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The Enhancement of Creative Thinking Skill Using Creative Problem Solving Learning Model

Syarifatul Luthfia[1]*
[1]Al-Irsyad Banyuwangi Elementary School, Jawa Timur, Indonesia

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***Correspondence Author:**
syarifatulluthfia@gmail.com

Abstract: This study aims to determine students' creative thinking skills by applying the creative problem-solving (CPS) model to electricity material with fluency, flexibility, originality, and elaboration indicators. The subjects of this research are 27 sixth-grade students in Al-Irsyad Banyuwangi Elementary School. This research was conducted through classroom action research consisting of two cycles. Data were collected using essay test instruments with scores of 1 to 4. The results of the diagnostic assessment of creative thinking were 43.17. After applying the CPS model, the results showed that the average fluency was 52.78 (cycle I) and 58.80 (cycle II), flexibility was 48.15 (cycle I) and 64.35 (cycle II), originality was 41.67 (cycle I) and 57.87 (cycle II), and elaboration was 62.96 (cycle I) and 68.98 (cycle II). The class average score increased to 51.39 and again to 62.5 in cycle II. Based on these data, applying CPS in learning electricity can improve students' creative thinking skills.

INTRODUCTION

Students' competitiveness in the 21st century relates to the Industrial Revolution 4.0. To prepare students for this era by using the 4C approaches (Creative Thinking, Critical Thinking, Communication, and Collaboration), which are applied throughout the learning process. Creativity is essential for problem-solving, and teachers are expected to design learning approaches or methods to develop students' creative skills. Therefore, they must understand their students' potential and determine the proper techniques to enhance their creative thinking abilities (Mandari Arbia et al., 2020).

Creative thinking skills are emphasized in 21st-century education among students worldwide. Teachers must know the importance of effective teaching and learning strategies to improve students' creative thinking abilities (Jamal & Ibrahim, 2020). Creative thinking is a thinking process that involves fluency, originality, elaboration, and flexibility. It is a cognitive skill that promotes problem-solving and innovation (Fatmawati et al., 2022). Creative thinking is one of the divergent thinking skills. Students will easily analyze a problem if they are able to use good critical thinking skills, so that the problem they face can be solved effectively. Creative thinking skills have been needed since primary school because They are the golden generation. They are curious, think concretely, enjoy interaction with friends, and like investigation. In this case, they need exceptional guidance from the teachers (Fauziah et al., 2020).

The learning model that can improve creative thinking skills is the CPS (creative problem solving). One of the learning models that can attract students to be able to think and work actively and creatively is Creative Problem Solving (CPS). It can connect the problem-solving process and creative thinking skills. CPS is a process that presents the framework to plan and develop ways to solve problems by using creative thinking skills (Ummah & Yuliati, 2020). Creative thinking skills include fluency, flexibility, originality, and elaboration. Fluency refers to the ability to generate many ideas or multiple answers. Flexibility refers to the ability to create diverse ideas. Originality refers to the ability to produce unique ideas. Elaboration refers to the ability to detail, develop, assess, and enrich ideas (Appulembang et al., 2014). The results of the research conducted by Fatmawati et al. (2022) were that the experimental class obtained significant average scores on fluency (78.00), flexibility (77.00), and originality (54.73) compared to the control class, namely fluency (60.18), flexibility (55.48), and originality (50.18). This study concludes that the CPS learning model impacts students' creative thinking on all indicators with an increased average value in the experimental class.

Another study has found that Creative Problem Solving (CPS) is more effective than Direct Instruction (DI) in developing divergent thinking skills (Fauziah et al., 2020). In line with the research result of Kartikasari et al. (2022), the CPS model is more effective than the DI (Direct model) in influencing creative thinking skills. The CPS model can change the habits from convergent thinking to divergent thinking. The model through open-ended experiments can improve students' scientific work in formulating problems, describing problems, designing investigations, conducting experiments, processing data, and making conclusions (Heliawati et al., 2021). The research findings demonstrated that implementation of the CPS (Creative Problem-Solving) model positively influenced students' creative thinking skills in terms of fluency, flexibility, and originality (Fatmawati et al., 2022). The learning process of the CPS model is: (1) Clarify the problem, (2) Ideate through brainstorming, (3) Develop to formulate solutions, and (4) implement (Satriani & Wahyuddin, 2018).

The results of the research on the application of the CPS (Creative Problem Solving) model show that the model is effective for improving creative thinking skills in science material. based on the results of the t-test of student worksheets showed a value of 5.035 in the control class and 10.041 in the experimental class (Fahrisa & Parmin, 2022). A study on the application of biomimicry using the CPS (creative problem-solving) model was conducted. Biomimicry is a sustainable design approach that utilizes the knowledge of nature's efficient resource utilization. The study reveals that the use of CPS and its creative tools can empower students to establish a well-structured and organized process (Mejía-Villa et al., 2023).

Creative thinking skills are one of the abilities needed to improve student competencies in the era of the Industrial Revolution 4.0. Based on this background, this study aims to determine students' creative thinking skills through the CPS model in learning electricity in grade 6 Al-Irsyad elementary school. The indicators measured are fluency, flexibility, elaboration, and originality. This is a teacher's effort to improve student competence in the era 4.0.

METHOD

This type of research is a classroom action research consisting of 4 cycles, namely plan, action, observation, and reflection, can be seen in figure 1. This classroom action research takes November 2023. The subjects of the research are 27 male sixth-grade students in Al-Irsyad Banyuwangi Elementary School. The researcher in this research is a science teacher and one partner teacher is an observer learning in the classroom.

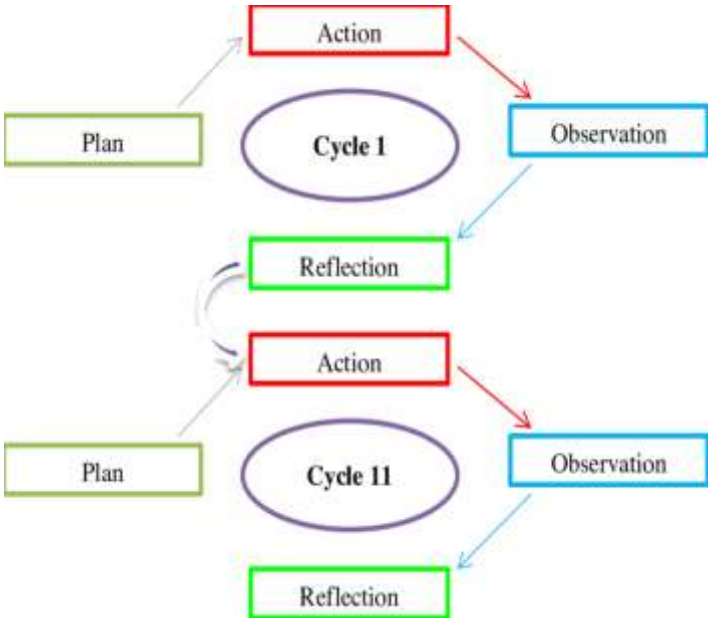

Figure 1. The cycle of classroom action reserach (Yampap et al., 2019)

The planning step begins with giving students a cognitive diagnostic assessment of creative thinking about basic electrical materials. The cognitive diagnostic assessment measures indicators of fluency, flexibility, originality, and elaboration. From the assessment, the teacher as a researcher knows the initial condition of students' creative thinking. The planning step begins by providing students with a creative thinking diagnostic assessment regarding basic electrical material. In this classroom action research, the researcher focuses on providing an effort that can help improve student learning outcomes for the better. In the learning process carried out it will be carried out by considering various factors that can influence student learning outcomes. During the research process, observations and research will be carried out. The assessment is carried out as one of the teacher's efforts to find out what the actual effect is after giving special treatment to students.

The assessment carried out in this research is a cognitive diagnostic assessment, where the cognitive diagnostic assessment will be used to measure indicators of student fluency, flexibility, originality and elaboration in the learning process. From this assessment, the teacher as a researcher knows the initial conditions for students' creative thinking. The creative thinking diagnostic assessment is based on the creativity domain that will be measured as in Table 1. Next, the teacher can determine learning methods to overcome the problems found. Teachers use lesson plans as lesson plans and learning tools.

Table 1. Distribution Item of Electrical Creativity diagnostic assesment

No. Item	The Indicator of Item	Creativity Domain
1	Students can give ideas or impacts if the world is without electricity.	Fluency and Originality
2	Students can give choices on where and how they use electricity	Fluency
3	Students can give ideas or opinions about actions to save electricity	Fluency and Originality
4	Students are able to draw a simple electrical circuit design with electrical components that have been presented in the drawing.	Flexibility and Elaboration
5	Students can give an opinion of a problem if the light bulb cannot be lit.	Flexibility
6	Students can give detailed instructions or design on the steps to turn on a light bulb	Elaboration

Table 1 above explains how the distribution of Electrical Creativity Diagnostic Assessment Items actually occurs among students. The data obtained shows that the 6 questions produce several domains of student creativity where there are 2 indicators in the Fluency and Originality domain, 1 indicator in the Fluency domain, 1 indicator in the Flexibility and Elaboration domain, 1 indicator in the Fluency and Elaboration domain, 1 indicator in the domain Fluency and Elaboration, 1 indicator in the Fluency and Elaboration domain, flexibility domain and 1 indicator in the elaboration domain. Then the Creative Thinking Test Items were assessed which can be seen in Table 2.

Table 2. Scoring Items of Creativity Thinking Test

Aspect	Respons	Score
Fluency	No answer	0
	1 answer 1 idea	1
	2 answers 1 idea	2
	2 answers 2 ideas	3
	More 2 answers	4
Flexibility	No answer or wrong answer	0
	1 wrong idea and does not provide another point of view	1
	1 wrong idea but provide another point of view	2
	1 right idea	3
	Gives more 1 ideas	4
Originality	No answer	0
	The same idea as others	1
	The idea is the result of adaptation of other people's ideas and does not yet contain novelty	2
	The idea is the result of adaptation of other people's ideas and contain novelty	3
	Unique idea	4
Elaboration	No answer	0
	Able to understand the problem, provide problem solving that is not detailed and coherent and does not use science principles	1
	Able to understand the problem, provide detailed and coherent problem solving, and do not use science principles	2
	Able to understand the problem, provide detailed and coherent problem solving, use science principles but not precise enough.	3
	Able to understand problems, provide detailed and coherent problem solving, use science principles appropriately	4

Scoring for all items is determined based on the scoring criteria as shown in Table 2. The items in this section are given four marks. rubric of fluency, flexibility, originality, and elaboration modified from the rubric creative-thinking in research (Jamal & Ibrahim, 2020; Wahyudi, 2017; Wenno et al., 2021). As for determining the level of creative thinking of students based on three categories which can be seen in Table 3

Table 3. The Level of Creativity Thinking Based Three Categories

Marks	Level of Creativity
0-33	Low
34-67	Moderate
68-100	High

Table 3 shows the meaning of median scores to determine the level of creative thinking. Three levels of creative thinking are low level (a score of 0 to 33), moderate level (a score of 34 to 67), and high level (a score of 68 to 100) (Jamal & Ibrahim, 2020; Kumari et al., 2014). This research is based on action steps that have been well prepared and planned, where the action steps in this research consist of 2 cycles. The first cycle consists of 2 meetings and the second cycle consists of 3 meetings. The second cycle was implemented to improve the shortcomings in the first cycle. In the first meeting, students learned about electrical components and created simple electrical circuits. In the second meeting, students carried out the first test. The first test consists of 4 questions.

The indicator of the first question is that students can understand the problem and solve it by creating a designed electrical circuit with certain electrical components. It measured elaboration. The indicator of the second problem is that students can provide another view to turn on the light bulb and measure fluency. The indicator for the third problem is that students are given a solution to turn on a light bulb without a light fitting and battery holder. This measures flexibility. The indicator of the last item is that students create LED lamp designs (mini lamps) which are measured for originality. It measures flexibility. The final item indicator is that students create an LED lamp design (mini lamp) whose originality is measured. The results of the phase I creative thinking test are used as evaluation material to improve learning in cycle II. The reason for the evaluation from cycle one is to include problems and obstacles that occurred during the research, especially obstacles that are considered to be able to influence student learning outcomes so that stage I evaluation is very important to measure how students understand, so that students in stage II will not make mistakes. as in stage I. This is what makes one of the advantages of action research in changing or improving student learning outcomes during the research process.

The research process after the first cycle will continue to the second cycle which consists of three meetings (3rd, 4th and 5th meetings). In the third meeting, students create a series of circuits and find the advantages and disadvantages of the series. At the fourth meeting, students make parallel circuits and find the advantages and disadvantages of the circuit. At the last meeting, students were given 8 items to measure creative thinking. At the last meeting, students were given 8 questions to measure creative thinking. The questions used are questions that researchers believe are able to help students show their

true abilities. The questions are prepared using valid and very good criteria so that they can become a test tool that is truly capable of measuring student understanding. The distribution of creativity test items in the last test can be seen in Table 4.

Table 4. Distribution Item of The Last Test

No.Item	The Indicator of Item	Creativity Domain
1	Students can draw serries circuit design	Fluency
2	Students can draw parallel circuit design	Fluency
3	Students can draw the detail circuit design for the case study presented in the problem.	Elaboration
4	Students can draw another prespective design circuit from a case study	Flexibility
5	Students create LED lamp design	Originality
6	Students give opinions or solutions for the lit light bulb without batteray problem	Originality

In Table 4 the researcher explains how the final test questions are distributed which are used as the final step in the research of each cycle, which in this research is called reflection. From the results of the electrical thinking creativity test, the teacher analyzes learning deficiencies to improve or perfect learning in the next cycle. The reflection process at the end of cycle II is used to draw research conclusions about whether the research will be completed by seeing whether there have been any improvements or whether the research will continue in the next cycle.

RESULT AND DISCUSSION

One type of assessment is cognitive diagnostic assessment that aims to determine the basic knowledge and initial condition of students. The teacher wants to know the students' creative thinking ability through creativity diagnostic test. Cognitive diagnostic assessment is a method for providing effective feedback. This text presents the concept of assessment as information about students' performance or understanding. It has the potential to provide useful information for teachers to improve their teaching (Sun & Suzuki, 2013). Cognitive diagnostic assessment refers to a set of cognitively based diagnostic procedures that attempt to identify students' strengths and weaknesses regarding their knowledge structures and processing skills (Lee & Sawaki, 2009).

There are 6 basic questions about electricity topics given to students to find out their fluency, flexibility, originality, and elaboration. The diagnostic test results can be seen in Figure 2. The results of the Fluency indicator are 10 students are at a low level, 16 students are at a moderate level, and 1 student is at a high level. The average of this indicator is 42. For the flexibility indicator, 15 students are at a low level, 11 students are at a moderate level, and 1 student is at a high level. The average of this indicator is 37,5. For the originality indicator, 15 students are at a low level, 11 students are at a moderate level, and 1 student is at a high level. The average of the indicator is 34,26. For the elaboration indicator, 2 students are at a low level, 16 students are at a moderate level, 9 student is at

a high level and the average of this indicator is 59,26. The classical average of the diagnostic test of thinking creativity was 43,17.

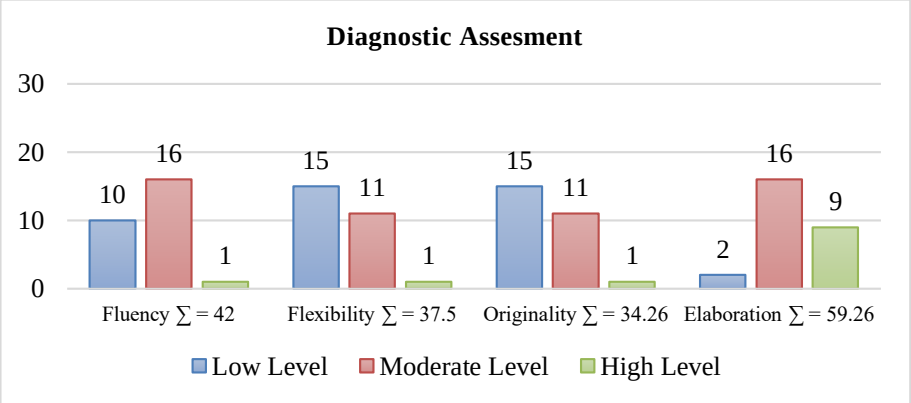

Figure 2. The result of Diagnostic Assesment

Based on the cognitive diagnostic test results, it shows that students' creative thinking skills must be improved. Teachers create a lesson plan using CPS (creative problem solving) as one of the models to improve students' creative thinking skills. The CPS (Creative Problem-Solving) model had a positive influence on students' creative thinking skills in terms of fluency, flexibility, and originality (Fatmawati et al., 2022). The learning process of the CPS model is: (1) Clarify the problem (2) Ideate through brainstorming (3) Develop to formulate solutions and (4) implement (Satriani & Wahyuddin, 2018).

The first stage of CPS is clarifying the problem. The teacher challenges the team with the question: "What are the electrical components and how do they function?" and "How do you turn on a light bulb with the components in front of you?". The second step of the CPS model is brainstorming and the third step is the formulation of solutions. Each team is given the opportunity to draw electrical components and draw more than one simple circuit design in their notebooks. After brainstorming, some teams drew simple electrical circuits, which can be seen in Figure 3. There were teams that drew only 2 circuits, 4 circuits, and 5 circuits. Drawings circled in red are ineffective circuits. The number of drawings, right or wrong, the teacher still appreciates their efforts.

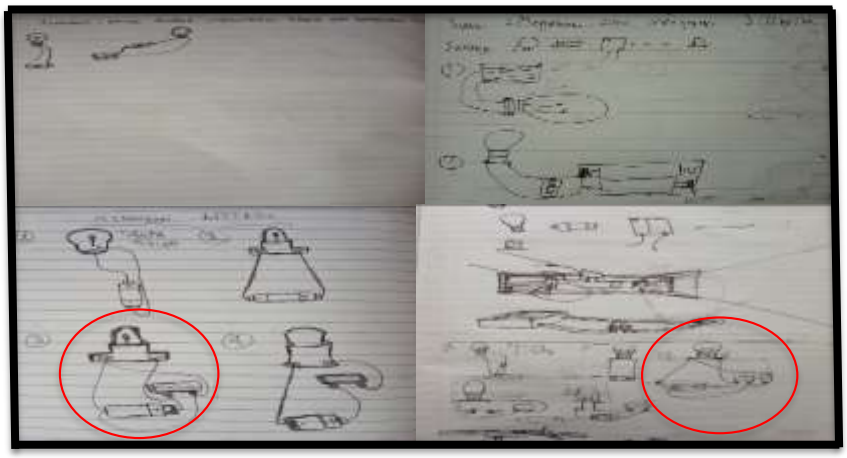

Figure 3. The differences in the results of drawing simple electrical circuits

In Figure 3, it is clear how different the results of students' drawings are in making simple electrical circuits. From the 4 pictures that the researcher shows in this article, it is clear how different students' views differ, this is of course because the way to understand and interpret knowledge will vary according to the child's ability to implement the knowledge they have. The children's ability to implement their knowledge can be seen in Figure 4.

Figure 4. Implement step

In Figure 4 it is clear how the implementation of teachers and students in carrying out the learning process also becomes a means for evaluating which sequences are right and wrong. This application section is used to strengthen the concepts students get from the material that has been taught. After evaluating and finding the best or most appropriate circuit, the team implemented the idea as in Figure 4, so that it became a preparation for making the learning process in cycle I better. The results of the first cycle can be seen in Figure 5.

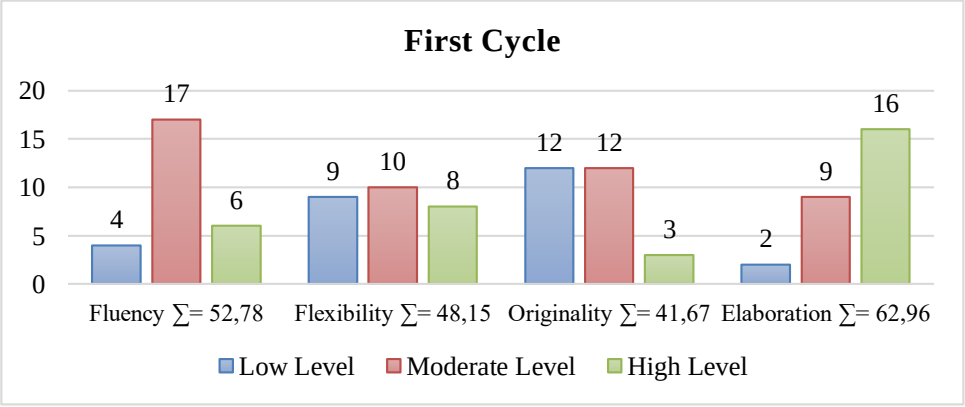

Figure 5. The result of First Cycle

The result of first cycle test can be seen in Figure 5. The results of the Fluency indicator are 4 students are at a low level, 17 students are at a moderate level, and 6 student is at high level. The average of this indicator is 52,78. For flexibility indicator are 9 students are at low level, 10 students are at moderate level, and 8 student is at high level. The average of this indicator is 48,15. For originality indicator are 12 students are at low level, 12 students are at moderate level, and 3 student is at high level. The average of the indicator

is 41,67. For elaboration indicator are 2 students are at low level, 9 students are at moderate level, 16 student is at high level and the average of this indicator is 62,96. The classical average of the first cycle test was 51,39. It shows that there is an increase in students' creative thinking from pre-learning to the first cycle, which is 8,22.

If we compare the diagnostic assessment with the first cycle, we find that the first cycle test results across all indicators have improved. Each indicator saw a decrease in the number of low-level students and an increase in the number of high-level students. The average for each indicator has also increased. Based on the average creative thinking, it shows that students' fluency, flexibility, and originality, and elaboration are at a moderate level. Reflection based on the results of data analysis in cycle 1, it can be concluded that students' learning outcomes have increased from an average score of 43,17 to 51,39 and classically students' creativity thinking is in the moderate level category.

However, in the learning activity, there were still shortcomings, including the teacher's lack of guiding students to find new ideas. Teachers should be more creative in guiding students to look for new ideas and maximize brainstorming between groups. To maximize brainstorming between teams, the teacher provides an idea canvas worksheet as a team idea drawing sheet. Then the teacher and teams paste the worksheets on the board. All teams can see their drawings and those of other teams. Based on the results of the researcher's observations of student activities during learning, they provide a good and orderly pattern. This gives them a different perspective in understanding familiar material. Teachers and teams work together to evaluate work to find the best or most appropriate design. Then the team carried out the evaluation results which can be seen in Figure 6.

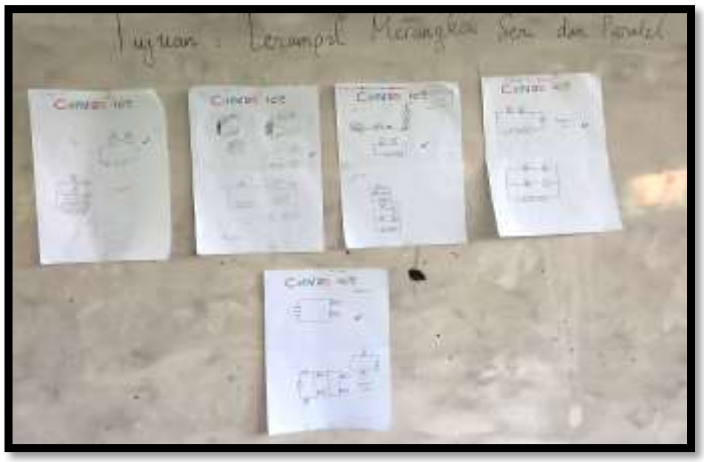

Figure 6. Brainstorm Among The Team Through the Idea to Canvas

Figure 6 clearly shows the student learning activities carried out during the research process in electrical learning, where students in groups carry out an analysis together which will later be expressed in the form of an image. The group learning process will provide enthusiasm and increase students' interest in learning where they can exchange information and understanding that they have individually in the learning process. Students' ability to make a conclusion after discussion is considered an Inter-Team Brainstorming Through

Ideas to Canvas. The ideas expressed are an accumulation of knowledge that students have during the learning process. The results for the second cycle can be seen in Figure 7.

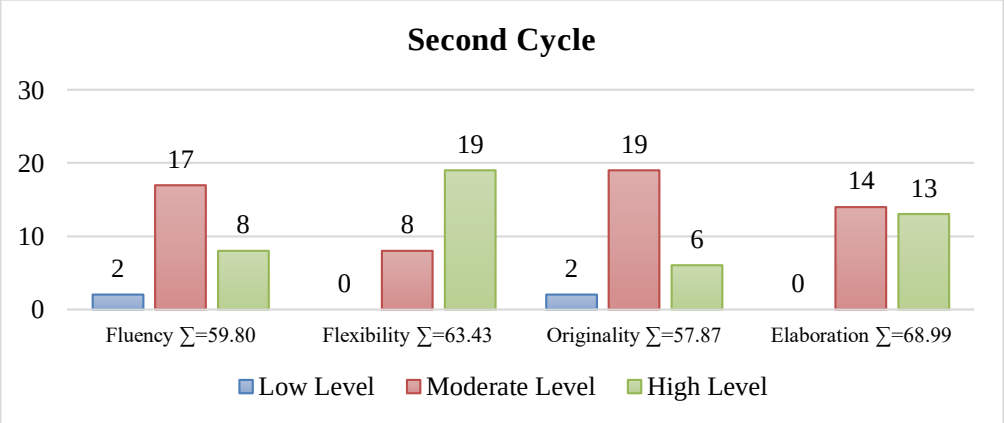

Figure 7. The result of Second Cycle

The result of the second cycle test can be seen in **Figure 7**. The results of the Fluency indicator are 2 students are at a low level, 17 students are at a moderate level, 8 student is at a high level and the average of this indicator is 59,80. For the flexibility indicator, no students are at a low level, 8 students are at a moderate level, 19 student is at a high level and the average of this indicator is 63,43. For the originality indicator, 2 students are at a low level, 19 students are at a moderate level, and 6 student is at a high level. The average of the indicator is 57,87. For the elaboration indicator, no students are at a low level, 14 students are at a moderate level, 13 student is at a high level and the average of the indicator is 68,99. The classical average of the second cycle test was 62,5. It shows that there is an increase in students' creative thinking first to the second cycle, which is 11,11.

If we compare the first cycle with the second cycle, we find that the second cycle test results across all indicators have improved. Each indicator saw a decrease in the number of low-level students and an increase in the number of high-level students except the elaboration indicator. The elaboration indicator has decreased the number of students who are at the low level and high level of thinking creativity. The average for each indicator has also increased. Based on the average creative thinking, it shows that students' fluency, flexibility, and originality are at a moderate level and the elaboration indicator is at a high level. Reflection Based on the results of data analysis in cycle II, it can be concluded that student learning outcomes have increased from an average score of 51.39 to 62.5 and classically, students' creativity is thought to be in the medium level category. Because the increase has occurred, we can actually provide an initial understanding and conclusion that the researcher believes is that this research has had a fairly good effect, even though there has not been a maximum or drastic change. Of course, further research must be carried out so that the researcher's data or initial information can strengthen further research in the future.

The results of two cycles of research aimed at improving students' creative thinking skills show that the CPS (Creative-problem solving) model has contributed to improving fluency, flexibility, originality, and elaboration which are indicators of creative thinking

skills. Of these indicators, originality is the high challenging aspect to improve. Students' creative thinking skills must be trained continuously in learning.

CONCLUSION

Based on the results of the research and discussion at all stages of the research conducted in class VI A Al-Irsyad Banyuwangi Elementary School, it is concluded that students' creative thinking skills in electrical subjects have increased after participating in learning with the CPS (creative-problem solving) model. We can see from the average value of students before applying the CPS model that it was 43.17; after participating in learning by applying the CPS model, the average value of student learning outcomes increased to 56.25 and again to 62.5 in cycle II. The CPS model improved influence, flexibility, originality, and elaboration. The results of this study show that the originality aspect has a high challenge to be improved. On the other hand, the elaboration aspect has a higher average than other aspects. Creativity thinking skills must be trained continuously in the learning. Maximizing brainstorming sessions is a critical stage in improving creative thinking skills.

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