Research Article

doi: 10.12973/eu-jer.9.2.877

European Journal of Educational Research

Volume 9, Issue 2, 877 - 887.

ISSN: 2165-8714

http://www.eu-jer.com/

Where Exactly for Enhance Critical and Creative Thinking: The Use of Problem Posing or Contextual Learning

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Received: January 4, 2020 ▪ Revised: March 11, 2020 ▪ Accepted: April 13, 2020

Abstract: Learning models that can improve critical thinking, skills collaborate, communicate, and creative thinking are needed in the 21st-century education era. Critical and creative thinking are the two essential competencies of the four skills required in the 21st century. However, both are still difficult to achieve well by students due to a lack of thinking skills during mathematics learning. This study was conducted to determine the model of learning that is appropriate to develop students' critical and creative thinking skills. The study used three-class samples from eighth grade. The first class is given the problem-posing lesson; the second class is given contextual learning and third class as a control class. The results of the study indicate that improving students' critical and creative thinking skills are included in the moderate category for types using contextual learning and problem-posing. Also, it is found that contextual learning is more effective for improving critical thinking skills when compared with learning problem posing and expository learning. Meanwhile, learning problem posing is more useful to enhance creative thinking skills compared with contextual and expository learning.

Keywords: *Critical thinking, creative thinking, problem posing, contextual learning.*

To cite this article: Toheri, Winarso, W., & Abdul Haqq, A. (2020). Where exactly for enhance critical and creative thinking: The use of problem posing or contextual learning. *European Journal of Educational Research, 9*(2), 877-887. https://doi.org/10.12973/eu-jer.9.2.877

Introduction

Critical and creative thinking are very important for students in school and life going forward. Thinking skills of this are necessary to face the 21st century (Sanabria, & Aramburo-Lizarraga, 2017; Koetzsch, 1997), as the objective of mathematics learning (Pieronkiewicz, 2015), analyzing problems and synthesizing (McCormick et al., 2015), make decisions and make judgments (Paul & Elder, 2007). There are essential for solving everyday problems (Swanson, 2016).

Firdaus et al., (2015) states that critical thinking in mathematics is a cognitive ability and disposition to combine knowledge, reasoning, and cognitive strategies in generalizing, proving, and evaluating situations mathematical that are not recognized reflectively.

Mathematics is thinking that tests, questions, connects, evaluates every aspect that is in a particular problem or situation (Unver et al., 2018). Someone who thinks critically will always be sensitive to the information or situation he is facing and tends to react to that situation or information. Therefore, critical thinking skills in mathematics learning can be developed by exposing students to new and contradictory problems so that they construct their thoughts to find the truth and apparent reason (English & Kirshner, 2015).

Results of the 2015 TIMSS Review show Indonesian students are still weak in the content and cognitive domains of mathematics. In line with the findings of Faizah and Murtiyasa (2017), which states that national exam (UN) questions are still minimal in the domain of cognitive reasoning, such as generalize and justify. Lack of linkage between creativity in the curriculum and creativity taught by teachers (Aizikovitsh-Udi & Cheng, 2015), Feeling less ready to show creativity (Mullet et al., 2016).

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Experts and researchers present the various notions of critical thinking. Skills to engage in activities with reflective skepticism (McPeck, 2016). Rational-Reflective thought to decide what to believe or do (Ennis, 2015), a metacognitive process involving analysis, evaluation, and inference (Dwyer et al., 2014). So that in this study, the critical thinking that we use is adopting from Ennis with four indicators: 1) formulating the main issues, 2) analyzing arguments, 3) determining the strategy, and 4) concluding.

The ability to think mathematically creative is a skill in mathematics, which includes fluency, flexibility, authenticity, and elaboration (Purba et al., 2017). Fluency is the ability to answer math problems correctly. Flexibility is the ability to answer mathematical questions through non-standard ways. Authenticity is the ability to answer mathematical problems using language, methods, or ideas themselves. Elaboration is the ability to expand answers to problems, bring up new problems or new ideas (Turkmen & Sertkahya, 2015; Sari & Hidayat, 2019). Creative thinking using in the study refers to Torrance (Yoon, 2017). Stated creative thinking contained innovative creativity (fluency, originality), and adaptive creativity (flexibility, the abstractness of titles, and Resistance to Premature Closure).

The ability to think mathematically creative can be interpreted as the ability to solve mathematical problems with more than one solution, and students believe fluently, flexible, do elaboration, and have originality in their answers. Mathematical creative thinking can be useful for practicing different thinking skills in mathematics. Therefore, to make this happen, it is necessary to choose the right and helpful learning model.

Various efforts were made by teachers and researchers to develop students' critical and creative thinking in mathematics learning. Problem posing is central to the nature of mathematical thinking (Ayll on et al., 2016). Strategies for questions asked by teachers in discussions and play roles in real-life problem solving very well for developing critical thinking (Abrami, et al., 2015). Problem-based learning affects students' mathematical thinking skills (Mulyanto et al., 2018). At the same time, Paul and Elder (2019) suggest Problem Posing as an alternative to improving critical thinking.

The problem-posing approach is also one of the learning approaches that is expected to be able to develop the achievement of competency standards, critical thinking skills, and creative thinking. Cai et al., (2015) revealed that students should be given opportunities to mathematical problem solving using multiple solution strategies and formulate and create their problems from given situations. Students should be allowed to solve mathematical problems using a variety of strategies and to develop and devise their problems from a given position. A learning approach that involves making formulas and questions which is then interpreted as a problem-posing approach.

According to Silver (1994), problem-posing leads to the generation of new problems and the reformulation of given problems. In line with this, Silver and Cai (1996) revealed that mathematical problems were posing as generating a new problem or uncovering (formulating) again, an old problem. Mathematical problem posing is making a new problem or dismantling (formulation) back to an existing problem. Problem posing is one of the learning approaches that can make students become active and develop students' minds so that students can later solve existing mathematical problems (Silver, 1997). Problem-posing and problem-solving led to a deeper understanding of both content and process. Learning that involves a problem-posing and problem-solving approach will bring about a better understanding of the material and the learning process (Cai, 1998).

Posing problems can be carried out individually or classically, in pairs, or groups. Problems or questions raised by first being discussed with other students will result in more developed questions and complete information content. If the items are formulated by a small group (team), then the quality will be higher both in terms of the level of completion and the information content. Collaboration between students can spur creativity and complement their shortcomings. Submitting problems in groups is one way to build mutually beneficial cooperation (Sung et al., 2016). The mathematical problem faced by most students is the lack of ability to solve math problems provided by the teacher, even though the questions given have already been discussed through examples of existing problems. However, by using the problem-posing approach with the cooperative setting, students can be directed to have competence in solving problems of the problems they make themselves in various ways that they can understand.

Guvercin et al., (2014), problem-posing is intellectually a more demanding task than solving problem tasks. Intellectual problem posing is a task that has more requirements than problem-solving tasks. That is, problem-posing activities require or involve more thinking activities that are more intellectual than problem-solving activities. Therefore, problem-posing activities have more influence on the development of students' thinking skills than problem-solving activities. The problem-posing approach with the cooperative setting in this study is a learning approach that emphasizes the making of questions by students based on the situation given by the teacher, with the steps of learning, among others, situation orientation; make a problem; solve problems; class discussion; and provide training (Lester & Cai, 2016).

State the importance of active learning, so students become critical thinkers and how students learn effectively, the role of students, teachers and the context in teaching critical thinking, In line with the traditional paradigm shift and the transfer of information toward constructivism of student activities for more meaningful learning (Bonney & Sternberg, 2015). If the teacher consistently and systematically encourages critical thinking in their class by applying mathematics to real-life problems, promoting debate, and planning investigative lessons, students tend to practice essential skills of thinking and develop critical thinking languages (Aizikovitsh-Udi & Cheng, 2015).

Creative thinking can be developed through problem-posing and problem-solving (Silver, 1997), with a model of eliciting activities (Wessels, 2014). Meanwhile, according to Lince (2016) revealed that models of number head together (NHT) is more suitable to enhance students' creative thinking mathematically. The importance of providing a variety of non-routine issues that enable students to practice asking "why and How" (Apino & Retnawati, 2017). Students are taught how to: identify the steps; evaluate; choose a troubleshooting strategy; identify possible conclusions; accepting logical conclusions; explains how solutions are obtained; and show how the solution can be applied to more extensive mathematical problems (Huang et al., 2016). The importance of student and context analysis, the setting of learning objectives, differences in strategy development, or assessment techniques in designing learning steps on problem-based learning approaches to develop students' critical and creative thinking (Birgili, 2015).

Another approach that teachers can use as an effort to optimize students' critical and creative thinking skills is a contextual approach called Contextual Learning. Contextual Learning is a learning strategy that emphasizes the full process of student involvement to find the material learned and relate it to real-life situations that encourage students to apply it in their lives (Abeliovich, et al., 1993; Surya & Putri, 2017; Selvianiresa & Prabawanto, 2017). Contextual Learning requires a more empowering approach to students in the hope that students can construct knowledge in their minds rather than memorizing facts (Crawford, 2001).

Johnson (2002) Contextual Learning system is an educational process that aims to help students see meaning in the academic material they are studying by connecting academic subjects with the context of their daily lives, that is, with the context of their personal, social, and cultural circumstances. To achieve these aims, the system encompasses the following eight components: making meaningful connections, doing significant work, self-regulated learning, collaboration, critical and creative thinking, nurturing the individual, reaching high standards, using authentic assessment.

Contextual Learning is a learning concept that helps teachers' link material taught with real-world situations and encourages students to make connections between their knowledge and their application in their daily lives, involving seven main components of effective learning, namely: Constructivism, Questioning, Inquiry, Learning Community, Modeling, reflection, and Authentic Assessment (Bevins & Price, 2016). So, contextual learning is a learning concept that connects subject matter with its application in everyday life. Students are required to find and develop new knowledge and skills with the understanding they have. Thus, students will better understand and interpret that knowledge.

This study uses problems posing and contextual learning given to students. Developing critical thinking (analyzing arguments, being able to ask, able, answering questions, solving problems, determining strategies and making conclusions) and thinking creatively (thinking fluently, thinking flexibly, thinking original, and detailed thinking) students. So, many researchers have attempted to use problems posing and contextual learning to improve critical and creative thinking skills. However, there has not yet been found a more effective learning approach than both to improve critical thinking skills and or creative thinking.

Methodology

Research Goal

The quantitative approach is made by a quasi-experimental method (Campbell, & Stanley, 2015) with Nonequivalent Control Group Design (Denny et al., 2017) in sample eighth grade MTs N 1 Cirebon-Indonesia. This research was conducted to see the learning of the mathematical problem posing and contextual learning in improving critical and creative thinking skills.

Sample and Data Collection

The research procedure is done through the determination of 3 class samples, where 2 classes are given treatment and 1 grade as a control. Grade one is treated by learning of problem posing, the second class is contextual learning treatment, and the third class is controlled by expository learning. Prior learning was given preliminary tests with students' critical and creative thinking skills for the three groups.

Implementation of learning problem posing for experiment class 1 refers to pre-positioning posing activity with the learning stages adopting Mathematical education research (Silver, 1994; Silver & Cai, 1996). While contextual learning for experimental class 2 describes the steps of Contextual Teaching Learning with student activity and teacher activity (Johnson, 2002; Selvianiresa & Prabawanto, 2017). While the control class is given expository learning (Ivie, 1998). The second step of learning, namely problem posing and contextual learning carried out in this study, and the steps are in the following table 1.

Table 1. The implementation of a learning problem posing and contextual learning

Type of learning	Stages of learning	
	Teacher activity	**Student activity**
Problem posing	The teacher creates groups in pairs	Students follow the teacher's instructions by creating groups in pairs
	The teacher gives assignments to each group and discusses them, while the teacher controls and monitors student activities	Students discuss doing the commands given by the teacher
	Students are asked to arrange or make questions from the information that has been given	Students arrange questions
	The teacher provides an opportunity to create and discuss the problem in one group	Students review the questions they have made
	Next, the questions are exchanged with other groups and the group discusses problems that have been obtained from different groups	Students exchange questions with other groups
	The teacher asks representatives from several groups (not all groups) to present the results of the discussion questions. And ask for responses from other groups	Students selected present questions and answers that they have completed in groups, and other students respond
Contextual learning	Present contextual problems related to the relationship of the central angle, arc length, and area of the circle on the circle. As well as asking representatives from students to give examples	Listen to the initial explanation from the teacher
	Provide opportunities for students to question and answer material that is not yet understood	Observe and demonstrate examples of content learned in daily life
	Distribute worksheets and assign students in groups to work on worksheets	Ask questions to the teacher about material that is still not understood
	Guiding groups who have difficulty in doing worksheets	Discuss in worksheets according to their respective groups
	Ask representatives from each group to answer the worksheet	Work in groups and ask questions if there are difficulties
	Give awards to the group that gets the highest score	Each group chooses its group representative to present the results of the worksheet in front of the class and answering worksheets on the board

After the implementation of the learning, each group is given a final test related to students' critical and creative thinking skills related to the topic of the circle following the competencies contained in the 2013 curriculum at the subject of the circle and their parts.

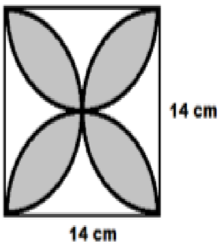
The technique of data collecting was using a description test, which amounted to 9 items. Where are the Test, five questions about which to measure a student's critical thinking ability, and four remaining matters to measure student's creative thinking ability. The test will be done before (pretest) and after learning (postest) in the experiment and control class. Both tests have similar indicators, but are different in the question. The scoring to calculate the results of the description test is by using Holistic Scoring Rubrics criteria (Mertler, 2000). Critical thinking tests using instruments with indicators cover four aspects (Ennis, 2013), details of this including at table 2 below;

Table 2. An instrument of critical thinking

Aspects	Indicator
Analyzing arguments	Determining a problem and identify reasons that match the question
Formulating problems	Digging information by asking and answering through various alternative answers to solve a problem
Determining strategies	Determining an alternative action that is possible to solve the problem
Concluding	Giving a meaningful idea

Examples of pretest and post for determining strategies can be seen in the following figure 1 and 2 below;

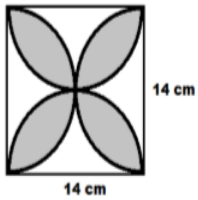
2. Perhatikan gambar di bawah ini.



Jika panjang sisi persegi 14 cm. Bagaimana cara menghitung luas daerah yang diarsir dan besarnya!

In English

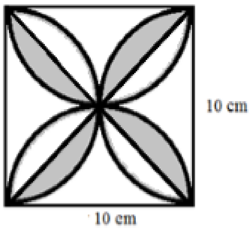
Number 2: look at the picture



The edge of a square has a distance of 10 centimeters. Find the shaded area and how to measure it!

Figure 1. Sample pretest of critical thinking

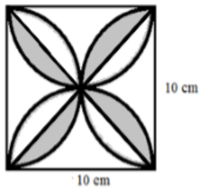
2. Perhatikan gambar di bawah ini.



Jika panjang sisi persegi 10 cm. Bagaimana cara menghitung luas daerah yang diarsi dan berapa besarnya!

In English

Number 2: look at the picture



The edge of a square has a distance of 10 centimeters. Find the shaded area and how to measure it!

Figure 2. Sample posttest of critical thinking.

The creative thinking test uses instruments with indicators, including 1) fluency, 2) flexibility, 3) originality, and 4) elaboration (Torrance, 1972; Almeida et al., 2008; Kim, 2011), details of this including at table 3 below;

Table 3. An instrument of creative thinking

Aspects	Indicator
Fluency	Students can provide relevant ideas to solve problems
Flexibility	Students can express various ways or approaches to a problem
Originality	Students can provide unique answers to solve problems
Elaboration	Students Able to develop ideas or ideas and explain in detail the problems resolved so that they are more interesting

Examples of pretest and post for determining strategies can be seen in the following figure 1 and 2 below;

4. Sebuah taman berbentuk persegi panjang dengan ukuran panjang 5 m dan lebar 3 m. Di dalam taman tersebut terdapat sebuah kolam berbentuk seperempat lingkaran dengan panjang diameter 3 m. Taman tersebut akan ditanami rumput kecuali kolamnya. Jika biaya penanaman rumput tersebut adalah Rp 35.000 untuk tiap 1 m^2, hitunglah biaya keseluruhan penanaman rumput tersebut!

In English

Number 4:

The length of a rectangular garden is 5 centimeters long, and its width is 3 cm. There is a quarter circle pool inside the garden. That's pools have a diameter of 3 meters, and the garden will be planted by grass. The fee spent on every square meter of grass is 35000 rupiahs. Find the total payment should be paying for the garden planted by grass!

Figure 3: Sample pretest of creative thinking

4. Sebuah taman berbentuk persegi panjang dengan ukuran panjang 12 m dan lebar 10 m. Di dalam taman tersebut terdapat sebuah kolam berbentuk seperempat lingkaran dengan panjang diameter 10 m. Taman tersebut akan ditanami rumput kecuali kolamnya. Jika biaya penanaman rumput tersebut adalah Rp 20.000 untuk tiap 1 m^2, hitunglah biaya penanaman rumput tersebut!	**In English** Number 4: The length of a rectangular garden is 12 centimeters long, and its width is 10 cm. There is a quarter circle pool inside the garden. That's pools have a diameter of 10 meters, and the garden will be planted by grass. The fee spent on every square meter of grass is 20000 rupiahs. Find the total payment should be paying for the garden planted by grass!

Figure 4: Sample posttest of creative thinking

This instrument is analyzed in advance to see the validity, reliability, indices of difficulty (easy and middle), and distinguishing power (good and very good) previously tested by experts.

Analyzing of Data

Data analysis techniques used to describe the three learning approaches used are problem posing, contextual learning, and expository learning. The analyzed influence of the use of learning in students' critical and creative thinking skills through normality, homogeneity tests, N-gain calculations, and One Way ANOVA. The normality tests by using the Kolmogorov Smirnov test. While the homogeneity test is intended to test whether the sample groups come from the same population, meaning that the distribution is deep, the population is homogeneous. After the prerequisites are fulfilled, then hypothesis testing is performed research with N-gain calculation for both variables (Creswell & Creswell, 2017). The hypothesis did through One Way ANOVA for critical and creative thinking to the three groups sample research (Gorecki & Smaga, 2015). Next use, to test Data analysis by the Scheffe Test to determine which variable is better. All data analysis is done by using SPPS software version 20.

Results

Overall, the critical and creative thinking for the three groups can be presented in the following table 4;

Table 4. Mean value of creative and critical Thinking

	Critical Thinking		**Creative Thinking**	
	Pre-test	**Post-test**	**Pre-test**	**Post-test**
Eks. 1	38,82	77,37	35,36	79,44
Eks. 2	37,57	77,30	35,47	75,17
Control	36,25	65,14	33,85	63,19

The data in table 4 shows all groups have an average increase from pretest to posttest. This increase occurs in students' critical and creative thinking skills in mathematics, especially with regard to the topic of the circle and their parts. To achieve the intended objectives in this study, the research findings will be presented in 3 sections, namely: the difference in the increase of critical and creative thinking, the best improvement of critical thinking, and the best improvement of students' creative thinking.

Differences in improving the critical and creative thinking skills of the student

The students' critical and creative thinking skills improved in the medium category as measured by N-gain. All students experience this increase in experimental 1 (Problem Posing), experiment 2 (Contextual Learning), and the control group (expository learning). However, the N-gain value varies for both capabilities and the three groups, as shown in Table 5 below.

Table 5. N-gain value of students' critical and creative thinking skills

Class	**N-Gain**		**Interpretation**	
	Critical	**Creative**	**Critical**	**Creative**
Exp. 1	0,63	0,68	Moderate	Moderate
Exp. 2	0,64	0,61	Moderate	Moderate
Control	0,45	0,44	Moderate	Moderate

The data in Table 5 shows that the N-gain of experimental group 1 (who studied with problem-posing) and experiment 2 (who studied contextual learning) were higher than the control group, either critical thinking or creative thinking in mathematics. For critical thinking, the n-gain value of the problem-posing group is higher than the contextual group. Conversely, n-gain creative thinking posing problem groups are lower than contextual groups. Although, all of the treatments give as same criteria about n-gain.

The involvement of students in problem posing and contextual learning are the cause of the development of critical thinking (Abrami et al., 2015; Widyatiningtyas et al., 2015) and creative students (Ayllon et al., 2016). The existence of mathematical problems presented in learning posing and contextual learning makes learning more meaningful (Tan & Halili, 2015).

The differences in increasing critical thinking

To answer the second question, the first analysis used by One Way ANOVA. The differences in critical thinking between groups can be seen in Table 6 below;

Table 6. ANOVA the ability of creative thinking

	Sum of Squares	df	Mean Square	f	Sig
Between Groups	1,127	2	,564	22,128	,000
Within Groups	2,751	108	,025		
Total	3,879	110			

Furthermore, we founded significant differences in students' critical thinking skills between classes in the learning process using problem posing, the learning process using contextual learning, and the learning process using expository learning. The analysis used the Scheffe test, which is a 95% significant level, to know the difference of significance at treatment. The output results of this analysis can be seen as follows:

Table 7. Scheffe test of critical thinking skill

Multiple Comparisons

Dependent Variable: Learning approaches
Scheffe

(I) Learn. App.	(J) Learn. App.	Mean Diff. (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Exp. 1	Exp. 2	-,00753	,0335	,975	-,090	,0756
	Exp. 3	,15240*	,0338	,000	,0686	,2362
Exp. 2	Exp. 1	,00753	,0335	,975	-,075	,0907
	Exp. 3	,15994*	,0340	,000	,0756	,2442
Exp. 3	Exp. 1	-,15240*	,0338	,000	-,236	-,068
	Exp. 2	-,15994*	,0340	,000	-,244	-,076

Table 7 shows significant differences in students' critical thinking skills between classes using problem-posing approaches (Experiments 1) and those using a contextual approach (Experiment 2) with a class using expository learning. However, there is no significant difference in students' critical thinking skills between classes using the problem-posing method (Experiment 1) with those using the contextual approach (Experiment 2). Nonetheless, classes that acquire a contextual learning approach are better than categories using problem-posing methods to the inability of critical thinking.

Real issues related to the student's daily life in contextual learning trigger student activities to identify and analyze information logically, find solutions, and present them argumentatively. Discussions of small groups and large groups trigger them to argue with each other and reasoning that trains them to be more critical. Contextual Teaching and Learning (CTL) is a learning strategy that emphasizes the full process of student involvement to find the material learned and related it to real-life situations that encourage students to be able to apply it in their lives, to empower students with the hope that students can construct knowledge in their minds, rather than memorizing facts (Paul & Elder, 2007).

This is in line with what suggests, Bonney and Sternberg (2015) state the importance of effective learning so that students become critical thinkers and how students learn effectively, the roles of students, teachers, and the context in critical thinking teaching. Contextual learning is a constructivist approach to student activity for more meaningful learning (Tan & Halili, 2015).

The students who learn through contextual have excellent abilities in identifying, formulating things that are known and asked correctly, and the results of calculations are correct. However, the aspect of determining the strategy for problem-solving is less systematically and logically, even though the results are accurate.

The results of the analysis are related to the functional aspects of critical thinking. They can identify 5 to 6 elements contained in a circle. They can provide a good explanation of the exact calculation results, although in concluding, there are still some mistakes.

Differences in Enhancing Creative Thinking

Differences in creative thinking between groups can be seen in Table 8 below.

Table 8. ANOVA the ability of creative thinking

	Sum of Squares	df	Mean Square	f	Sig.
Between Groups	1,127	2	,564	22,128	,000
Within Groups	2,751	108	,025		
Total	3,879	110			

Table 8 shows that there is a significant difference in students' creative thinking ability between classes, which in their learning process use posing, contextual, and expository approaches. The next analysis used the Scheffe test, which is a 95% significant level to know the difference of significance at treatment.

Table 9, shows significant differences in students' creative thinking ability between classes using a problem-posing approach (Experiment 1) and using the contextual approach (Experiment 2) with a class using an expository learning approach. However, there is no significant difference in students' creative thinking ability between classes using the problem-posing method (Experiment 1) with those using the contextual approach (Experiment 2). Nonetheless, the class that acquired the problem-posing learning approach is better than the class using the contextual approach inability of creative thinking.

Table 9. Scheffe test- the ability of creative thinking

Multiple Comparisons
Dependent Variable: Learning approaches
Scheffe

(I) Learn. appr.	(J) Learn.appr.s	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Exp. 1	Exp. 2	,068	,0369	,189	-,0237	,1593
	Exp. 3	,240*	,0371	,000	,1482	,3325
Exp. 2	Exp. 1	-,068	,0369	,189	-,1593	,0237
	Exp. 3	,173*	,0374	,000	,0798	,2653
Exp. 3	Exp. 1	-,240*	,0371	,000	-,3325	-,1482
	Exp. 2	-,173*	,0374	,000	-,2653	-,0798

*. The mean difference is significant at the 0.05 level.

These findings reinforce the results of research (Ayll on et al., 2016), who argue that posing problems can develop students' creative thinking, also supporting the results of research (Silver & Cai, 1996) that problems posing are at the core of mathematical reasoning, a problem that implies students train to ask " why and how "through a variety of problems, so students have various ways, arguments, alternatives in identifying ways to solve problems at hand.

The exercises to make sub-questions from the main problem make them accustomed to finding ideas, ideas in finding alternative solutions. Students are also trained to complete their ideas so that they are triggered to find new ideas or strategies for finding more effective solutions. Sharing ideas in problems posing is an essential medium in finding new ideas and revised old ideas.

Students who learn through problem posing have excellent abilities in aspects of flexibility and elaboration. This is characterized by the ability to provide answers in more than one way, the calculation process, and the results are correct and resolve problems accompanied by reasons or explanations in detail correctly, and the results are accurate.

Discussion and Conclusion

Based on the results and discussions conducted in this study can be concluded that problems posing and contextual learning more effectively used to improve the ability of critical thinking and creative thinking of students compared with expository learning. Problem posing learning enables the development of creative thinking better than contextual learning. In line with the findings that learning problem-posing and problem-solving can develop creative thinking (Ayll on et al., 2016). Conversely, contextual learning is more instrumental in developing students' critical thinking than learning problem posing. In parallel with the traditional paradigm shift and the transfer of information toward constructivism from student activities for more meaningful learning (Tan & Halili, 2015).

Critical and creative thinking can be improved through thinking exercises during the learning process (Bostic et al., 2016). This practice of thought will be formed through the context of problems that are close to their lives, questions that have many ways to be solved.

To provide opportunities for them to share ideas or opinions, give one or two trigger questions by the teacher when they are deadlocked. Teachers should make instructions on how to talk or use talk to ask questions, to explain their thinking, to analyze and solve problems, explore and evaluate ideas, argue, reason and justify (Gillies, 2016).

Furthermore, the study needs to be done to see which aspects of critical thinking and creative thinking can be developed through the problems posing and contextual learning. Also, the research needs to be done through a mixed-method approach to obtain more complete data again. Innovations in problem posing and contextual learning by utilizing technology and collaboration with other subjects need to be done to comprehensively the students can develop, especially to face the century 21 ahead.

Teachers can implement this method for any topic in mathematics. Further studies can be conducted to identify 21st-century character quality through contextual learning and problem posing.

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