The Enhancement of Students' Creative Thinking Skills in Mathematics through The 5E Learning Cycle with Metacognitive Technique

Runisah (Corresponding Author)
runisah_unwir@hotmail.com
Wiralodra University, Indramayu, Indonesia

Tatang Herman
tatangherman@upi.edu
Indonesia University of Education, Bandung, Indonesia

Jarnawi Afgani Dahlan
jarnawi@upi.edu
Indonesia University of Education, Bandung, Indonesia

Abstract

This study aimed to describe enhancement and achievement of students' Creative Thinking Skills in Mathematics (CTSM) as a result of 5E Learning Cycle with Metacognitive Techniques (LCM). This research used a quasi-experimental design with pretest-posttest control group. The population of the research is Junior High School students in Indramayu City, Indonesia. The sample is eighth grade students from two school levels, amounted to 173 students. The instruments used were consisted of CTSM tests and observation sheet. The study reveal that in terms of overall and in all school level, the enhancement and achievement of students' CTSM who received LCM is better than those who received 5E Learning Cycle (LC) and Conventional Learning (CL). Likewise the enhancement and achievement of students'CTSM who received LC is better than those who received CL. there is no interaction effect between learning model and school level towards enhancement and achievement of students'CTSM.

Keyword: creative thinking skills; 5E Learning Cycle; Metacognitive technique

1. Introduction

Creative thinking skills is one of the capabilities required to solve various problems. This is in line with Kuo & Hwang (2014), which summarizes the opinion of some researchers that solving the problem is a complex thought process that involves critical thinking, creativity, and reasoning . furthermore according Munandar (2012) increased technological advances and population explosion is accompanied by a lack of resources natural-source creatively requires adaptation and the ability to find imaginative solutions. It can be concluded that through creative thinking someone will be able to use a variety of resource constraints that supports the problem solution.

Creative thinking skills is higher order thinking skills. The scholars explained about creative thinking skills with different ways, but contain similar concept that is the generation of something or ideas which have value of novelty. Creativity means cognitive skill to propose solution to problem or make something useful or has value of novelty (Hwang, Chen, Dung & Yang, 2007). Whereas Moore et al (2009) stated that some researchers relate creativity to novelty, variety, and ability to understand some ideas which need divergent thinking in the process to generate new ideas. Graham (in Sambo & Ibrahim, 2012) describe creative person as individual who provide

unique and unusual problem solution, which is different from other people. Therefore, creative thinking is the way of thinking which direct to generation of new ideas or view or new way in solving the problem.

The main source of creativity come from Guilford's intellectual model structure. That model which was explained by Starko (2010) is complex intelligence model and made to become the main source of creativity idea, consist of 180 components which are formed through content, product and operations combinations. Guilford identify component of divergent thinking (divergent production) which comprise fluency (build many ideas), flexibility (build various kind of ideas from various different point of views), originality (build uncommon ideas), and elaboration (add ideas to develop them). Guildford also introduce the importance of sensitivity to problem and evaluation in building and evaluating creative ideas.

Creativity is contained in various domains, includes in mathematics. Mann (2005) summarized some scholars' opinion who applied concepts of fluency, flexibility, and originality to creativity concept in mathematics. Fluency refer to ability to generate many ideas, flexibility refer to many approaches which are observed in solving the problem, and originality refer to possibility that new and unique ideas are emerged. Another component of creative thinking are elaboration and sensitivity.

Novelty as creative product in mathematics education point of view is a new thing which is viewed from individual point of view as the creative idea impetus. This is suggested by Briggs and Davis (in Nurlelah, 2009) that creativity in mathematics is different from creativity of another science. The generation of solution from new problem is creative product for that individual, on the other word in mathematics, creativity not always present new thing. Students who present the solution from problem with their own way with right concept can be called as a creative student. Therefore, a solution is new thing for someone but not for other people.

Furthermore, Chiu (2009) relate creativity in mathematics with students' ability to solve routine problem and non routine problem even ill structured problem. Similarly with Oksuz (2009) who stated that mathematical creativity sometimes can be observed from non-routine mathematical problem solution. The solution of many non-routine problems involve flexibility in thinking and mathematical knowledge and mathematical analysis.

Based on various scholars' opinion as had been explained, it can be concluded that mathematical creative thinking skills is thinking skills to generate ideas in solving mathematical problem or in perceiving certain mathematical situation which is marked by aspects of sensitivity, fluency, elaboration, flexibility, and originality. Sensitivity is ability to identify the problem. Fluency is ability to generate many relevant ideas. Elaboration is ability to develop, add, enrich an idea, elaborate details, and extend the ideas. Flexibility is ability to build various ideas and ability to change a way or approach, and different thinking direction. Originality is ability to determine ideas which are unusual, uncommon or different from another.

By seeing the importance of creative thinking skills development, that skills development become one of mathematics learning goals. This is in accord with what is asserted by *Kurikulum Tingkat Satuan Pendidikan* (KTSP). In KTSP it is suggested that mathematics need to be given to all students started from elementary school until secondary school to equip students with logical, analytical, systematical, critical and creative thinking skills and cooperation ability.

Based on KTSP as had been explained above, creative thinking skills can be developed through mathematics learning. Related with that Sriwongchai, Jantharajit, and Chookhampaeng (2015)

argued that mathematics is the science of thinking and important thing to enhance thinking potency in learning process. This because to learn concepts and solve the problem in mathematics well, critical and creative thinking skills is needed. By developing creative thinking potency through mathematical learning, students will be able to use it in solving the problem creatively in daily life.

Even though creative thinking skills is skills which is important to be possessed, in fact the study result indicated that skills is still low. This based on result of Trends in International Mathematics and Science Study (TIMSS) in year of 2007 and 2011 that the average score of achievement in mathematics subject is under average, in which in 2011 was in 38th rank from 42 participated countries. In TIMSS 2011 students are involved in various cognitive processes to solve the problem (Mullis, Martin, Michael, Foy & Arora, 2012). The lack of problem solving ability indicate that students' creative thinking skills is still low. This because that creative thinking skills is used to solve the problem. Another study was conducted by Runisah (2014) who concluded that students' mathematical creative thinking skills is still low. Based on her study result, it is founded that students are less able to make or construct question or problem from a situation given. Besides, students are less able to decide another way to solve the problem and they more depend on the ways which are given by teacher them.

One of factor which influence the lack of creative thinking skills is learning process which is done in school. This revealed by Rohaeti (2010), that learning in school focus on material content and ignore development of students' thinking skills. In addition, It is based on the study included the National Research and National Education Development Department (Balitbang Depdiknas) in 2007. From the study found that starting from primary to secondary education, in general, the implementation of learning still used lecturing and question and answer methods, as well as teaching and learning activities was less in making students active in learning (Depdiknas, 2007). Futhermore, Munandar (2012) explained that in education, the emphasis is more on memorizing and search one correct answer to problems given. Higher order thinking process includes creative thinking is seldom trained.

The development of creative thinking skills can be done through learning which involve students to do exploration activity to solve problem or find ideas or new concept. This in accord with Ruseffendi (2006) who said that students' creativity will grow if they are trained to do exploration, inquiry, invention, and solve the problem. In parallel with that, according to Munandar (2012) this study showed that optimal development of creative thinking skills is tightly related with the way of teaching. To develop creative thinking skills, students should be given opportunity to express their ideas and work in accord with their interest and needs.

In addition, to develop creative thinking skills, students metacognition must be empowered. The term of Metacognition is introduced by Flavell in 1976. Flavell (in Lioe, Fai & Hedberg, 2006) stated that metacognition is a person's consciousness about the cognitive processes and independence to achieve the goal. Student metacognitive skills useful for controlling what is known and has been done by the students. This is very useful in the process of creative problem solving. Importance of empowerment of metacognition of the students expressed by Panaoura and Philippou (2005), if a person is not aware of the process and cognitive ability, we will not be able to improve their performance.

One of learning model that seems can be used to develop creatve thinking skills is 5E Learning Cycle with Metacognitive Technique (LCM). It is because various activities to develov mathematical creative thinking as stated by Ruseffendi (2006) and Munandar (2012) contain in 5E

Learning Cycle (LC). Furthermore, the empowerment of students' metacognition can be done by integrating metacognitive techniques into LC.

The 5E Learning Cycle model was developed by Bybee In 1980. According to Bybee, et al (2006) 5E Learning Cycle has five stages, engage, explore, explain, elaborate, and evaluate. At this stage of engage, teachers access students' prior knowledge and help them engage in new concepts that encourage their learning interest. In the stage of explore, students are involved in exploration concepts activity to generate new ideas. In the stage of explain, the students explained the conceptual understanding or process skills obtained in explore stage and provides an opportunity for teachers to directly introduce the concept, process, or skill. In the elaborate stage, teachers broaden understanding of the concept. In evaluate stage, carried out an assessment of their understanding and ability.

Furthermore, if it is seen from creative process, the use of LC model contain activity which is involved in that process. According to Fisher (1995), initial stimulus is forced by awareness of problem which should be solved, or by uncertain feeling that there is idea which cannot be understood or fully realized. Stimulus is given in engage stage in LC model. The second stage is the exploration. To think creatively students should be able to investigate further, and review the things which are needed. In third stage, planning, after given stimulus then exploration is done to search solution and determine various plans to solve the problem. From various plans made, some most appropriate plans can be taken to solve solution. The next stage is activity. After the plan is determined then activity is done to implement it. The last stage is review. Students need to evaluate and review their work.

The 5E Learning Cycle model with metacognitive technique, is a learning model that integrates directly metacognitive techniques in every stage of 5E Learning Cycle model. One type of metacognitive technique is self asking. In this study the questions is made focused on three categories adopted from Beeth (in Mittlefehldt & Grotzer, 2003) namely intelligibility, wide-applicability, and plausibility. In intelligibility category, the question asked is, "Is the concept I learned can be understood?" In wide-applicability category, the question asked is, "What concept that can be used to solve the problem? "or," can the concept that I learned be used to solve problems in other areas or in their daily lives? ". in plausibility category the question asked " Is the problem solving that I created believable?"

Various studies have been done on the use of 5E Learning Cycle and metacognitive empowerment. Walia (2012) the result of the study indicates significant effectiveness of 5E instructional model on mathematical creativity. Sofuroh, Masrukan & Kartono (2014) concluded that critical thinking skills of students who received 5E Learning Cycle with Scientific approach is better than the expository class on derivative Function. Schraw (in Toit & Kotze, 2009) and Camahalan (2006) supports that achievement is enhanced by setting metacognitive students to utilize the resources and strategies exist well. Liu, Peng, Wu, & Lin (2009), based on the conclusions of the researchers, the activities in the 5E Learning Cycle helps to activate prior knowledge, overcome their misunderstandings, and help them further expand the conceptual understanding. Tuna & Kacar (2013) concluded that the average academic achievement of students in the material Trigonometry in class X which used 5E Learning Cycle was higher than students who used conventional learning.

Based on the description above, the use of 5E learning Cycle with metacognitive technique can be used to develop students' and creative thinking skills. However, research on the use of the 5E Learning Cycle to enhance students' creative thinking skills in mathematics, is limited. Even,

research on the use of the 5E Learning Cycle with metacognitive technique to enhance students' creative thinking skills in mathematics, has not been found.

Purpose and Significance of Research

The purpose of this study was to describe the enhancement and achievement of students' Creative Thinking Skills in Mathematics (CTSM) who are thougt by LCM, LC, and Conventional Learning (CL). This study is need to be conducted because study about development of students' creative thinking skills is is still limited, whereas development of creative thinking skills is the important thing to be done. It is hoped that this study can add the literature about learning that can enhance students'Mathematical creative thinking skills. Thus the results of this study are expected to overcome the lack of students' creative thinking skills

2. Method

This study used a quasi experimental method with pretest-posttest control group design, as described below (Ruseffendi, 2005)

R	O	X_1	O
R	O	X_2	O
R	O		O

Notes:
R : Random sampling
X_1: LCM
X_2: LC
O: Pretest of CTSM = Posttest of CTSM

2.1. Population and Sample

The research was conducted in academic year 2015/2016. The population of the research is Junior High School students in Indramayu City, West Java Province, Indonesia. The sample is eighth grade students amounting to 173 students from two school levels, classified as high amounting to 83 students and medium levels amounting to 90 students. In this research, one school was randomly selected from both high and medium-level school. Furthermore, three classes were randomly selected from all of the eighth grade students in high-level and medium-level school, one class received LCM, one class received LC, and another class received CL. School level has been determined based on school accreditation score which is valid until the year 2014.

2.2. Instruments

In this study The material was adjusted to the subject matter of Mathematics in the first semester of 2015/2016 which refered to the curriculum. The material being taught include Relations and Functions, Equations of Straight Lines, and The System of Linear Equations in Two Variables.

The instruments used in this research was CTSM tests, and observation sheets. CTSM tests were given prior to the learning activity (pretest) and after the learning activity (posttest). CTSM test consists of 14 items with maximum ideal score of 56 Evaluation of CTSM using components, namely sensitivity, fluency, flexibility, elaborate and originality. These components associated with material being taught.

Before used, the experts consider CTSM test to fulfill face and content validity. Then try out test is done in limited scale. After being improved, instrument is tested in wide scale. Based on test result, it is obtained that test is valid and reliable.

The achievement of students' CTSM determined based on posttest scores. Meanwhile, to calculate the magnitude of the increased, it use of the gain normalized formula developed by Meltzer (2002) and the gain calculation results are interpreted using the classification Gain from Hake (1998).

3. Results and Discussion

3.1. Descrription Data

From the calculations, recapitulation of students' CTSM test can be seen from Table 1.

Table 1. Recapitulation of Students' CTSM Test Result

School Level	Group	Number of students (n)	Mean		
			Pretest	Postest	Gain
High	LCM	26	8.77	42.12	0.71
	LC	27	8.37	35.52	0.58
	CL	30	8.67	28.30	0.42
Medium	LCM	30	8.70	40.33	0.68
	LC	30	7.97	33.30	0.54
	CL	30	8.03	25.37	0.37
Total	LCM	56	8.73	41.16	0.70
	LC	57	8.16	34.35	0.56
	CL	60	8.35	26.83	0.40

Maximum ideal score CTSM test of 56

From Table 1, we can see that the results of pretest for each group was relatively similar. furthermore it can be seen that in all school level, and from totally students, CTSM enhancement and achievement of LCM group is higher than CL group. Whereas CTSM enhancement and achievement of LC group is higher than CL group.

3.2. Data Analysis

The Enhancement of Students'Creative Thinking Skills

Based on the test results of normality, in all school level, and from totally students the enhancement of creative thinking skills of LCM, LC, and CL group data not entirely normally distributed. Thus, the mean difference test used is Kruskal Wallis.

Table 2. Summary of Mean Difference Test Result of CTSM Enhancement

School Level	Group	Mean	Kruskal-Wallis	*Sig.*	H_0
High	LCM	0.71	29,49	0.000	Rejected
	LC	0.58			
	CL	0.42			
Medium	LCM	0.68	27,37	0.000	Rejected
	LC	0.54			
	CL	0.37			
Total	LCM	0.70	55.24	0.000	Rejected
	LC	0.56			
	CL	0.40			

Based on Table 2. it is found out that probability (significance) value for totally students and for each school level is less than significance degree $\alpha = 0.05$. thus H_0 is rejected. It means that at least, there is one group who has mean gain which is different from another group. Next, Multiple Comparison Between Treatments test is done. Test result which had been done is presented on Table 3.

Table 3. Summary of Paired Test Result of CTSM Enhancement

School Level	$\lvert \bar{R}_u - \bar{R}_v \rvert$	Critical Value $\lvert \bar{R}_u - \bar{R}_v \rvert$	H_0
High	$\lvert \bar{R}_1 - \bar{R}_2 \rvert = 17.08$	15.86	Rejected
	$\lvert \bar{R}_1 - \bar{R}_3 \rvert = 35.01$	15.46	Rejected
	$\lvert \bar{R}_2 - \bar{R}_3 \rvert = 17.93$	15.31	Rejected
Medium	$\lvert \bar{R}_1 - \bar{R}_2 \rvert = 16.58$	16.15	Rejected
	$\lvert \bar{R}_1 - \bar{R}_3 \rvert = 35.27$	16.15	Rejected
	$\lvert \bar{R}_2 - \bar{R}_3 \rvert = 18.68$	16.15	Rejected
Total	$\lvert \bar{R}_1 - \bar{R}_2 \rvert = 33.35$	22.56	Rejected
	$\lvert \bar{R}_1 - \bar{R}_3 \rvert = 69.11$	22.28	Rejected
	$\lvert \bar{R}_2 - \bar{R}_3 \rvert = 35.76$	22.18	Rejected

Notes:
$\bar{R}_1$ = *mean rank* LCM model
$\bar{R}_2$ = *mean rank* LC model
$\bar{R}_3$ = *mean rank* CL model

Based on Table 3, in value significance degree $\alpha = 0.05$. value of $\lvert \bar{R}_u - \bar{R}_v \rvert$ for each learning group is higher than critical value of. $\lvert \bar{R}_u - \bar{R}_v \rvert$ Therefore, whether viewed from students totally and from high and medium school level, CTSM enhancement of students who are taught by LCM is better than students who are taught by LC and CL. CTSM enhancement of students who are taught by LC is better than students who are taught by CL.

Interaction Effect between Learning Model and School Level toward Students' CTSM Enhancement

Based on normality test results, CTSM enhancement of learning group data not all distributed normally. Therefore, *The Adjusted Rank Transform Test* (Leys & Schumann, 2010) is done to find out interaction effect between learning model and school level toward students' CTSM enhancement. From the calculations, the value of F = 0.215 with a probability value 0.807. This value is greater than the significance level of 0.05. Thus, it can be concluded that there is no interaction effect between learning model and school level toward students' CTSM enhancement.

The Achievement of Students'Creative Thinking Skills

Based on normality test results, CTSM achievement of learning group data not all distributed normally. Therefore, Kruskal-Wallis test is used to test mean difference of CTSM achievement test result which is presented in table as follow:

Table 4. Summary of Mean Difference Test Result of CTSM Achievement

School Level	Group	Number of students (n)	Kruskal-Wallis	*Sig.*	H_0
High	LCM	26	24.70	0.000	Rejected
	LC	27			
	CL	30			
Medium	LCM	30	24.47	0.000	Rejected
	LC	30			
	CL	30			
Total	LCM	56	47.39	0.000	Rejected
	LC	57			
	CL	60			

Based on Table 4, it is found out that probability value (significance) for totally students, and for each school level data is less than significance degree $\alpha = 0.05$. thus H_0 is rejected. It means that at least, there is one group who has mean of CTSM achievement which is different with another group. Next, Multiple Comparison Between Treatments test is done.

Table 5. Summary of Paired Test Result of CTSM Achievement

School Level	$\lvert \bar{R}_u - \bar{R}_v \rvert$	Nilai Kritis $\lvert \bar{R}_u - \bar{R}_v \rvert$	H_0
High	$\lvert \bar{R}_1 - \bar{R}_2 \rvert = 15.88$	15.86	Rejected
	$\lvert \bar{R}_1 - \bar{R}_3 \rvert = 31,89$	15.46	Rejected
	$\lvert \bar{R}_2 - \bar{R}_3 \rvert = 16.01$	15.31	Rejected
Medium	$\lvert \bar{R}_1 - \bar{R}_2 \rvert = 16.80$	16.15	Rejected
	$\lvert \bar{R}_1 - \bar{R}_3 \rvert = 33,50$	16.15	Rejected
	$\lvert \bar{R}_2 - \bar{R}_3 \rvert = 16.70$	16.15	Rejected
Total	$\lvert \bar{R}_1 - \bar{R}_2 \rvert = 31.96$	22.56	Rejected
	$\lvert \bar{R}_1 - \bar{R}_3 \rvert = 64.02$	22.28	Rejected
	$\lvert \bar{R}_2 - \bar{R}_3 \rvert = 32.06$	22.18	Rejected

Notes:

$\bar{R}_1$ = *mean rank* LCM model

$\bar{R}_2$ = *mean rank* LC model

$\bar{R}_3$ = *mean rank* CL model

Based on Table 5. in value significance degree $\alpha = 0.05$. value of $\lvert \bar{R}_u - \bar{R}_v \rvert$ for each learning group is higher than critical value of $\lvert \bar{R}_u - \bar{R}_v \rvert$. Therefore, whether viewed from students totally and from high and medium school level, CTSM achievement of students who are taught by LCM is better than students who are taught by LC and CL. CTSM achievement of students who are taught by LC is better than students who are taught by CL.

Interaction Effect between Learning Model and School Level toward Students' CTSM Achievement

Based on normality test results, not all data of learning group in all school level, and from totally students, CTSM achievement of learning group data not all distributed normally. Therefore, *The Adjusted Rank Transform Test* (Leys & Schumann, 2010) is done to find out interaction effect between learning model and school level toward students' CTSM achievement. From the calculations, the value of F = 0.215 with a probability value 0.807. This value is greater than the significance level of 0.05. Thus, it can be concluded that there is no interaction effect between learning model and school level toward students' CTSM achievement.

3.3. Discussion

Viewed from totally students, CTSM enhancement of students who are taught by LCM is 0.70. That enhancement is in high category based on classification of Hake.. Whereas students who are taught by LC is 0.56 and students who are taught by CL is 0.40.That enhancement is in medium category. CTSM enhancement of students is supported by its achievement. CTSM achievement of students who are taught by LCM is 41.16 or 73.5% from ideal maximal score. CTSM achievement of students who are taught by LC is 34.35 or 61.3% from ideal maximal score. Meanwhile, CTSM achievement of students who are taught by LC is 26.83 or 47.9% from ideal maximal score.

Based on statistic test result, Viewed from totally students and from all school level enhancement and achievement of students who are taught by LCM is better than students who are taught by LC and CL. CTSM enhancement and achievement of students who are taught by LC is better than students who are taught by CL.

Based on explanation above, viewed from totally students and students from all school level, the use of LCM has significant effect toward students' CTSM enhancement and achievement, even though if viewed from magnitude and category of enhancement it has not been maximal. The use of LCM is more effect toward students' CTSM enhancement and achievement than LC and CL. LC is more effect toward students' CTSM enhancement and achievement than CL.

The result of study show that LCM is better in facilitating students to develop CTSM than LC and CL, and LC is better in facilitating students to develop CTSM than CL. This is possible because in LC students are involved in learning activity actively through discussion to do activities such as exploration, inquiry, and problem solving. Those activities will develop students' mathematical creative thinking skills, as revealed by Ruseffendi (2006). LC also includes activities in the creative process as described by Fisher (1995). Furthermore, Ergin (2012) added that 5E model is the most effective way to involve students in learning. Students involvement in learning will develop their thinking skills among other creative thinking skills.

In LC, students are involved in exploration activity toward concept learned, thus students understanding will become deeper. According to Carpenter (in Franke and Kazemi, 2001), when individuals learn with understanding, they can use the knowledge to solve new problems. Meanwhile, in CL, teacher give concept which is learned directly, students just receive what is delivered by teacher, then students are given problem exercises.Thus in CL development of creative thinking skills is lacking

In LCM, besides having strengths contained in LC, students' metacognition is more empowered compared to LC and CL. Students' metacognition empowerment is done by guiding student to ask

themselves and answer it. Therefore, students will try to realize their thinking process. This is strongly support development of creative thinking skills that which will be used in solving the problem. This is in accord with Panaoura and Phillippou (2005) that if someone not aware of his/her process and cognitive ability, we will not be able to improve his/her performance. Furthermore, Schraw & Dennison (Panaoura and Philippou, 2005) concluded that students who are skillful in assessing their metacognitive and aware of their ability to think are better than students who not aware of their mental system mechanism in solving mathematical problem.

This study result is in accord with study result of Walia (2012) the result of the study indicates significant effectiveness of 5E instructional model on mathematical creativity. Several other studies are consistent with the results of this research include studies conducted by Tuna and Kacar (2013) and Qararch (2012), that the use of Learning Cycle 5E model support students' academic achievement. Schraw (in Toit & Kotze, 2009); Camahalan (2006); Paris & Winograd (in Toit & Kotze, 2009) and Ozcan & Erktin (2015) concluded that metacognitive empowerment support students' academic achievement.

This study also find that there is no interaction effect between learning model and school level toward enhancement and achievement of students' CTSM. Therefore, LCM can be used in medium and high level school, because in whichever level, CTSM enhancement and achievement of students who are taught by LCM will be higher than students who are taught by LC and CL. CTSM enhancement and achievement of students who are taught by LC will be higher than students who are taught by CL.

4. Conclusion and Recommendation

4.1. Conclusion

Based on result study, it can be concluded that viewed from totally students and from all school level, CTSM enhancement and achievement of students who are taught by LCM is better than students who are taught by LC and students who are taught by CL. CTSM enhancement and achievement of students who are taught by LC is better than students who are taught by CL. CTSM enhancement of students who received LCM is 0.70. it is in high category. Meanwhile CTSM enhancement of students who received LC is 0.56 and students who received CL is 0.40.That enhancement is in medium category. Furthermore, there is no interaction effect between learning model and school level toward enhancement and achievement of students' CTSM.

4.2. Recommendation

LCM and LC learning can be used for high school level and medium school level to enhance students' CTSM. To use LCM model, teacher need to prepare worksheet which is used in exploration activity in group discussion. worksheet must be adjusted to the students' level of thinking with attention to the linkages between concepts.

In the stage of engage, to improve student interest, issue or problem situation can be presented with pictures. At this stage of explore, formation of groups was heterogeneous in terms of academic achievement so that discussions run more smoothly. To train students to create mathematical models, in elaborate stage required considerable practice by providing word problems.

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