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**Students' Critical Mathematical Thinking Skills and Character:
Experiments for Junior High School Students through Realistic Mathematics
Education Culture-Based**

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Abstract

This paper presents the findings of a quasi-experimental with pre-test-post-test design and control group that aims to assess students' critical mathematical thinking skills and character through realistic mathematics education (RME) culture-based. Subjects of this study were 106 junior high school students from two low and medium schools level in Ambon. The instruments of the study are: students' early math skills test, critical thinking skills mathematical test and perception scale of students' character. Data was analyzed by using t-test and Anova. The study found that: 1) Achievements and enhancement of students' critical mathematical thinking skills who were treated with by realistic mathematics education is better then students' skills were treated by conventional mathematics education. The differences are considered to: a) overall students, b) the level of early math skills, and c) schools' level; 2) Quality of students' character who were treated by realistic mathematics education is better then students' character who were treated by conventional mathematics education The differences are considered to: a) overall students, b) the level of early math skills, and c) schools' level

Keywords: Critical Thinking, Students' Character, Realistic Mathematics Education Culture-Based

Abstrak

Makalah ini melaporkan temuan suatu kuasi eksperimen dengan disain pre test- post test dan kelompok kontrol yang bertujuan untuk menelaah kemampuan berpikir kritis matematis dan karakter siswa melalui pembelajaran matematika realistik (PMR) berbasis budaya. Subjek penelitian adalah 106 siswa SMP dari dua SMP level rendah dan sedang di Kota Ambon. Instrumen yang digunakan adalah, tes kemampuan awal matematika siswa (KAM), tes kemampuan berpikir kritis matematis, dan skala pendapat mengenai karakter siswa. Analisis data yang digunakan adalah uji-t, dan Anava. Penelitian menemukan bahwa: 1) Pencapaian dan peningkatan kemampuan berpikir kritis matematis siswa yang memperoleh PMR lebih baik dari kemampuan siswa yang memperoleh PMB ditinjau dari: a). keseluruhan siswa, b) tingkat KAM, dan c) level sekolah; 2) Kualitas karakter siswa yang memperoleh PMR lebih baik dari karakter siswa yang memperoleh PMB ditinjau dari: a). keseluruhan siswa, b) tingkat KAM, dan c) level sekolah

Kata Kunci: Berpikir Kritis, Karakter Siswa, Pembelajaran Matematika Realistik Berbasis Budaya

Introduction

PISA study (Balitbang-Depdiknas, 2009) reported that students' mathematics learning achievement of junior high school students in Indonesia is not encouraging. Indonesia is ranked 61st of 65 countries by obtaining a score of 371 of the 600 scores obtained by students in Shanghai China. The low of students' math achievement, among others, because of the students themselves, teachers and learning environment. Students experiencing difficulty in learning mathematics, teachers have difficulty in delivery of materials, and the learning environment encourages students have learned significantly. Yet the achievement of meaningful understanding in students, among others reflected also in the case of students who can cite the definition of a parallelogram, but they mentioned that the rectangle is not a parallelogram. (Marpaung, 2001). In the above case, students are accustomed to memorizing definitions and work according to procedures without a proper understanding of the meaning. As the implications of the above cases, Marpaung (2001) suggests that teachers need to pay attention to learning math-oriented students' understanding.

In addition to skills of mathematics understanding, critical mathematical thinking skills should be developed in the students of junior high school (National Education goals, KTSP, 2006). The importance of developing students' critical thinking skills are also presented by Uyangor and Uzel (2005) and Ismaimazu (2010), which states that critical thinking skills mathematical can assist students in mathematics problem solving. Some of the results of the above studies reported that critical thinking skills mathematics of junior high school students who obtain mathematical innovative learning better than critical thinking skills students who obtain conventional learning. These findings support the suggestions to need learning which implemented to train the students think. Sabandar (2009) states that the thought process built from the beginning should be taken into account. These circumstances indicate that during the process of thinking lasted students thoroughly trained to empower and enable the skills which he has, so that he can understood and mastered what he does.

One of the mathematics learning that allows students to develop the skills to think mathematically is *Realistic Mathematics Education (RME)* and in Indonesia known as Pendidikan Matematika Realistik Indonesia (PMRI). RME is a movement that is based on the philosophy of constructivism which aimed to reforming mathematics education in Indonesia. A side from being a method of learning mathematics, RME

also be an attempt to transform social (Sembiring, 2007). Some characteristics of RME are: (a) the students more active thinking, (b) context and teaching materials directly related to the schools' environment and students, and (c) teachers' active role in designing teaching materials and classroom activities. This is supported by the results of research conducted Yuwono (2001), Fauzan, Slettenhaar and Tjeerd Plomp (2002), Zulkardi (2002), Palinussa (2009), Sugiman and Kusuma (2010), and Turmudi (2012), which states that realistic mathematics education help teachers to teach mathematics to the students and managed to improve the their mathematical skills.

In essence, RME is in line with the suggestions of KTSP (Depdiknas, 2006) which advocate the use of contextual problems in starting the mathematics learning activities and prioritize development of character and culture. Character education is an effort to educate students to make decisions wisely and practice it in their daily lives, so that they can make a positive contribution to the environment (Megawangi: 2004). Character values are very important in learning mathematics because it can shape the good attitudes and behaviors and expected to improve students' mathematics achievement.

RME mathematics instructional materials tailored to the cultural context involves some cultures of Maluku-Ambon such as *pela* and *gandong*, *Salam* and *Sarani*, *masohi culture*, and *badati culture*. *Pela* and *gandong* shows the kinship between the land of *Salam* and *Sarani* which have a close brotherly relationship and help each other in solving problems in the community together. For example, in building a house of worship (Mosque or Church) and *masohi* culture is a culture of mutual aid cooperation in completing a task such as building a home /custom home. Meanwhile, *badati* culture is mutual aid or contribution to a particular event that shouldered the burden together.

Cultural aspects presented indicate a cooperative relationship very closely either individual or group that performed in completing a job and this is very typical in Maluku because reflects religious harmony. This Rational in line with the opinion of Leung (2009) that Indonesia with cultural diversity, it is necessary to apply etnopedagogick in the system and learning culture. Culture-based math learning in this culture of Maluku-Ambon has two advantages that it can learn math in two

different cultural perspectives and the culture itself. For example, flat-packed learning materials wake with involving culture of *pela gandong* and *Masohi*.

Conditions of various levels of school and early math skills of students, the importance of critical thinking skills and superiority of culture-based learning encourages researchers conducted a study of mathematical critical thinking skills and character development of students through RME culture-based.

Theoretical Review

1. Critical Thinking Mathematically

Some experts define the term critical thinking mathematically with a similar meaning. The Fisher (1995) suggested critical thinking is to explain what someone is thinking. Learning to think critically is to learn how to ask, when to ask, what's the question, how to reason, when to use reasoning and what reasoning methods which use. Ennis (1996) suggested that critical thinking is a process that aims so that we can make decisions that make sense, so what we think is the best of a truth we can do it right. Then Chanche (Huitt, 1998), a cognitive psychologist defines critical thinking as the ability to analyze facts, generate and organize ideas, defend opinions, make comparisons, draw conclusions, evaluate arguments and solve problem.

Similar to the above definition of critical thinking, Krulik and Rudnick (NCTM, 1999)) suggests that including critical thinking in mathematics is a test thinking, questioning, connecting, evaluating every aspect of a situation or a mathematical problem. Expressed the same sense Sukmadinata (2004) suggested that critical thinking is a skill of reason on a regular basis, systematic skills in assessing, solving problems, appealing the decision, give confidence, analyzing assumptions and scientific inquiry.

Based on the opinions of experts, and customized to the level of junior high school student thinking, critical thinking indicators in this research include identifying, connecting, analyzing and solving mathematical problems.

2. Realistic Mathematics Learning

Realistic Mathematics Education (RME) must be linked to the context of the real world (reality) and can be categorized a human activity. Based on the mathematical view, Gravemeijer (1994) suggests that RME developed four basic principles,

namely: (a) guided-reinvention, (b) progressive mathematizing, (c) didactical phenomenology as a initiated Freudenthal, and (d) self-developed model.

Furthermore, the implementation of learning mathematics in the classroom, the fourth principle, translated into five RME characteristics which include: (a) the use of context, (b) use models, bridging by vertical instruments, (c) students contribution, (d) interactivity, and (e) intertwining.

Based on the principles and characteristics of RME as described above, it can be designed in a step-by-step in learning mathematics core activities realistic as follows: (a) understanding the contextual issues, (b) solving the problem of contextual; (c) compare and discuss answers in small groups and in class discussions, and (d) drawing conclusions.

3. Character

Character building is an effort to educate children in order to take the right decisions and to practice them in daily life, so the decision to make a positive contribution to the environment (Megawangi: 2004). Koesoema expressed a similar notion (2007) that the character is an anthropological structure focused on the process of development in human beings is continuously to improve himself as a virtuous man. That is, the values of virtues such as tenacity, responsibility, generosity and others.

Then Rachman (2010) suggested that as a conscious and deliberate effort to cultivate the characters on student character building must be carried out with 3C is consistent, continuous and consistent. In more depth, Hasan et al (2010) detailing the characters into the following indicators: religious, downright, tolerance, discipline, hard working, creative, independent, democratic, curiosity, the spirit of nationalism, patriotism, esteeming achievement, friendship/communicative, peace-loving, fond of reading, environmental care, social care and responsibility.

4. Culture

1. Maluku Culture

Culture is deeply rooted in people's lives is one of the Maluku capital to increase the unity including encouraging the people especially learning community in implementing learning in school.

Gandong Culture is one's relationship of family, a *gandong* or blood from one of the descendants of the same religion are not familiar with then parting leave Seram into a new home and lease the island of Ambon, which is called the country and embraced Christianity and religion was Muslim or ambon dialect called Salam and Sarani. While culture is the relationship of the brothers *pela* caused by an event so that no oath and promise made to strengthen the relationship. For example war *pela*, siri and blood *pela*. For example, Porto and Haria is war *pela*. (Source: <http://www.depdagri.go.id>).

Ambon society, both migrants and indigenous people to develop forms of cooperation "Masohi" that are helping each other. Activities of mutual help has been a common pattern. The relationship between people or groups in society is very clearly visible at a particular time or in the event of an incident the construction of mosques or churches, death, marriage, build houses, harvest, clean villages, and other events. In this activity, each of its members are not bound to the interest of religion and place of residence. Fellow villagers actively involved selfless (Sriwigati, et al: 2004).

2. Culture in Learning Mathematics

As with many other disciplines, mathematics is also heavily influenced by the cultural values in the development and teaching. Although the results are the same calculations, mathematical methods and techniques are different in every culture of the world community. Leung (2009) pointed out, the math on the Chinese calendar and the Islamic calendar. Although both are calculated based on the circulation of the month, but the beginning of the calculation is different. It shows there are cultural influences in the methods and techniques, but in the end, the result and the formula is the same. He also added to the cultural diversity of Indonesia, should also apply *etnopedagogik* in learning and teaching culture. "Should a country with distinctive culture is superior, because we can learn mathematics in two different cultural perspectives and values.

Sinaga (2007), reported that the development of mathematical learning model insight-oriented, problem-solving, based on the local culture (culture of Batak) managed to enrich students 'knowledge of mathematics, enabling students to face global challenges, and also closer to the students' culture. The findings above, supports the

rationale that the application of learning mathematics using a cultural approach Maluku predicted to improve students' math skills.

Method of This Study

This study was a quasi-experimental design with pre-test-post-test and control class, which aims to analyze the role of realistic mathematics education Maluku culture-based, school level, and students' early math skills to students' critical mathematical thinking skills and character. The study subjects were 106 from 7th class students of two medium and low levels junior high schools in Ambon. The instruments of the study are: students' early math skills test, critical thinking skills mathematical test and perception scale of students' character. Data was analyzed by using t-test and Anova between critical thinking skills, character, school level and the level of early math skills.

The following are examples of critical thinking test items and examples of teaching materials realistic mathematics education based on culture.

1. Examples of critical mathematical thinking test items

1. Living room floor in house of Mr. Andrew which sized 3 m x 4 m will be fitted rectangular tiles with the size of the side tiles is 22 *cm*.
 - a. How many tiles can be installed along the width?
 - b. How many tiles can be installed along the length?
 - c. How many tiles are needed to cover the living room?
2. Mrs. Merlin has a rectangular garden clubs with size 45 m x 30 m. That Gardens will be fenced using a metal pole attached with pole spacing of 1.5 *m*. Furthermore, three rows of barbed wire mounted horizontally.
 - a. How many poles are required to make an iron fence? Explain where to begin installing the pole?
 - b. Determine the length of barbed wire entirely!

2. Examples of students' character scale items

Statement of character scales in the form of positive and negative statements are:

1. Argues that learning mathematics in a religious atmosphere is fun
2. Feel less comfortable learning mathematics in groups with different friends of religion
3. While studying mathematics as a group, try to respect each religion

4. Argues that there are rules/mathematical formula as opposed to a particular religion
5. Argues that learning mathematics with believe in God will boost confidence

3. Examples of teaching materials

1. The presence of old mosques and churches in Ambon demonstrated religious harmony and also shows *pela* and *gandong* culture as the family cultural life of Muslims and Christians so closely. The condition was seen at the time of construction or renovation building of mosques and churches conducted jointly by the community of Muslims and Christians.



Look the picture above

Observe the picture above, write-up contained flat on the picture!

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2. Sago is the staple food Ambonese and various kinds of starch can be made include: *sagu manta*, *papeda* and *sagu lempeng*. Usually the sago tree growing at the *tana Dati* (heirloom land) owned by the people of *negeri*, located in the image below!

Students' Critical Mathematical Thinking Skills and Character: Experiments for Junior High School Students through Realistic Mathematics Education Culture-Based



Place of Making Sago



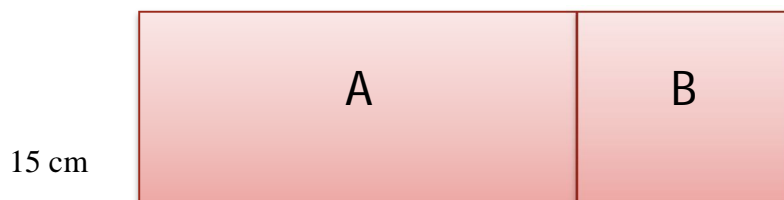
Sagu manta

Papeda

Sagu Lempeng

Look at the proper manufacture of making sago above. Suppose there are two kinds of place-making sago as shown below.

45 cm



Compute the area and the circumference of the making of sago as a whole. If the ratio of length A and B is 3: 1, how many breadth and circumference of A and B. Explain your answer.

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Findings and Discussion**1. Critical thinking skill mathematical**

Students' critical thinking skills based on school level, the level of early math skills and learning, presented in Table 1.

Table 1
Students' Critical Thinking Skills based on School Level,
Early Math Skills Level and Learning

School Level	EMS Level	x SD	Critical Thinking Skill mathematical							
			RME Culture-Based				CME			
			Pret est	Poste st	Gai n	n	Prete st	Poste st	Ga in	n
Low	Low	x	25.76	57.24	0.43	1	16.14	49.38	0.40	21
		SD	6.43	8.60	0.07	7	6.39	8.81	0.10	
	Moderate	x	29.30	64.00	0.49	4	25.50	54.75	0.40	4
		SD	10.30	4.90	0.02		3.70	8.50	0.08	
	High	x	44.00	77.00	0.59	1	0	0	0	0
		SD	0	0	0		0	0	0	
	Sub Tot	x	27.27	59.36	0.45	2	17.64	50.24	0.40	25
		SD	7.60	9.00	0.07	2	6.91	8.82	0.09	
Moderate	Low	x	23.22	57.18	0.45	2	21.45	50.76	0.38	25
		SD	7.03	11.82	0.12	3	5.82	10.71	0.11	
	Moderate	x	35.00	72.60	0.58	5	28.67	63.67	0.49	3
		SD	7.78	6.54	0.06		6.11	7.57	0.07	
	High	x	37.00	80.50	0.69	2	30.00	68	0.54	1
		SD	1.41	2.12	0.03		0	0	0	
	Sub Tot	x	24.32	61.30	0.49	3	22.48	52.69	0.39	29
		SD	8.62	13.15	0.10	0	6.23	11.27	0.11	
Total	Low	x	24.30	57.20	0.44	4	19.02	50.13	0.39	46
		SD	6.82	10.65	0.10	0	6.58	9.80	0.10	

Students' Critical Mathematical Thinking Skills and Character: Experiments for Junior High School Students through Realistic Mathematics Education Culture-Based

Moderate	x	32.56	64.31	0.54	5	26.86	58.57	0.44	7
	SD	8.95	9.26	0.07		4.71	8.83	0.09	
High	x	39.33	76.50	0.66	3	30.00	68.00	0.54	1
	SD	4.16	6.03	0.06		0	0	0	
Total	x	26.60	60.48	0.47	52	20.24	51.56	0.40	54
	SD	8.29	11.71	0.11		6.94	10.20	0.10	

Maximal Score is 100

a) No difference of students' early math skills based on school level (medium and low) and overall in both learning classes. The mean of students' early math skills include in medium category

b) Pre test of critical thinking skills mathematical based on learning

After testing for normality and homogeneity of data students' critical thinking mathematically pre test, further analysis on the whole there is a difference in pre test of critical thinking skills mathematical between students who were treated with RME culture-based (26.60 out of 100), and students who treated with conventional learning (20.24 of 100). Both of students' critical thinking skills mathematical as less. The test results are listed in Table 2.

c) Post test of critical thinking skills mathematical based on learning.

After testing for normality and homogeneity of data students' critical thinking mathematical post test, further analysis on the whole there is a difference in post test of critical thinking skills mathematical between students who were treated with RME culture-based (60.48 out of 100) better then students who treated with conventional learning (51.56 of 100). The students' critical thinking skill mathematical who received RME culture based classified on medium and students' critical thinking skills mathematical who received conventional learning classified on low. The test results are listed in Table 2.

Table 2
The Results of Normality Test, Homogeneity Test, Difference Test,
Critical Thinking Skills Mathematics Based on Learning

Variabel	Test	Normality Test			Homogeneity Test		Difference Test		
		Group	Sig	Ket	Sig	Ket	Stat. Test	Sig	Ket.
<i>Learning</i>	<i>Pre Test</i>	RME	0.200	Normal	0.297	Homogen	Uji-t	0.000	There is Difference
		CME	0.200	Normal					
	<i>Pos Test</i>	RME	0.090	Normal	0,541	Homogen	Uji-t	0.000	There is Difference
		CMB	0.200	Normal					

2. Critical thinking skill mathematical based on school level and students' early math skills

a) Pre test of critical thinking skill mathematical based on school level and students' early math skills

After testing for normality and homogeneity of data students' critical thinking mathematical pre test based on level of students' early math skills, there are differences in the subsequent analysis of students' critical thinking skill mathematics pre tests between students with low, medium and high early math skills who have been using RME culture-based (respectively 24.30, 32.56, and 39.33) and students with low, medium, and high early math skill who have been using Conventional Mathematics Education (respectively: 19.02, 26.86, and 30.00). All of the students' critical thinking skills mathematics in the pre test relatively less. The test results are listed in Table 3.

b) Post test of critical thinking skill mathematical based on school level and students' early math skills

Based on the data in Table 1, it was found that in both the learning, achievement and enhancement students' critical thinking skills mathematics at the medium school level (61.30 and 12:49 on RME group and 52.69 and 12:39 on Conventional Mathematics Education group), each better than the achievement and enhancement students' critical thinking skills mathematics at the low school level (59.36 and 0.45 on RME group and 50.24 and 0.40 on Conventional Mathematics Education group). These findings support the role of either the school level to the achievement and

enhancement of students' critical thinking skills mathematics. On further analysis, it was found achievement and enhancement students' critical thinking skills mathematics at the low school level who have been using RME (59.36 and 0.45) is better than the achievement and enhancement students' critical thinking skills mathematics at the medium school level who have been using Conventional Mathematics Education (52.69 and 0.39). These findings indicate that the RME culture-based provide a better role than the role of schools on achievement levels and enhancement of students' critical thinking skills mathematical.

Testing analysis of data' normality and homogeneity post test students' critical thinking mathematical, produce data of critical thinking skills in students' early math skills who are low not normally distributed. Further analysis test using Kruskal-Wallis test. The results of Kruskal-Wallis test indicate there is a difference in the post test students' critical thinking skills mathematical based on early math skill level (low, medium, and high) in both of study (RME and Conventional Mathematics Education). The average value of post test critical thinking skills mathematical based on early math skills for RME was 57.2 (low early math skills), 64.31 (medium early math skills) and 76.50 (high early math skills) and to Conventional Mathematics Education was 50.13 (low early math skill), 58.57 (medium early math skill) and 68.00 (high early math skill). Score of students' critical thinking skills mathematical post test who have been getting RME with low and medium early math skill belonging to the category of medium and students with high early math skills belonging to the category of high. In Conventional Mathematics Education class, students' critical thinking skills mathematical post test with low early math skill belonging to the category of low and students with medium and high early math skills belonging to the category of medium. The results of the Kruskal-Wallis Test of critical thinking skills mathematical post test based on students early math skills are listed in Table 3.

Table 3
Normality Test, Homogeneity Test, Difference Test, Critical Thinking Skills
Mathematical Based On Students' Early Math Skills

Variabel	Test	Normality Test			Homegeinity Test		Difference Test		
		Group	Sig	Ket	Sig	Ket	Stat .Test	Sig	Ket
<i>Early Math Skills</i>	<i>Pre Test</i>	Low	0.512	Normal	0.746	Homo Gen	One Way Anova	0.000	There is Difference
		Medium	0.214	Normal					
		High	0.962	Normal					
	<i>Pos Test</i>	Low	0.035	Tidak	0.113	Homo gen	Kruskal Wallis	0.000	There is Difference
		Medium	0.620	Normal					
		High	0.478	Normal					

3. Upgrades of Critical Thinking Skills Mathematical Based On Learning, School Level, and Early Math Skills Level

After testing for normality and homogeneity enhancement of critical thinking skills in both of learning, analysis of the t-test, results enhancement students' critical thinking skills mathematical who have been using RME (0.47) is better than the enhancement students' critical thinking skills mathematical who have been using Conventional Mathematics Education (0.40). Both are classified moderate upgrades. The results of homogeneity test, normality test and t-test improved critical thinking skills mathematical based on learning is presented in Table 4. The findings are consistent with research findings Uzel and Uyangor (2005), which suggests that the RME successful in improving students' critical thinking skills mathematical.

Table 4
The Results of Normality Test, Homogeneity Test, difference Test, Improved Critical Thinking skills Mathematics Based On Learning

Variabel	Test	Normality Test			Homogeneity Test		Difference Test		
		Kel.	Sig	Ket	Sig	Ket	Stat. Test	Sig	Ket
<i>Learning</i>	<i>Critical</i>	RME	0.200	Normal	0.965	Homogen	t-test	0.000	There is difference
		CME	0.200	Normal					

Similarly, based on students' early math skills, improving students critical thinking skills mathematics who have been using RME is 0.44 (low early math skills), 0.54 (medium early math skills), and 0.66 (high early math skills), each better than the improving of critical thinking skills mathematical who have been using Conventional Mathematics Education is 0.39 (low early math skills), 0.44 (medium early math skills), and 0.54 (high early math skills). Improved of critical thinking skills mathematical based on early math skills on both of learning belong to the medium category. The results of normality test, homogeneity test and t-test improved critical thinking skills mathematical based on early math skills in both of learning presented in Table 5.

Subsequent analysis, the findings obtained achievements and enhancement of students' critical thinking skills mathematical from low school level who have been using RME (59.36 and 0.45) better than the achievement and enhancement of students' critical thinking skills mathematical from medium school level who have been using Conventional Mathematics Education (52.69 and 0.39) These findings indicate that RME culture-based variable provide a better role than the role of school level to achievement and improving students' critical thinking skills mathematical.

Table 5
The Results of Normality test, Homogeneity Test, Difference Test, Improved Critical Thinking Skills Based On Students' Early Math skills

Variabel	Test	Normality test			Homogeneity Test		Difference Test		
		Group	Sig	Ket	Sig	Ket	Stat. Test	Sig	Ket
<i>Early math Skills</i>	<i>Critical</i>	Low	0.116	Normal	0.255	Homogen	One Way Anova	0.000	There is difference
		Medium	0.916	Normal					
		High	0.768	Normal					

4. Students' Character Based On Overall Student.

Students' character based on the overall, school level, early math skills, and learning as Table 6.

Tabel 6
Students' Character Based On Learning and Students' Early Math Skills

School	Early math Skills	\bar{X} & SD	RME	N	CME	N
Low	Low	\bar{X}	70.21	17	63.97	21
		SD	3.60		3.41	
	Medium	\bar{X}	78.57	4	76.42	4
		SD	0.83		3.99	
	High	\bar{X}	79.29	1	0	0
		SD	0		-	
Total	\bar{X}	72.14	22	65.97	25	
	SD	4.82		5.78		
Medium	Low	\bar{X}	75.00	23	67.91	25
		SD	3.81		4.22	
	Medium	\bar{X}	82.43	5	79.05	3
		SD	4.18		2.50	
	High	\bar{X}	87.14	2	79.29	1
		SD	8.08		-	
Total	\bar{X}	77.04	30	69.45	29	
	SD	5.57		5.58		
Total	Low	\bar{X}	72.96	40	66.11	46
		SD	4.39		4.31	
	Medium	\bar{X}	80.71	9	77.55	7
		SD	3.62		3.47	
	High	\bar{X}	84.52	3	79.29	1
		SD				

Students' Critical Mathematical Thinking Skills and Character: Experiments for Junior High School Students through Realistic Mathematics Education Culture-Based

		SD	7.29		0	
	Total	\bar{X}	74.97	52	67.84	54
		SD	5.76		5.89	

Maximal Score is 100%.

After testing for normality and homogeneity of students' character by t-test analysis produces the students' character who have been using RME (74.97 out of 100) is better than the students' character who have been using Conventional Mathematics Education (67.84). Both characters are quite good. The results of normality test, homogeneity test and t-test of student's character based on learning and early math skills are presented in Table 7.

Analysis of the students' character based on early math skills produce students' character who have been using RME is 72.96 (low early math skills), 80.71 (medium early math skills) and 84.52 (high early math skills) each higher than students' character who have been using Conventional Mathematics Education is 66.11 (low early math skills), 77.55 (medium early math skills) and 79.29 (high early math skills). The results of normality test homogeneity test and t-test of the students' character based on learning and early math skills, presented in Table 7.

Table 7
The Results of Normality Test, Homogeneity Test, Students Character Test
Based On Learning and Early Math Skills

Variabel	Normality Test			Homogeneity Test		Difference Test		
	Group	Sig	Ket	Sig	Ket	Stat.Test	Sig	Ket
<i>Learning</i>	RME	0.200	Normal	0.973	Homogen	t-test	0.000	There is difference
	CME	0.200	Normal					
<i>Early Math skills</i>	Low	0.305	Normal	0.451	Homogen	One-Way Anova	0.007	There is difference
	Medium	0.067	Normal					
	High	0.352	Normal					

Conclusions and Recommendations

Based on data analysis and discussion of some of the conclusions obtained are as follows:

- a) Pre test of students' critical thinking skills mathematics who have been using RME better than students who have been using Conventional Mathematics Education in term of overall students, students' early math skills, but the skills is still quite lacking. After learning, in term of overall student, school level and early math skills, students' critical thinking skills who have been using RME is better than students skills who have been using Conventional Mathematics Education. Similarly, in term of students' early math skills after learning, students critical thinking skills mathematics who have been using RME is better than students skills who have been using Conventional Mathematics Education.
- b) Considered as a whole, based on school level and level of students early math skills, the enhancement of students' critical thinking skills mathematics who have been using RME is better than the enhancement of students skills who have been using Conventional Mathematics Education.
- c) School level variables, early math skills, and RME culture-based each providing a good role towards the achievement and improvement of mathematical critical thinking skills of students. Of the three variables, variables of RME culture-based provides the best role for the achievement and improvement of mathematical critical thinking skills of students. This shows that the efforts of teachers in the learning provide a better role than the role of other variables.
- c) Based on the overall and the school level and level of students' early math skills, students' character who have been using RME better than the students' character who have been using Conventional Mathematics Education. Character of students in both learning (RME and Conventional Mathematics Education) is quite good.

Recommendation

Based on data analysis and conclusions of this study, proposed some recommendation, as follows.

- a) Realistic mathematics Education culture-based to become a learning alternative to use in schools by teachers, especially at the medium school level and low levels in

an effort to improve the critical mathematics thinking skills and character of junior high school students.

- b) Emphasis development of students' character and other affective domain in the learning of mathematics in order to remain balanced attention to the development of learning outcomes in the cognitive domain. Through RME-culture based nurtured expected mathematical learning outcomes in cognitive, affective domain so as to form an intelligent student, have a character and appreciate the culture of the local community.
- c) To support the success of learning math better, so that teachers strengthen students' mastery of the material prerequisite math and choose the relevant cultural context for the material that will be taught ..
- d) Further research by applying RME culture-based to enhance other ability mathematical and other affective domain of students from various school levels.

References

- Depdiknas, (2003). Kurikulum 2006: Kurikulum Tingkat Satuan Pendidikan. Jakarta: Depdiknas.
- Ennis, R. H. (1996). *Critical Thinking*. USA : Prentice Hall, Inc.
- Fauzan, A., Slettenhaar D., Plomp T. (2002). Traditional Mathematics Education vs. Realistic Mathematics Education: Hoping for Changes. Proceedings of 3rd International Mathematics Education and Society Conference. Copenhagen: Centre for Research in Learning Mathematics.
- Gravemeijer, K. (1994). *Developing Realistic Mathematics Education*. Utrecht: Freudenthal Institute.
- Hasan, Dkk. (2010). *Pengembangan Pendidikan Budaya dan Karakter Bangsa*. Jakarta. Kementrian Pendidikan Nasional Badan Penelitian dan Pengembangan Kurikulum.
- Huitt, W. (1998). *Critical Thinking: An Overview*. Educational Psychology Interactive. Valdosta, GA: Valdosta State University.
- Ismaimuza, D. (2008). Kemampuan Berpikir Kritis dan Kreatif Matematis Siswa SMP melalui Pembelajaran Berbasis Masalah dengan Strategi Konflik Kognitif.
- Krulik, S. dan Rudnick J.A.(1999). Innovative Tasks to Improve Critical and Creative Thinking Skills. Dalam *Developing Mathematical Reasoning in Grade K-12*. Stiff. L.V dan Curcio FR. Ed. 1999 Yearbook NCTM, Reston, Virginia
- Leung, F. K.S. (2009). *Kebudayaan Pengaruhi Pembelajaran Siswa*. Kuliah Umum di gedung pasca sarjana Universitas Pendidikan Indonesia (UPI), Kamis (14/1).

- Lokolo. (1997). *Budaya Pela Gandong Dari Pulau Ambon*, Lembaga Kebudayaan Maluku
- Marpaung, Y. (2001). Implementasi pendidikan matematika realistik di Indonesia. (Makalah disajikan dalam seminar nasional). Medan: Depag Propinsi SUMUT.
- Megawangi, R. (2004). *Pendidikan Karakter*. B P. Migas Energy.
- Palinussa A. L. (2009). "Pembelajaran Matematika Realistik untuk materi belah ketupat dan layang-layang di Kelas VII SMP Negeri 19 Ambon". *Mathedu. Jurnal Pendidikan Matematika PPs Unesa*
- PISA.(2009).Badan Penelitian dan Pengembangan. Kememterian Pendidikan dan Kebudayaan.
- Rachman, Arief. (2010): Urgensi Pendidikan Karakter dalam Membangun Bangsa. Makalah pada Seminar Nasional Pendidikan Nilai Karakter, 28 juli 2010.Sekolah PascaSarjana UPI Bandung.
- Sabandar, J. (2009). *Berpikir Reflektif*. Prodi Pendidikan Matematika Sekolah Pasca Sarjana UPI Bandung. [makalah : tidak di publikasi]
- Sembiring, R.K. (2010). Perkembangan Matematika Realistik Indonesia.(PMRI); Perkembangan danTantangannya. *IndoMS,J. M. E.Vol. 1. No. 1 Juli 2010*.
- Sugima dan Kusumah, Y. (2010). Dampak Pendekatan Matematika Realistik Terhadap Peningkatan Kemampuan Pemecahan Masalah Siswa SMP. *Journal IndoMS. J.M.E. Volume 1*.
- Sinaga, B. (2007). *Pengembangan Model Pembelajaran Matematika Berdasar Budaya Batak*. Disertais Sps Unesa
- Turmudi. (2012). Teachers,Perception Toward Mathematics Teaching Inovation In Idonesian Junior High School: Eksploratory Factor Analisis. *Journal Mathematics Education*. August 2012, Vol. 5, No.1, pp. 97-120
- Uzel, D., Uyangor, S. M. (2005).Attitudes of 7th Class Students Toward Mathematics in Realistic Matematics Education. *Jurnal International Mathematical Forum..* [di akses Febuary 2011]
- Yuwono, I. (2001).Realistik Mathematics Education dan Hasil Studi Awal Implementasi di SLTP.Surabaya. Makalah disampaikan pada Seminar Nasional RMedi Jurusan Matematika FMIPA di UNESA.
- Zulkardi (2002).Developing a 'rich' learning environment on RME for student teachers in Indonesia.Paper presented in the IAMS-1 seminar at the Faculty of Mathematics at the University of Twente, 23-24 June 2002 and will be published in the special edition of International

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