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The ability of mathematical creative thinking viewed from student learning interest of class VIII in learning CPS contextual approach

Masrukan [a,*], Andar Jaya Parotua [a], Iwan Junaedi [a]

[a] *Universitas Negeri Semarang, D7 Buildinng First Floor, Sekaran Campus Gunung pati, Semarang 50229; Indonesia*

** E-mail address: J.andar@ymail.com*

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Abstract

The purpose of this study was to determine the effectiveness of Creative Problem Solving learning model with a contextual approach to students' mathematical and creative thinking ability. The population in this study were all students of class VIII SMP Mataram Semarang academic year 2017/2018 spreading in four classes. Sampling was done with selected random sampling technique and resulted class VIII-A as control group and VIII-C as experimental group. Data collection methods used were the test of creative thinking ability, the scale of interest in learning, observation and interview. Proportion test results obtained z_calculation = 2.77 then h_i was accepted, so it can be concluded the percentage of classical completeness. The t test results showed that the difference of two average obtained t_hitung = 8.63 and z_table = 1.68. Since t_calculation > t_table, it can be concluded that the mean of mathematical creative thinking abilities test of experimental class students who got CPS learning with contextual approach was more than the average of the data of mathematical creative thinking abilities tested in control group which achieved Discovery Learning. The proportion difference test resulted z_hitung = 5.67 and z_tabel = 1.64. Since z_count> z_tabel, the proportion of thorough students in the class using the CPS model with contextual cognition was greater than the proportion of students who completed the study in the classroom using the Discovery Learning model. From the result of difference test of average and proportion, it can be concluded that result of the test of the ability of mathematical creative thinking on students in experimental group which applied Creative Problem Solving learning with contextual approach was better than the control group which applied Discovery Learning. Based on the analysis, it can be known the implementation result of Creative Problem Solving learning model with an effective contextual approach in the delivery of material probability class VIII SMP Mataram Seamrang academic year 2017/2018. Students with a high learning interest had a high level of creative thinking ability. Students with fair interest in learning gained enough criterion. Meanwhile, students who had a low interest in learning had low level of creative thinking ability.

1. Introduction

Mathematics learning is closely related to efforts to improve students' mathematical abilities. NCTM (2000) defines mathematical ability as: 1) problem solving ability, 2) reasoning ability, 3) communication ability, 4) connection and 5) ability of representation. Based on the description, the purpose of learning mathematics is that students learn about the values in learning mathematics, have a curiosity in solving problems, can communicate mathematically, and can make the reasoning mathematically. Today the ability of mathematical creative thinking has become one of the important mathematical learning focuses to develop. Students often face various problems in solving problems that are not routine or complicated problems in learning mathematics. Therefore, the ability of creative bracket in

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learning mathematics need to be improved to solve the problem. With the ability to think creatively, students will be able to solve math problems in various ways. According to Yaftian (2015), the ability of mathematical creative thinking is a sustainable nature of the human mindset that can be improved and should be rewarded for strengthening. Educators aim to understand the development of students' creative thinking skills by providing many opportunities for students to express opinions in mathematics learning.

Based on the data of the results of National Exam for Junior High School 2015, the absorptive power mathematics in the city of Semarang on the ability to understand the concept of probability of occurrence and apply it in problem solving reached 48.64%. Meanwhile, the Central Java provincial level only reached 42.72% and at the national level of 56.25%. These facts assert that most students more often memorize the formulas without understanding the actual concept. Also, students are only able to work on problems that are similar to examples so that when the level of difficulty and variation of the given problem is higher than before, students have difficulty in working on these questions. If this continues to be left, the student will have difficulty in studying the concept and solve the problem of materials.

As an effort to improve student learning outcomes, it is necessary to develop an appropriate learning so as to provide opportunities for students to develop students' mathematical creative thinking abilities. It is because through creative thinking, students can find the concept of a material more easily with their own style and provide alternatives ,and more varied way to understand the concept of mathematics material, especially the probability material. Thus, students are able to confidently solve problems related to the probability of an event by exploring the mathematical ideas that are present in each of them. In relation to the above problems, it can be emphasized that efforts to improve the learning process through the effort of selecting the appropriate and innovative model of learning in learning mathematics in school is a very important to be done. One of the intended learning models that can be used to improve the quality of the learning process and outcomes is the Creative Problem Solving (CPS) learning model. According to Hajiyakhchali (2012), CPS aims to enable students to solve the questions given in a way as creative as possible and successfully solve everyday problems well. With the application of CPS, students are given the opportunity to solve problems creatively by maintaining the authenticity of their ideals in developing real solutions. In this model, teachers do not present the concept of mathematics in the complete form, but through problem-solving activities, students are guided to discover the concept itself.

Based on observations and interviews with two mathematics teachers grade VIII and IX on 12 February to 3 March 2108 and the results of first semester final exams 2017/2018 showed the learning was still in form of memorizing concepts given by teachers and it tended to be boring for students. Students found it difficult to apply abstract mathematical concepts so that they could not solve mathematical problems related to everyday life. This can be observed visually where there were some students went out during the class, slept in the classroom, and were not present during the test. This resulted students to have difficulty in solving mathematical problems because the learning model was considered boring. The results of this observation indicated that interest in learning in SMP Mataram Semarang was still in low-level, so there is a need to develop a non-boring learning model that is close to the daily life of the students, and able to improve their creative thinking ability.

Based on the description, it is necessary to conduct a study with the aims to (1) know the effectiveness of mathematics learning in CPS model with contextual approach on students' creative thinking ability; (2) acquire students' mathematical creative thinking ability in terms of student learning interest based on learning model stage of CPS learning. Hence, the researcher conducted research with title of Ability of Mathematical Creative Thinking Viewed from Students' Learning Interest in Class VIII On Learning CPS With Contextual Approach.

2. Methods

The method used in this research was mixed method. Data collection techniques done were test method, scale, observation and interview. Furthermore, this research employed True Experimental design in form of posttest-only control design. In the design of this study, there were 2 randomly selected groups to be the experimental group and the control group. Both groups were given different treatments during the learning, which at the end of the learning they were given a test to determine the ability of mathematical creativity in both groups.

The research design used in this study can be seen in table 1.

Table 1. Research Desain

	Group	Independent Variables	Post Test
R	Experimental	X	O1
R	Control		O2

The population in this study were students of class VIII SMP Mataram Semarang in the academic year of 2017/2018 as many as 228 students. Next, the researchers took two samples from the existing population with random sampling. In this study, two classes, class VIII-A as the control class was given usual learning in the school, namely Discovery Learning model and VIII-C as the experimental class received CPS learning model with contextual approach with probability material.

After the learning was completed, both groups were given the same mathematical creativity thinking ability test to measure students' mathematical creative ability level. A day before the tests were given to the experimental class, a scaled-up interest in the experimental students' study was conducted to determine the subjects to be interviewed regarding the creative thinking ability mathematically viewed from the student's interest in learning. Six subjects were selected based on the student's interest in learning. Two subjects were selected from students with a high learning interest, two subjects selected from students with moderate learning interests, and two subjects selected from students with low learning interests. The following are criteria for interpreting the score.

Table 2. Scale Interpretation criteria of Interest in Learning

Interval Value	Interpretation
$\boldsymbol{X \geq M_i + Sb_i}$	High
$\boldsymbol{M_i - Sb_i \leq X < M_i + Sb_i}$	Moderate
$\boldsymbol{X < M_i - Sb_i}$	Low

After selecting six subjects, two students based on each level of high, medium and low student interest were interviewed. The interview aimed to describe the ability of students' mathematical creative thinking in terms of student's interest in learning. There were four indicators of students' creative mathematical thinking ability contained in the interview, namely smooth in problem solving, refers to the ability to answer the problem well and correctly without doubt, flexibility in problem solving refers to the ability of students generate a variety of ideas with different approaches to solve problems, authenticity refers to the ability of students to provide unique answers, different from other students and true value, and elaboration refers to the ability of students to provide answers that can be developed, added and enrich an idea. Interviews were conducted on six subjects individually outside of school hours so as not to interfere with teaching and learning activities. Interviews were done using semi-structured interview guidelines with reference to test results of creative mathematical thinking skills that have been subjected to work and the results of the scale of student interest in learning

3. Results & Discussion

The study was conducted with special treatment to the experimental class in the form of application of learning using Creative Problem Solving learning model with contextual approach on the opportunity material. Whereas, the control class adopted common learning used by the teachers, namely Discovery Learning. Prior to conducting the research, the initial data required were the scores of the final test of Semester (UAS) of class VIII students, namely class VIII-A, VIII-B, VIII-C, and class VIII-D. Once the preliminary data obtained, they were tested the normality and homogeneity. Once the final data were collected, the researchers did normality test. This test was aimed to find out whether the CPS learning model with contextual approach more effectively to students' mathematical creative thinking ability than the learning model of Discovery Learning. The result of KBKM test of experimental group required students to complete better average, and more proportion from the control group. The final test used the right-side proportion test. Proportional test was done with Ms. Excel program. The results of this test can be seen in Table 3.

Table 3. The proportion of Test Results

$\boldsymbol{z_{Calc}}$	$\boldsymbol{z_{table}}$	Hasil
2.77	1.64	$z_{hitung} > z_{tabel}$

Based on Table 4, the value of z_calc = 2.77 and z_table = 1.64. Because z_count> z_table. Because z_calc ≥ z_ (0,5-α), h_0 was rejected and h_i was accepted. It can be concluded that the percentage of classical completeness in

mathematical creativity thinking ability test on CPS learning with contextual approach gained minimum criterion with value ≥ 70, and reached classical completeness. Furthermore, the average difference test was done by t test. The results of this test can be seen in Table 4.

Table 4. Two Differential Test Results Mean

t_{hitung}	t_{tabel}	Hasil
8.64	1.68	$t_{hitung} > t_{tabel}$

Based on Table 3, the value of t_hitung = 8.63 and z_tabel = 1.68 were obtained. Because t_calc> t_table, it can be concluded that the mean of the mathematical creativity thinking ability test of experimental group students who obtained CPS lesson with contextual approaches was more than the mean data of the mathematical creativity thinking ability test scores of the control class students who received the Discovery Learning. Furthermore, there were two different test proportions of the experimental and control group to test mathematical creativity thinking ability test results. Different test results of these two proportions can be seen in Table. 5.

Table 5. Different Test Results Two Proportions

z_{hitung}	z_{tabel}	Result
5.76	1.64	$z_{calc} > z_{table}$

Based on Table 3, the value of z_calc = 5.67 and z_tabel = 1.64. Since z_calc > z_table. It can be concluded that the proportion of thorough students in the class using the CPS model with contextual cognition was greater than the proportion of students who completed the study in the classroom using the Discovery Learning model.

From the test results, the researchers obtained (1) the average score of students' mathematical creative thinking ability in the CPS learning model with a contextual approach on the material occurrence of an opportunity reached the expected minimum completeness criteria that was 70 individually and achieved completeness lesson in a classical manner that was more than equal to 75 % of the number of students, (2) the mean value of the students 'CBC tests in the class using the CPS model with the Contextual Approach was more than the average of the students' CBC test scores in the class which used Discovery Learning, and (3) the complete proportion of students studying in a classroom that received the CPS model with contextual approaches was more than the proportion of students who completed the learning in the classroom using the discovery learning model. Then, the CPS learning with contextual approaches in the experimental class on the opportunity material was declared effective.

Learning in experimental class using CPS learning with contextual approach can be effective because in this class students were more interested in learning. In the class, students felt new things with the stages of the CPS that went through from the clarification of the problem, disclose opinions, choose, and implement ideas and strategies that arise from student thought. Students were interested in this lesson because of the problem given at the CPS stage aimed to articulate students how the Creative Problem Solving (CPS) learning model can be used in various fields and situations. (Cahyono, 2007: 3). With the above explanation the researcher gave problems close to the daily life situation of the students. This is in accordance with the definition of a contextual approach of teacher-assisted teaching and learning receptiveness and instruction to relate material taught to real situations in everyday life (Bern, 2001). Students were given problems raised from daily life so that students were interested in the problem to be solved because of finding concrete problems about the material opportunities of learning mathematics. To describe the level of creative thinking ability mathematically based on students' interest in learning, the researcher gave a scale of interest in learning and analyzed the results of the test scale to determine six selected subjects from each level of different students' learning interests. Based on these results, it can be accumulated interest in the learning of class VIII C students. There were 6 students who had high learning interest, there were 9 students who had a moderate interest in learning, and 8 students who had low learning interest. Based on the result of the study on interest scale analysis from the 23 students, two randomly selected subjects were selected from each class of students' interest. The subjects of the study are presented on. and Table 6.

Table 6. Research Subjects

Learning Interest	Subjects
High	C-09
	C-12
Moderate	C-06
	C-17
sLow	C-21
	C-22

Interviews were conducted to describe the ability of mathematical creative thinking in terms of student's interest in learning. Students were given 20 individual questions in the form of semi-structured interviews. The results of interview were analyzed based on indicators of creative thinking ability, (1) fluency; (2) flexibility; (3) authenticity; and (4) elaboration. The analysis was done based on the results of KBKM test, the scale of interest in learning and interview on the subject. In this study, the subjects of interview with high learning interest were C-09 and C-12. It is concluded that C-09 and C-12 have met all indicators of mathematical creative ability. In the results of the analysis of KBKM tests and interviews that have been done, the answers given both subjects already meet almost all indicators of the ability of mathematical creative thinking that existed, although there were still answers and responses, especially from the subject of C-12 who was still in doubt, but has approached one indicator of the indicator of flexibility. This was because C-12 subject was more oriented to the standard formula to solve the given problem. This was not to blame because the subject had the freedom in determining the strategy that the subject has during thinking process (authenticity). It can be said that students with high learning interest had excellent mathematical creative ability. Students in this group were on average, and able to understand the material being taught and solved creatively for the given problem. In addition, in the learning, students were actively involved in the learning process both at the time in their respective groups as well as individual tasks.

In this study, the subjects with a moderate learning interest were C-06 and C-17. It is concluded that C-06 and C-17 have met several indicators of mathematical creative ability. In the results of the mathematical creativity thinking ability test analysis and interviews that have been conducted, the answers provided by both subjects met most of the existing mathematical creative thinking indicators. However, the subject of C-06 still could not give an alternative idea / strategy in doing the problem, but has done the given problem correctly and could not solve the problem in detail and clear. The subject acknowledged that the problem could still be further developed and could be solved in a way that shorter and easier, so this subject not met the flexibility and elaboration indicators. The subject of C-17 has met the indicators of mathematical creative ability although the subject in flexibility indicator provided an answer that has not varied from other answers, and the indicators of the authenticity of claimed that the subjects have occasionally mimic the work of his friend.

Subjects in this group still had some shortcomings in solving the problems given. For example in the withdrawal of conclusions from a problem, the subject often forgot to give conclusions on the problems they have solved. However, when the learning took place students in this group often asked the researchers about a particular concept, but when the next meeting the researchers found that the subject in this group forgot the concept. Researchers assumed that the subjects in this group did not repeat the materials taught at home so they often forgot or less understood the material given. This can be overcome by providing more intensive guidance and counseling for the subject to increase interest in learning.

In this study, the subjects with low learning interest was C-21 and C-22. It is concluded that C-21 and C-22 have not met the indicators of mathematical creative ability. In the results of the analysis of mathematical creativity thinking ability tests and interviews that have been done, the answers given both subjects have not been able to meet most of the indicators of the ability of mathematical creative thinking that exist. Even though the subject of C-22 was able to solve the problem in detail and clear, he admitted that the he did not master the problem, so his answer was doubted. The subject explained the problem given with substandard and made many mistakes. Subjects have not been able to explain the process of working fluency with coherent and correct. The subject of C-22 fulfilled the elaboration indicator despite admitting that it still lacked the mastery of the material so that he was unsure of the answers. Based on the results of interviews and mathematical creativity thinking ability test , subject C-21 could not meet one of the indicators of students' mathematical creative ability. The answers and responses given by the subjects were

still less close to the indicators of students' mathematical creative ability. Subjects in this group still had many shortcomings in solving the problems given. Subjects still less mastered material, so they were not maximized in answering the given problem. This was seen during an interview conducted where the subject in this group was less able to explain the results of his own work. This was also reinforced by the claim of a subject who claimed to cheat most of his friend's work. At the time of study, even students in this group often did not pay attention to learning carefully and often joking with friends. This made the subject difficult to solve problems because they have not mastered the material provided. Researchers assumed that the subject did not enjoy the learning of mathematics in school. Subjects also did not study the material taught at home, so they often forgot or less understood about the material provided. This can be overcome by providing more intensive guidance, motivation and advice to the subject to increase interest in the subject of this group.

From the results, it can be seen that students with high learning interests had the ability to think better than students with moderate or low interest in learning. Students with high learning interests possessed excellent mathematical creative skills, were able to do things smoothly, able to work on problems with more than one idea / strategy, could come up with new ideas and give unique answers, and could work on the problem in detail . Students with sufficient learning ability still had difficulty to answer questions smoothly proved by less able to explain back given problem, less able to find more than one idea / strategy in solving problem, but can generate ideas the results of his own thinking with typical answers, but less able to do the problem in detail. Students with low learning interests had a lack of creative thinking ability, students still unabled to explain the problem fluently and correctly, have not been able to find other ideas / strategies to solve the problem, and were still less able to work on the problem in detail.

4. Conclusions

Based on the result of the research, it can be concluded that (1) Creative Problem Solving Learning with Effective Contextual Approach to Creative Thinking Skill of Grade VIII is effective to use for Students on Opportunity Material, (2) Students with high learning interest have high creative thinking ability, students with learning interest are having sufficient levels of creative thinking ability, and students with low learning interests have low levels of creative thinking ability. Based on the conclusions (1) and (2), the CPS learning with the contextual approach is effective on the achievement of the ability of mathematical creative thinking which is viewed from the students' learning interest.

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