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The Effectiveness of Creative Problem Solving (CPS) Learning Model on Divergent Thinking Skills

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Abstract. This study has a goal to determine the effectiveness of the CPS learning process in thematic learning and the effectiveness of CPS on students' divergent thinking skills. The exploratory sequential mixed method was used in this study. The study participants were 184 fifth-grade students at public elementary schools in Laweyan District. Test instruments, observation sheets, and documentation were used to collect research data. The content and construct validations were used to test the validity of the test instrument, while the observation sheet and documentation were only tested for their content validity. This study went through two stages of data analysis, namely quantitative tests (normality, homogeneity, balance, hypothesis, and post-ANOVA tests) and qualitative analysis using interactive analysis methods through data reduction, data display, and conclusion drawing. The results of the study describe the calculation of the hypothesis test with an F obs value of 18.23 which is higher than the F table value of 3.02 with a significance level of 0.05. The average score of students who learn using the CPS model is 69.36 while students who use the DI model obtain an average score of 63.43. Students demonstrate every indicator of divergent thinking skills (fluency, flexibility, originality, and elaboration) during the learning process with the CPS model. Therefore, it can be concluded that the CPS learning model is more effective than DI to improve students' divergent thinking skills. The results of this study can be applied to improve the divergent thinking skills of elementary school students.

Keywords: Divergent Thinking Skills, Creative Problem Solving, Elementary School

1. Introduction

Indonesia's 2013 curriculum seeks to improve the quality of education and produce creative graduates [1]. In the development of this curriculum, students are directed to be able to face life in the future. To realize this goal, students' thinking patterns and processes are upgraded to be more extensive and comprehensive [2]. The ability to think consists of several main components, such as thinking to solve problems, thinking metacognition, convergent (critical) thinking, and divergent (creative) thinking. This way of thinking is a method used to support competitive human resources [3].

Thinking patterns and processes are divided into two, convergent and divergent. Convergent thinking is a way of thinking that focuses on the problem at hand and is not biased by subjective opinions that are not related to the problem, while divergent thinking is creative thinking to use information and ideas as much as possible [4]. Current needs are directed at divergent thinking processes. Divergent thinking is synonymous with

lateral thinking. This thinking is a type of creative thinking to use as much information as possible, sometimes irrelevant or wrong (maybe different from the general), in several stages to solve problems appropriately [5]. Lateral or divergent thinking is exploring various options to find unusual solutions, not just accepting general solutions that seem to have the most potential. The possible choices may not exist before, are considered strange, but thinking laterally will bring out new and innovative ideas, resulting in more varied choices [6].

Divergent thinking is defined as part of the creation and process of creating ideas, information, or new things that are unexpected [7]. The uses for this thinking ability are very broad. It is easier for a person to direct ideas to the right place or condition. This means that the application of thinking is not misplaced and right on target. A person with divergent thinking skills can help himself and even his country to compete, still exist, and show up in front of many competitors both at national and international levels [8]. The Indonesian government has hopes for educators to produce quality graduates, especially in their thinking skills, attitudes, and skills. Emphasizing knowledge without being balanced with qualified attitudes and skills is also not the right way to increase human resource competence. The importance of having divergent thinking has been included in the education curriculum in Indonesia. This ability bridges someone (student or anyone) to be able to accept the reality and the possibility of changing times [9].

Current formal education only emphasizes the development of the cognitive domain over affective. Teaching in schools still rarely demands divergent or creative thinking. Many teachers apply conventional learning models, so it is not surprising that student learning outcomes are not optimal. Several observations made by previous researchers were not in line with student learning outcomes. Student learning outcomes do not reflect whether the learning process leads to the divergent or creative thinking of the students. Student learning activities do not facilitate them to actively ask, answer questions, think flexibly, or think broadly. Students are still asked to memorize, imitate teacher's orders, have a lack of original thinking, and are unable to explain things in detail.

The problems at school are not just discussed without any basis. Survey results from several well-known world organizations such as the 2016-2017 World Economic Forum and the 2018 PISA results also provide data that is not much different from conditions in the class [10]. The thinking ability of students in Indonesia is still far from expectations, especially the analytical, critical, creative, and divergent way of thinking. Previous research provides evidence that the emphasis of these abilities is rarely done by teachers [11]. Teachers have not found the right way to optimize divergent thinking skills.

The problem of low divergent thinking skills can be overcome with the creative problem solving (CPS) model. This model emphasizes creative problem-solving skills [12]. Through this model, students can use divergent thinking skills to select and develop responses. CPS model is a learning model that implements teaching and problem-solving skills followed by strengthening skills [13]. Student-centered teaching characterizes this model. The implementation is not just reading, memorizing, noting the material, but teaching is carried out through more weighty processes such as critical, creative, and metacognitive thinking [14]. CPS learning has a character in teaching that is treated to

problems at the beginning of learning. As the name implies, students must be able to solve problems creatively or in various ways [15]. Previous research has revealed that this model is successful in being a creative and well-conceptual way of teaching [16].

The CPS learning process consists of four stages. The first is problem clarification. Problem clarification includes explaining the problem posed to students so that they can understand the expected solution. The second stage is expressing an opinion. At this stage, students are free to express opinions about various solutions/problem-solving. The third is evaluation and selection. Here, each group discusses which opinions or solutions can solve the problem more effectively. At this stage, students use critical, selective considerations by thinking in a convergent manner. They choose the best alternative as a solution. The next stage is implementation. Students determine which solutions they can use to solve the problem and then apply them until they find a solution to the problem [17].

The advantage of the CPS model is it places students in real situations because the problems raised are complex and meaningful [18]. Students can work in groups, collaborate, and show a professional attitude in confronting the problem with the widest possible real situation [19]. Each learning implementation is often faced with various problems as every learning model has the main advantages and disadvantages. Through this model, students are trained to design meaningful inventions and have a realistic attitude in solving problems [20]. CPS model allows students to be more creative through group work [16]. The steps of this model can train students to come up with mathematical ideas, think critically, systematically, logically, or according to data and facts, and train their social interactions [15].

Similar studies have been carried out. A study combines the CPS model with the creative thinking of junior high school students in terms of student interest in learning [21], which is almost similar to this study. The difference is that this study is not related to students' learning interests because researchers only find out student activities during learning and prove that the CPS model influences students' divergent thinking skills. Another study on the CPS model aims to describe students' personalities towards their creative thinking skills [22]. This study has a similarity with the present study in the use of the CPS model as an alternative innovative model. It can be said that it does not have the same variable as the present study. This study describes each stage of the CPS model and relates these stages to each divergent thinking indicator. The researchers also prove the effectiveness of this model on divergent thinking skills through an experiment. This research is aimed at fifth-grade students who enjoy learning while playing. They are deemed suitable and in line with the stages of the CPS model and indicators of divergent thinking skills with the levels from the lowest to the highest. Based on this, this study aims to see the CPS learning process and the effectiveness of the model on students' divergent thinking skills in thematic learning.

Based on this explanation, the formulation of the problem of this research is whether the CPS learning model is effective against students' divergent thinking skills in thematic learning. Following its objectives, this study aims to see the CPS learning process and the effectiveness of the model on students' divergent thinking skills in thematic learning.

Thus, this research hypothesizes that the CPS learning model is effective against students' divergent thinking skills in thematic learning.

2. Research Methods

2.1. Research Design

This study used a mixed-method. The mixed-method is a type of research that combines two methods (qualitative and quantitative) to obtain more valid or verified data [23]. The method used was the exploratory sequential mixed method. It is a method that combines two methods, qualitative and quantitative, sequentially. The qualitative method was used in the first stage, followed by a quantitative method in the second stage.

2.2. Research Participants

The population in this study consisted of all fifth-grade students of public elementary schools in Laweyan District, Surakarta, Indonesia for the 2019/2020 academic year. This study was conducted at public elementary schools throughout Laweyan District, Surakarta City, with a total of 184 students. There were six partnering elementary schools, public elementary schools of Kleco 1, Begalon 2, Purwotomo, Tegalsari, Jajar, and Pajang 3. The fifth-grade students were chosen as the research subjects. The researchers chose fifth-grade students because their thinking processes have gone through a transition period. They can think concretely and follow systematic directions.

2.3. Data Collection Technique

Test and observation techniques were used to collect data. There were eight essay questions used. The material used has been integrated with thematic learning. Each question is represented by each indicator of divergent thinking skills. The indicators are fluency, flexibility, originality, and elaboration. Before the instrument was used as a data collection tool, data validation was conducted. Test and observation instruments were validated for their construct and content. The assessment was carried out by expert judgment in accordance with the indicators of each variable. The test instrument was initially tested to find out its accuracy. The test results were then calculated for their validity and reliability. A research instrument has good quality and can be accounted for if its validity and reliability have been proven. The data were validated using product-moment correlation formula. The results showed that the test instrument could be used to collect the data because it scored more than 0.30. Then, the test instrument was analyzed for its reliability. The score was more than 0.70. This means that the instrument has high consistency.

2.4. Data Analysis Technique

Interactive analysis with three stages (data reduction, data display, and conclusion drawing) was applied [24], while the quantitative procedures are as follows:

a. Distributing test instruments according to the specified material.
b. Performing the normality test using the Liliefors test.

c. Performing the homogeneity test using Bartlet test.
d. Performing the average similarity test with one-way variance analysis of different cells.
   The hypothesis tested is:
   H_0: $\mu 1 = \mu 2$ (There is no effect of CPS learning model on students' divergent thinking skills)
   H_1: $\mu 1 \neq \mu 2$ (There is an effect of CPS learning model on students' divergent thinking skills)

3. Results and Discussion

Data on students 'divergent thinking skills can be seen through observations during the learning process and the final test results.

3.1. CPS Learning Process in Thematic Learning

The learning process with the CPS model has run effectively and created a pleasant learning atmosphere. Every learning activity facilitates students to provide solutions or create new things to solve problems because the learning process in the experimental class has gone quite well following the steps of the CPS model. The stages of the CPS model begin with problem identification/classification. Then, students express their opinions on what they have learned during learning. Evaluation and selection are the third stages in the CPS model. In this stage, students evaluate some of the opinions of group members to then choose the best solution. The final stage is implementation. Students implement the results of the discussion with group members to answer all the problems being discussed.

In CPS learning, there is a group performance strategy that involves all members to actively work. At the first meeting, the students were asked to make concept maps about the text they had read and analyzed. Before making concept maps, they were first directed to observe the problems presented about human respiratory organs through the media. After that, they had Q&A with their teacher and tried to clarify the main problem from the picture of the human respiratory organ. The students mentioned and explained problems about respiratory organ material to each other. Problem clarification is needed because the solution to a problem depends on understanding the problem itself [25]. Once the problem has been formulated, the next steps can be followed easily. Next, students made work charts of human respiratory organs in groups. To make this work chart, they expressed their opinions, conducted evaluation, and selection. In the end, they have the most favored discussion results. The last stage, implementation, was carried out by communicating the results in front of other groups. It is different from learning in the control class, which only comes from one direction. The teacher explained the material and the students listened carefully. During the first meeting, students were still fixated on the teacher's instructions, but the directions were clear. They still look confused even though they had been explained many times by the teacher.

At the second meeting, they were getting more and more active. Students who learn to use CPS and DI models can engage in learning. The stages carried out were essentially the same as the first meeting. However, the difference is the material. At the second

meeting, students learning with the CPS model played a small game, talking stick. This game led to a discussion of the benefits of oxygen for human life. Those who got the stick were asked to make a concept map according to the problems posed by the teacher spontaneously but might have discussions with their group members. Because the learning is thematic, there are several basic competencies carried out by students, such as material on types of businesses, economic, and deliberation activities in the community.

At the third meeting, the students were getting used to asking questions and enjoying the CPS learning stages. They experimented by making props about how diaphragm muscles work. They demonstrated independently by bringing the tools and materials in groups. After creating and demonstrating, they completed the worksheets given by the teacher. The worksheet measures the students' abilities in making teaching aids and understanding the function of their props. At the fourth to the eighth meeting, the students understood each stage of the CPS model. The teacher rarely provided directions, and even the students did not need verbal instruction anymore. They could already carry out their respective duties and roles properly and independently.

CPS learning has triggered the students to think divergent. They are more focused and able to face problems in the classroom. Students act as a teacher because they can carry out various activities. They can combine the steps of CPS model appropriately. Each learning step facilitates indicators of divergent thinking skills. Thus, students' divergent thinking skills are increased. Students can achieve fluency level because the stages of CPS model have been sequenced and enable students to solve problems well. In addition to supporting the fluency indicator, the stage of expressing opinions also supports the indicators of student flexibility because students can express their opinions from several different points of view. They try to find various alternative solutions to problems [26]. Therefore, every student must be creative, think divergent, and have high inventiveness. Furthermore, the originality indicator is supported during the evaluation and selection stages, while the elaboration indicator is represented at the implementation stage. Evaluation and selection activities facilitate students to review their opinions by providing an explanation of each opinion expressed, thereby eliminating irrelevant strategies/methods/solutions [27].

By carrying out the stages of CPS model in sequence and continuously, students will be familiar with even a complicated learning process. They are used to solving problems correctly. This habit will become a characteristic or learning style of students because it is done repeatedly and in a relatively long time. Learning style will influence the student's way of thinking (knowledge, attitudes, and skills) [28]. In other words, learning style or habit can affect student learning outcomes or achievements.

3.2. The Effectiveness of CPS Learning Model on Divergent Thinking Skills

After the learning process and test of divergent thinking skills, the data on divergent thinking skills using CPS learning model and conventional model were found as in the following figure.

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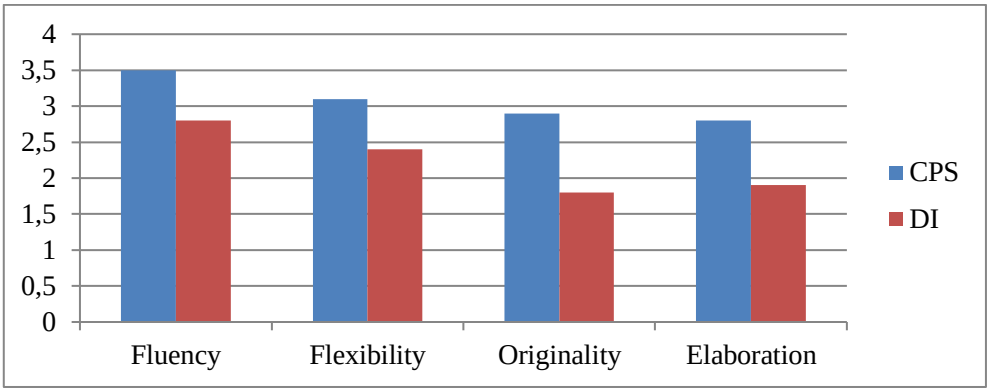

Figure 1. The average score of post-test for each indicator of divergent thinking skills

From the diagram, we can see the differences in the average scores of students in each indicator. In CPS model, the highest average score is on the fluency indicator while the lowest is on elaboration. In DI model, the highest score is on the fluency indicator while the lowest is on originality. From each indicator, it shows that the average score of the experimental class is higher than that of the control class.

Table 1. Average score of divergent thinking skills

	Average Score (Experiment)	Average Score (Control)
$\bar{X}$	69.36	63.43
I	12.34	9.35

The data above show that the average score of students' divergent thinking skills in thematic learning in the class using CPS learning model is higher than the class using DI learning model. Student learning activities with CPS model are more focused and well-conceptualized. In CPS learning, there is a group work strategy that involves all group members to complete the assignments given by the teacher so that no students are passive in learning. They are also trained to dare to express their opinions and discuss with group members in finding, investigating, and creating different ways of solving problems or assignments given by the teacher so that they can solve any problem in their environment more easily [29].

In DI learning, the learning process does not involve students actively. They only listen and note what the teacher explain so that they get bored easily. Students are not required to find their problems and are not required to have divergent thinking skills in providing or creating different ways of solving problems [30]. After finding the differences between the two learning models, the data analysis was carried out by first performing a normality test using Liliefors test, which results are presented in the following table.

Table 2. The result of normality test calculation

	Experimental Class	Control Class
L_0	0.0871	0.0874
L_t	0.0928	0.0939

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Table 2 above shows that $L_0 < L_t$, which means that both classes are normally distributed. Then, the researchers conducted a homogeneity test of variance using Bartlett test with the test criteria of $F < F_{table}$. From this test, it was found that $F = 3.771$ and $F_{table} = 5.991$. After that, a hypothesis test was carried out using the one-way variance analysis test of different cells to determine the effectiveness or effect of CPS learning model on students' divergent thinking skills with the testing criteria that H_0 is rejected if $L > L_{table}$. The calculation results are as follows:

Table 3. The result of hypothesis test calculation

L	L_{-table}	Conclusion
18.23	3.04	H_0 is rejected

Based on table 3, $L > L_{table}$, which means that H_0 is rejected. This shows that the CPS learning model influences students' divergent thinking skills. The results show that the model influences students' thinking abilities. However, these results are supported by the teaching process and student attitudes in learning. Students show an enthusiastic and happy attitude during teaching so that some students get good grades. An example of a picture of student work after participating in CPS learning is in the following picture.

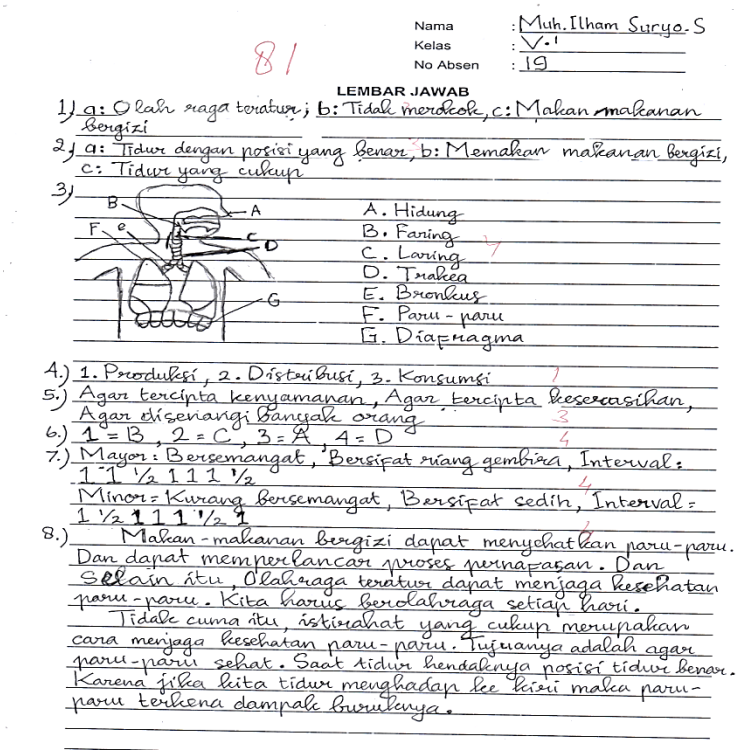

Figure 2. Examples of student work results

Figure 2 is an example of a student getting good grades. Students complete each question item in detail. However, students still experience some difficulties. Students do not get the maximum score at number 4. Question item 4 is asked to explain the types and mention examples of economic activities in the community. The student only cited

examples, without explaining each type of economic activity. Then, more deeply analyzed the students' reasons for not answering the questions completely. Students said that they did not master the concept of types of economic activity. Likewise in number 2, students only got a score of 3 out of 4. The average student wrote almost similar answers. From the observation and analysis of student learning outcomes, there are no answers that show originality.

Each student has different competencies. In thinking skills, students have a way of thinking and a point of view to assess new things. Students have shown divergent thought processes when viewed from observations in class. However, the results of the analysis of student learning scores still lead to convergent answers. Students' answers are still at the level of memory, explanation, implementation, and a little analysis. Some have reached the realm of synthesis and creation, but not many. The average student answers are also less varied and similar to books. Although the test items have been made as creative as possible, the students' way of thinking is still heavy on convergent thinking. A result certainly has a cause. After being analyzed with several techniques (observation and interviews), students were not familiar with varied teaching. Students are also not used to working on high order thinking test items. They are used to taking the test in a multiple-choice form.

The multiple-choice test forms and essays have different levels of difficulty. The essay form is open and aims so that students can answer questions freely but still in line with the questions asked. The strength of this test is that students organize their answers, students cannot guess answers, and are suitable for measuring and evaluating the results of a complex and difficult to measure learning process [31]. This test trains students to choose facts that are in line with the problem and express a completely integrated thought. Meanwhile, the weaknesses of multiple-choice questions, among others, are that the test answers in the form of multiple choices are easier to correct, easy to analyze, and only need a short time [32]. However, the weakness of this form of the test takes longer to make questions. The teacher cannot know the process of solving student questions [33]. Another weakness could be that students answer questions only by speculation.

The use of the right learning model will make the learning process run well which aims to solve problems that arise in the learning process and result in an increase in learning success in the form of students' creative thinking skills. This is following the results of previous studies showing that students' thinking skills after receiving treatment with innovative learning begin to increase [34], [35]. This research is supported by several previous researchers. As previously explained, students have difficulty explaining things in detail. From several studies on the use of the CPS model, many of them acknowledge the success of this model so that students have more opportunities to explain in their language. The CPS model affects student learning outcomes because teachers' pay attention to each student's character and master the material, student conditions, and pay more attention to students [36]. Motivational support also influences the successful implementation of this model. This model has also been used successfully by some teachers who implement distance learning.

CPS learning model can be used to improve students' divergent thinking skills in thematic learning because this model can train students to think or reason in trying to provide the correct answer to an existing problem in a different form even in a new form systematically [37]. It means that the CPS learning model has an effect or has effectiveness (achievement) on students' divergent thinking skills in thematic learning. Previous research has also proven that the CPS model produces high scores and affects students' creative thinking skills [38]. There is an opinion from previous researchers. CPS is a unifying tool to achieve thinking skills, problem-solving, collaboration, and decision making. Previous researchers concluded that the CPS model made learning effective in the classroom. The result, students better understand mathematical concepts when viewed from understanding mathematical concepts [39].

4. Conclusion

Based on the results and discussion, it can be concluded that the CPS learning process effectively influences students' divergent thinking skills and they can optimize their role during the learning process. Students are more active, dare to act independently, and can provide ideas or thoughts seamlessly, flexibly, originally, and in detail. CPS model helps them to solve problems and create new ideas. Therefore, the theoretical results of this study can be used to determine the appropriate learning model for thematic learning. Meanwhile, in practice, this study can be an alternative strategy for teachers to apply it in their classrooms.

Learning with the CPS model provides opportunities for students to learn to solve problems related to teaching materials so that students can explore their abilities. During the research, researchers encountered obstacles. There are several serious obstacles in this study. Some teachers have not mastered the steps of the learning model they use, so the researchers suggest them to prepare as best as possible, starting by looking for references of the model used to understand the detailed steps of it. Researchers recommend that teachers practice mastering students and classroom situations with alacrity. Teachers can ask other teachers through sharing sessions about the problems they experience during classroom learning. Another problem that arises is that several CPS stages do not significantly increase student learning outcomes. Thus, the researchers recommend other researchers to use other problem-solving models that support divergent thinking processes, such as problem-based learning model, problem posing, etc.

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Muna Fauziah as the second writer is in charge of assisting the implementation of research, collecting data, finding reference sources, helping data processing.

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