	24	36,71	12,96	1,686	0,007	Rejected
N-*gain* RML Experiment	27	0,36	0,11	1,121	0,162	Received
N-*gain* CL Control	24	0,26	0,16	0,766	0,600	Received

(Haji dan Abdullah, 2014)

The data were not normally distributed only posttest mathematical connection ability for the experimental group, while other data are normally distributed. Thus, different test posttest

advance of experimental class and grade control using Mann Whitney test, while data pretest and N-gain needs to be tested first and homogeneity of variance.

Table 3 : Results of Homogeneity of Variance Pretest Data and N-gain Students Mathematical connection Ability

Data Group	*N*	*F*	*Sig.* (2-tail)	H_0
Pretest RML Experiment	27	6,473	0,014	Rejected
Pretest CL Control	24			
N-*gain* RML Experiment	27	1,182	0,282	Received
N-*gain* CL Control	24			

(Haji dan Abdullah, 2014)

Based on the data in the Table 3, it can be concluded that all homogeneous data sets. Thus, different test pretest and N-graders gain between experimental and control classes using test-t .

4 RESULTS AND DISCUSSION

4.1 Improvement of Students Connection Ability

Increased students' mathematical connection ability who are taught through realistic mathematics learning is higher when compared with students who are taught through conventional learning. Improving students mathematical connection ability are taught through realistic mathematics learning of 0.36, while students are taught through conventional learning of 0.26. It is shown in Table 4. The increase is due to the influence of the connection ability of realistic mathematics learning. Realistic mathematics learning emphasizing aspects of mathematical linkage with everyday life , the relationship of mathematics to other sciences, as well as the relationship between parts of mathematics.

The learning about integer operations. Students conduct contextual solve problems associated with integer operations . Contextual problem solved student is a kite is at 13 m above sea level, while the fish are in the 2 m above sea level. How much distance meter kite with the fish ? With characteristic linkages between topics in RML, students perform simulations in solving the problem by linking kites and fish with a point, while the sea level with a straight line. Then the points are connected by a straight line. Then students measure the length of the connecting line between these points. In order to obtain the distance between the kite with the fish as far as 15 m .

In addition to the characteristics of the RML linkage, interactive characteristics and the principle of re-invention, contributing to the ability of the student mathematical connections. Through discussions, the students can develop the ability connection, because they can associate various mathematical ideas from his friends. Similarly, through the re-invention activity, linking students ' prior knowledge with new knowledge. This activity has established a mathematical connection ability of students. Improving the ability of the students taught mathematical connection through realistic mathematics learning and conventional learning are shown in Table 4 below.

Table 4 : Results of Calculation Test-t Pretest and N-gain Mathematical Connection ability between Experiment Group and Control Group

Kelompok Data	*N*	Average	Averege Difference	*t*	*df*	*Sig.* (2-tail)	H_0
N-*gain* Eksperimen Group	27	0,36	0,10	2,520	49	0,015	Rejected
N-*gain* Control Group	24	0,26					

(Haji dan Abdullah, 2014).

Table 4 shows that there are differences in pretest scores between students experimental group and control group.While the increase of (N-gain) significantly different between the two classes. The data showed an increase in student car loan experimental group higher than control group.

4.2 Achievement of Mathematical Connection Ability

Achievement of the students mathematical connection ability are taught through realistic mathematics learning better than students who are taught through conventional learning. Excellence of students who are taught through realistic mathematics learning is to have a score higher connection capabilities than students taught through conventional learning. This is shown in Table 5. The average score students mathematical connection ability are taught through realistic mathematics learning are 75.63. While the average score of the students mathematical connection ability are taught through realistic mathematics learning are 64.63. Another advantage is the ability to connect students who are taught through realistic mathematics learning more varied when compared with students who are taught through conventional learning. Variation of connections made in determining the number of students that can be expressed in the form 4a + b as follows: (1) number of 24 with a = 1 and b = 2, (2) number of 0 with a = 0 and b = 0, and the number of - 14 with a = -1 and b = -2. While the answer to the students taught by conventional learning only positive numbers, such as 50 with a = 10 and b = 1.

Table 5 : Calculation Results Student Achievement between Experiment Group and Control Group

Data Group	Average	*U Mann Whitney*	*Z*	*sig.*(2-tail)	H_0
Postes KP Experiment	75,63	131,000	-3,656	0,000	Rejected
Postes KP Control	64,63				

(Haji dan Abdullah, 2014).

Mann Whitney test results indicate that there are significant differences in achievement (posttest) between students' experimental group and control group. Achievement experimental group students is higher than the control group.

Achievement and improvement of students' mathematical connection ability are taught through realistic mathematics learning and convensional learning are presented in Figure 1 below (Haji dan Abdullah, 2014).

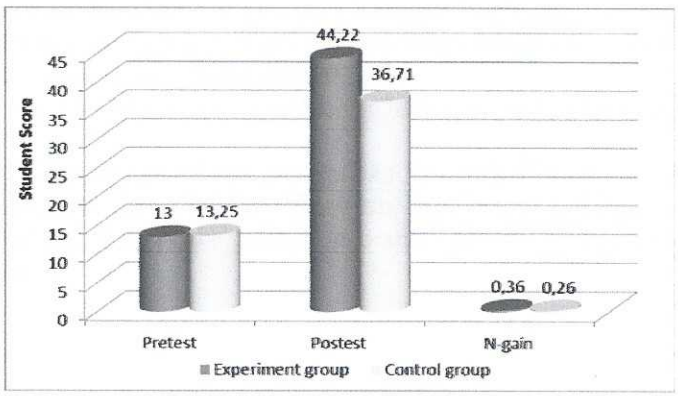


Figure 1. Score of Students Mathematical Connection Ability

5 CONCLUSION AND SUGGESTION

5.1 Conclusion

1) There is an increase in students' connection skills are taught through Realistic Mathematics Learning at 0,36.
2) Achievement of students connection skills taught through Realistic Mathematics Learning higher than students taught through Conventional Learning. Achievement through Realistic Mathematics Learning at 75.63, while the achievement by Conventional Learning at 64.63.

5.2 Suggestion

1) To improve the students mathematical connection abilty, teachers should use realistic mathematics learning with emphasis on the linkages between topics, interactive, and re-invention.
2) To achieve the students mathematical connection ability, teachers should use realistic mathematics learning by providing contextual issues better known students .

6 REFERENCES

Al Cuoco (2005). *Mathematical Connections A Companion for Teachers and Others*. Washington: The Mathematical Association of America.

Cohen, L., Manion, L. and Morrison, K. (2000). *Research Mathods in Education*. London: Routledge Falmer.

De Lange, J. (1987). *Mathematics Insight and Meaning*. Utrecht: OW & OC.

Gravemeijer, K.P.E. (1994). *Developing Realistic Mathematics Education*. Utrecht: Freudenthal Institute.

Haji, S. dan Abdullah, I. (2014). Model Pembelajaran Matematika Realistik untuk Meningkatkan Kemampuan Berpikir Matematika Tingkat Tinggi dan Kemandirian Belajar Siswa. *Laporan Penelitian Tim Pascasarjana*. Jakarta: Dikti. Tidak diterbitkan.

National Council of Teachers of Mathematics (2000). *Principles and Standards for School Mathematics*.United States of America: Reston, VA.

Yusepa, B. (2002). Penerapan Model Cooperative Learning Tipe STAI dalam Upaya Meningkatkan Kemampuan Koneksi Matematika Siswa. *Tesis*. UPI Bandung. Tidak diterbitkan.

Ruseffendi, E.T. (2006). *Pengantar Kepada membantu Guru Mengembangkan Kompetensinya dalam Pengajaran Matematika untuk Meningkatkan CBSA*. Bandung: Tarsito.

Saragih, S. (2007). Mengembangkan Kemampuan Berpikir Logis dan Komunikasi Matematik Siswa Sekolah Menengah Pertama Melalui Pendekatan Matematika Realistik. *Disertasi*. Bandung: Sekolah Pascasarjana. Tidak diterbitkan.

Sumarmo, U. (2000). Proses Belajar dan Pemahaman Materi Kuliah. *Makalah* Lokakarya TPB ITB Bandung.

Suryanto, et.al. (2010). *Sejarah Pendidikan Matematika Realistik (PMRI)*. Yoyakarta.

Van den Heuvel-Panhuizen, M. (2001). *"Realistic Mathematics Education as Work in Progress"*. Proceeding of 2001 the Netherlands and Taiwan Conference on Mathematics Education, Taiwan.