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Improvement of Creative Thinking at Elementary School Students Based on Problem Based Learning about Plane Area

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Abstract. This study aims to identify the creative thinking skills of elementary school students associated with the broad material of combining flat structures using problem-based learning. The method used in this study is a quasi-experiment with one group pretest-posttest design. The subjects of the study were fourth-grade elementary school students, amounting 25 people, 14 boys and 11 girls. Methods of data collection using test tools in the form of descriptions, questionnaires and observations. Data analysis methods used a *Mann-Whitney* with a significance level of $\alpha = 0.05$ to analyze the difference in the average *Mann-Whitney* creativity score before testing and the average creativity score after the test using SPSS version 24. The results showed that training based on problems can significantly improve students' creative thinking skills. Improving students' creative thinking skills shows that the indicator of detail in thinking has the greatest increase compared with smooth, original, and flexible thinking. It can be concluded that a problem-based learning model can improve students' creative thinking skills.

Keywords: creative thinking, creative mathematics, elementary school, problem based learning

INTRODUCTION ~ Mathematics is a terrible and complex subject, because it deals with numbers, counting and modeling. Indonesian students are weak in all aspects of content and cognitive, both for mathematics and for science. Indonesia ranks 45th out of 50 countries with 397 points in mathematics and 45th out of 48 countries with 397 points in science (TIMSS 2015).

Changing students' attitudes toward a positive attitude towards mathematics requires strategies for teaching mathematics that are attractive to students, motivate them to learn, provide a sense of security for learning and bring them pleasure. One of the important aspects in mathematics is creativity.

Creativity is necessary to meet the demands of the 21st century. Students should be able to think critically, creatively, communicate and collaborate that are able to compete in the 21st century. This corresponds to the four competencies that students should have in the 21st century, called 4C, namely: critical thinking and problem solving (critical thinking and problem solving), creativity (creativity), communication skills (ability to communicate) and the ability to work together (ability to work together).

Creative thinking implies that students learn to create and apply new ideas in a certain context, see the situation in a new way, identify alternative explanations and see or create new connections that give positive results. Some studies argue that creativity can be supported by a learning environment that fosters questions, patience, openness to fresh ideas, a high level of trust, and learning from mistakes and failures (Ulfah, 2017; Dewi, 2018; Setiawan, 2018).

The creative process in a person consists of six stages, which are usually combined using icedip, namely: inspiration (the stage of generating as many ideas as possible), clarification (focusing on the goal according to the goal), distillation (checking ideas that were generated, and an attempt to determine the work that will be ready), sweating (working with the best ideas diligently), evaluation (rethinking the work done) and incubation (be patient and leave the idea half ready until a brilliant idea comes up). Each of these creative processes must be completed several times, but not sequentially, sometimes in a very short time (Geoffrey, 1997: 7-16).

Every student has different creative thinking abilities. Torrance & Ball, Guilford (Munandar, 2016: 177-193) mentions five indicators of creative thinking, namely: sensitivity, fluency, flexibility, originality, and elaboration. In developing and realizing its creative potential, a person can experience various obstacles that can damage or even kill his creativity both internal nature that comes from the individual itself and that is external which is located in the family, school, peers, or the community and culture. In addition, the level of intrinsic motivation of students will be low if the teacher's attitude is too much controlling and higher and gives more autonomy (Munandar, 2016).

Creative thinking and problem solving is one of the "7Cs" learning skills that must be possessed in the 21st century in addition to communication skills, information, media literacy, collaboration, cooperation, leadership, creativity and innovation (Trilling & Fadel, 2009: 175-177).

Problem based learning (PBL/problem based learning) is one of the innovative learning models that is suitable for all levels of education and for all lessons that can be used to stimulate students' high level thinking skills where they are faced with problem situations which then through solving these problems students can learn more basic skills (Sujana, 2018: 145-174). One of the characteristics of PBL is giving problems that are close to real life and can occur in real life, so PBL is a solution to facilitate students to make the connection between material and real life (Kartikasari et al, 2017). Using PBL depends on the use of everyday cases and problems where students have the opportunity to find new knowledge into their prerequisite knowledge to solve problems. Therefore, they participate in an active process to create innovative solutions to problems through their experience. (Birgili, 2015).

Some studies show that this can improve students' creative thinking skills by solving problems as follows.

1. Nuswowati (2017) proves that PBL in the vision of green chemistry can increase student creativity and creative action.

2. Widiawati (2018) students who learn to use Problem Based Learning integrated with the inculcation of 4C skills have higher level thinking skills higher than those who

learn to use Think-Pair-Share learning with the inculcation of 4C skills.

3. Adnyani, et al. (2018) shows that mathematical problem solving instruments in linear equations are feasible to be used with some revisions of expert judgment.

4. Ambarita, et al. (2018) shows that the development of PBL-based learning can improve the high-level thinking skills of elementary school students.

Based on this background, it is deemed necessary to conduct research into elementary school students' creative thinking skills related to broad material to join flat build through problem-based learning.

METHOD

The method used in this study is a quasi-experimental, using one group pretest-posttest design (Sukardi, 2016) with research subjects of grade IV elementary school students totaling 25 people in the academic year 2018/2019.

Data collection techniques were carried out with documentation, a test in the form of a description to measure the understanding of the material about the area of the flat joining, questionnaire, and observation to see the extent of students' creative thinking abilities.

DATA COLLECTION AND ANALYSIS

Pre-test, treatment and post-test. The purpose of the pre-test and post-test is to find out the creativity of students in solving problems that are observed in the broad material merge flat after learning PBL. Post-test is given to students about one week after the pre-test. After a gap of more than four weeks, the same student is again given a test question. The aim is to test how much knowledge of the lesson students understand.

PROBLEM BASED LEARNING SYNTHES

In giving actions, students work in groups of 4 or 5 people and then each group is given a worksheet using a problem based learning model. Students are encouraged to have active interactions in their group members where students explain their reasons when solving problems. Students evaluate the findings of their group members and decide on the best approach and method to solve the given problem. The presentation is done when all group members have completed their findings. Reflection sheets are also given to each student to evaluate the overall presentation of their peers. The syntax of problem-based learning is used as in the following table (Nurdyansyah and Fahyuni E F, 2016

Table 1. Syntax of Problem Based Learning

No	Indicator	Teacher's activity
1	Student problem orientation	The teacher explains the learning objectives, explains the necessary logistics, offers events or demonstrations or stories to pose problems, and also

		motivates students to participate in individual problem-solving activities.
2	Organizing students to study	The teacher helps students to define and organize learning tasks related to the problem
3	Direction of individual/group experience	The teacher encourages students to gather relevant information, conduct experiments to get explanations and solve problems.
4	Design and submit work	The teacher helps students plan and prepare related work, such as reports, videos, and models, and helps them share their assignments with friends.
5	Analyze and evaluate the problem solving process	The teacher helps students reflect or evaluate their research and the processes they use.

RESULTS AND DISCUSSION

Test results are obtained from preliminary and post-test results. Find out how to improve students' creative thinking skills through problem-based learning. The results are as follows.

Table 2. Normality test for students' creative thinking skills

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Kelompok	Statistic	df	Sig.	Statistic	df	Sig.
Hasil	Pretest	.169	25	.064	.917	25	.043
	Posttest	.174	25	.049	.877	25	.006

a. Lilliefors Significance Correction

Based on the above table 3, the value of Sig namely 0,043 <0,05 and Sig. namely 0.006 <0.05, it can be concluded that the value after testing is not normal. Then comes the Mann-Whitney test to see the average difference for each value.

Table 3. Mann-Whitney: pretest and post-test creative thinking skills

Ranks

	Kelompok	N	Mean Rank	Sum of Ranks
Hasil	Pretest	25	19.80	495.00
	Posttest	25	31.20	780.00
	Total	50		

Test Statistics[a]

	Hasil
Mann-Whitney U	170.000
Wilcoxon W	495.000
Z	-2.776
Asymp. Sig. (2-tailed)	.005

a. Grouping Variable: Kelompok

Based on Table 4, the Mann-Whitney test results give Asymp.Sig = 0.005 <0.05. This shows that there are significant differences in the average score before and after testing. Then we can conclude that there are differences in the skills of creative thinking of students before and after the introduction of problem-based learning, associated with the broad issue of combining a flat design.

PBL models are implemented in accordance with the PBL steps. In the phase of problem orientation, students are grouped to formulate problems from the plot problems of the width of the apartment, developed skills of creative thinking (KBK) - fluency and flexibility; the stage of organization of student training, the compilation of an experiment by students, the development of KBK - fluency, study and originality; stage of individual experience, students conduct experiments developed by KBK - fluency, sophistication and flexibility; stage of development and presentation of work, students submit work, KBK developed fluency and originality; At the stage of analysis and evaluation of the problem-solving process, students conduct group discussions developed by KBK - fluency of speech. Each stage of PBL develops skills in creative thinking and conceptualization.

Students' creative thinking skills have improved significantly. This improvement is because PBL is not designed to help teachers provide students with as much information as possible, but rather helps them develop thinking, problem solving, and intellectual skills. One of the steps towards teaching creative thinking and increasing students' creative thinking is to provide students with space to express their creative thinking. One of the design learning models that creates space for students to think creatively is PBL.

1. Fluency

Students who have fluent thinking skills will give complete answers and the more answers given, the more smoothly the students will think.

This happens because when the PBL process takes place, students are very enthusiastic in looking for problems from the given story problems and trying to find solutions to those problems. In addition, almost all stages of PBL undertaken develop more fluent thinking skills.

2. Flexibility

More than half of the students in the class master creative thinking skills on the indicator of flexibility. Increased flexibility in the pretest and posttest questions is the lowest among other indicators, although it is still in the medium category range. This happens because students are less able to divide the flat shape and calculate the length of the side of each flat shape after it is divided into sections. The difficulty of students in thinking flexibly in classifying things into different categories.

3. Elaboration

In the pretest-posttest, the highest increase in creative thinking skills occurred in the elaboration indicator. Almost all students have creative thinking skills elaboration indicators. This happens because when the PBL process, students find problem solving from the problem of the story and know the formula of flat build requested, also students have high motivation and thinking that mathematics is identical with the count. This is in line with the results of interviews with several students and the distribution of questionnaires, they tend to prefer answering questions rather than reading because their learning is usually done by doing question exercises rather than understanding applications or reading texts that are memorized.

4. Originality

Only half the students in the class master original thinking skills. This shows learning to improve the indicator of originality is quite difficult. Students are used to learning that dictates students to books, so that their ideas cannot develop.

This is proven when the learning process takes place not much different from the source book with the completion steps that are not much different. Students lack confidence in the results of their own thinking so students will look for similarities with other groups or books to strengthen their confidence in the truth of the experiments they make. Therefore, the increase in indicators of creative thinking skills in the matter of pretest and posttest is quite low among other indicators.

CONCLUSION

PBL model characteristics that are applied to the learning process include 5 stages, namely the orientation of students to the problem, students are grouped to formulate the problem from the given story problem; organizing students to learn, designing an experiment; individual / group investigation, conducting an experiment in a laboratory; develop and present the work, presentation; analyzing and evaluating problem solving processes, conducting class discussions.

Creative thinking skills that are seen are fluency, flexibility, elaboration, and originality.

The application of problem-based learning models has been proven to significantly increase students' creative thinking skills in the broad material of joining and building significantly.

The improvement of students' creative thinking skills in the broad material combined with flat figure shows the elaboration indicator has the highest increase then fluency, originality and flexibility.

The response of students and teachers regarding problem-based learning that is applied very positively is that it can improve creative thinking skills and mastery of students' concepts in the plane area

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