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Enhancement of Problem-Solving Skill Using IDEAL Problem-Solving Learning Model

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ABSTRACT

The requirements of 21st century student competencies are getting more complex. One of the skills that must be developed is problem solving skills. The objective of this research is improving problem-solving skills in electricity through IDEAL problem-solving skills. There are five steps in IDEAL, which are (1) identify the problem; (2) define the goal; (3) explore possible solutions, ideas, or strategies; (4) anticipate results and act; and (5) review and learn. The results of the midterm exam in science subjects for the sixth grade of Al-Irsyad elementary school are low. Based on the research results, it indicates that students' problem solving must be improved. There are 11 students at the insufficient level, 6 students at the sufficient level, 6 students at the good level, and 2 students at the excellent level. This research method used classroom action research. Classroom action research consists of four steps, which are planning, action, observation, and reflection. This research consisted of two cycles. The class average in the first cycle was 85.28. There were 5 students at the less level, 8 students at the sufficient level, 2 students at the good level, and 10 students at the excellent level. The class average in the second cycle was 85.36. There were 5 students at the poor and fair level, 2 students at the good level, and 13 students at the excellent level. The class average was 85.36 and better than the first cycle about 0.6. Therefore, it means that the IDEAL problem solving model is effective in improving students' problem solving skills.

Keywords: *IDEAL, Problem-Solving Skill, Science Learning*

INTRODUCTION

The rapid development in the 21st century requires students to be more active in thinking and solving problems (Prilia et al., 2021). Currently, educational policies aim to develop individuals with 21st century skills, which are considered as universal needs. Problem-solving skills have appeared as a main requirement of the 21st century (Ince, 2018). Four learning competencies that students must have in the 21st century are indicated as 4Cs, which are (1) critical thinking and problem solving; (2) creativity and innovation; (3) communication; and (4) collaboration (Astuti et al., 2019). The 21st century requires students to learn and improve themselves through training or experience. Training provides insight, knowledge, changes in attitude, and skills that can be used to solve problems and adapt to the environment. Humans do learning activities in various ways depends on their situation. When someone has learned a new attitude, there will be changes that reflect the learning action. This change is referred to as student achievement. The learning process involves cognitive changes (knowledge), affective changes (feelings), and psychomotor changes (behavior). The learning model serves as a means to facilitate the teaching and learning process and encourage various student learning activities (Damopolii et al., 2018).

Problem solving ability is a competency or skill that students need in the 21st century. Problem solving is an approach to train students in solving problems through predetermined steps (Wijayanto & Santoso, 2018). The indicators of problem solving include (1) understand the problem and mention in detail the known and the asked; (2) plan problem solving or write a model to solve the problem; (3) solve the problem as planned; and (4) evaluate the results and draw conclusions (Winarti, 2017). Children use scientific skills, such as information seeking and problem solving, to explore and interact with the physical world around them. Problem solving has several components, such as having a goal, identifying obstacles to achieve it, using several strategies to solve the problem by applying relevant knowledge and social resources, and evaluating the results (Fusaro & Smith, 2018). Problem solving skills cannot be obtained instantly. Students must practice continuously. Teachers can design classroom learning according to students' motivation level. Non-routine tasks can be assigned to students to improve problem solving skills (Ulya, 2016). The problem solving model should be effectively implemented in the classroom as it has a positive effect on student achievement (Damopolii et al., 2018).

The problem solving learning model has an impact on students' critical thinking skills. The results of the research indicated that the critical thinking ability of experimental class students was 0.40 (medium) and the control class was 0.23 (low). The t-test results indicated that the experimental and control classes were quite different (Sunarti & Ristiani, 2018). There has been a shift in science education to help students understand phenomena and design solutions to

problems, rather than simply teaching scientific concepts (Krajcik, 2015). The acquisition of scientific understanding involves integrating content, procedural and epistemic knowledge through problem solving (KIND & OSBORNE, 2017). Multidimensional teaching approaches often involve different domains such as science, technology, engineering, math and computer science simultaneously. Therefore, problem solving can serve as a general and common approach to teach across all these domains (Priemer et al., 2020). The IDEAL Problem Solving model involves the following steps: problem identification, goal setting, strategy planning, strategy implementation, and review and evaluation (Rosyada & Wibowo, 2023). IDEAL is one of the problem solving models to improve students' problem solving skills. There are five steps in the IDEAL problem solving model, which are (1) identify the problem; (2) define the goal; (3) explore possible solutions, ideas, or strategies; (4) anticipate results and actions; (5) look back and learn (Islamiah et al., 2022; Maula, 2020; Nayazik, 2017). Diagram of the IDEAL problem solving model is illustrated on Figure 1.

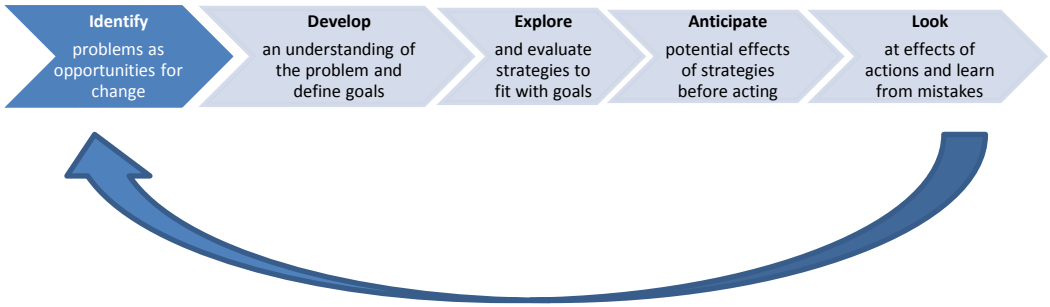

Figure 1. IDEAL Problem-Solving Model
Source: Loseby (2021)

IDEAL problem solving is useful for students' ability to learn. This model is suitable for solving well-organized problems that are clearly defined and structured (Maula, 2020). The ICT-assisted IDEAL problem solving model can assist students in improving their mathematical connection skills and self-efficacy (Ningrum et al., 2020). Based on the research results of Indriyani (2016), it indicates that the IDEAL model can create active learning and 74.01% of student activities are discussions to solve problems based on the strategies they choose. The IDEAL model can improve students' academic achievement and students give a positive response to the IDEAL model.

Based on the evaluation results of science subjects in the midterm exam at Al-Irsyad Elementary School in Banyuwangi, it indicates that students' problem solving skills are still low (deficient). Almost at least half of the 25 grade VI students in the class have low problem solving skills even though the questions

provided are still of the LOTS type. One of the factors causing this phenomenon is low interest in learning. On the other hand, teachers realize that student competencies in the 21st century are getting more complex. School education must develop students' potential and equip graduates to continue their studies to a higher level and survive in the real life (Ratumanan & Ayal, 2020).

For electrical experiments, students are asked to analyze their findings. They worked hard in the process to improve their cognitive, affective, and psychomotor abilities. Based on this background, teachers use the IDEAL problem solving model to improve students' problem solving skills. The purpose of this research is to enhance problem solving skills among 6th grade students at Al Irsyad Elementary School Banyuwangi by using the IDEAL problem solving model in electrical learning.

RESEARCH METHODOLOGY

The methodology of this research is classroom action research consisting of four cycles, such as planning, action, observation, and reflection which presented in Figure 2 (Jayantika et al., 2019). Classroom action research has been implemented in Indonesia for many years, after receiving training and education (Nurhayati & Sulistyowati, 2022). It aims to improve the teaching and learning process, which will improve learning outcomes. If CAR is implemented appropriately, it is expected that teachers will be able to teach better in their classrooms.

The research subjects consisted of 25 sixth grade male students of Al-Irsyad Elementary School Banyuwangi. The teacher formed 5 groups in the classroom. The groups were formed to prioritize brainstorming sessions. Teamwork is needed to solve the problem optimally. They had to practice collaborating to solve the problem. The research was conducted in November 2023. The data collection technique used HOTS-based problem solving essays at the end of each cycle. The essay is a form of exercise or test chosen by the teacher to determine the students' understanding of a problem, rewriting the problem, and presenting answers from various perspectives to solve the problem.

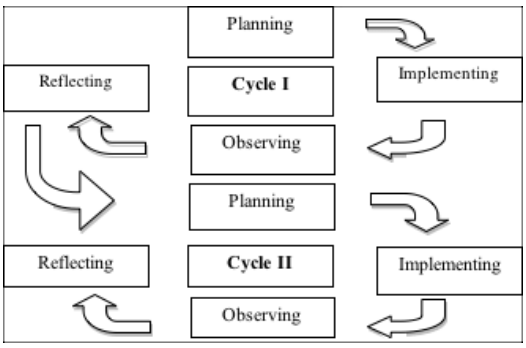

Figure 2. The Diagram of Classroom Action Research
Source: Jayantika et al (2019)

The results of the midterm exam in science subjects were used to determine the initial condition of students in the 6B class of Al-Irsyad Elementary School Banyuwangi. The minimum standard of completeness for all subjects at Al-Irsyad Elementary School Banyuwangi is 75. Determination of student categories or predicates is formed by class intervals. The Class Interval formula is calculated as follows:

$$Class\ Interval = \frac{maximal\ value - standard\ minimum\ completeness}{3}$$

$$Class\ Interval = \frac{100 - 75}{3}$$

$$Class\ Interval = 8.3$$

The results of class interval calculations indicated that the length of the call interval for each predicate was 8. However, Table 1 presents the groupings and predicates of test results from class interval calculations, which serves as a guide for teachers to group their students. Based on these results, the teacher will develop a learning improvement plan in the planning step.

Table 1. The Groupings and Predicates of The Exam Result

Interval	Predicate	Description
93-100	A	Excellent
84-92	B	Good
75-83	C	Fair
< 75	D	Poor

Source: Curriculum 2013 Teacher Training Experience

The action step consisted of two cycles. The first cycle consisted of three meetings, and the second cycle consisted of three meetings too and aimed to overcome the shortcomings of the first cycle. In the first meeting, students were introduced to electrical components and in the second meeting students made a simple circuit. In the third meeting, students took the first test. The distribution of items in the first test can be observed in Table 2.

Table 2. The Item Distribution in The First Test

No.	Constraints
1.	Students find problems from literacy, provide solutions about electrical components from other science components, and guess their names and functions.
2.	Students draw a simple circuit of the electrical components in number 1.
3.	A case study of someone forgetting 2 components: a light fitting and a battery holder. The students were asked to solve the problem and draw a circuit without these components.

Source: Processed Data by Researcher

The second cycle consisted of three meetings (3rd, 4th and 5th meetings). In the third meeting, the students created a series circuit and identified its advantages and disadvantages. In the fourth meeting, students made a parallel circuit and evaluated its advantages and disadvantages. In the last meeting, students were given a test to measure their problem-solving skills, which can be observed in Table 3.

Table 3. The Item Distribution in The First Test

No.	Constraints
1.	A case about a problem faced by someone who wants to make a decorative lamp. He has 3 lights and 2 batteries. He wants that if he turns on one light, the other lights also turn on. Students are asked to tell the problem, determine the type of circuit, and draw the circuit.
2.	A case about a problem faced by someone who wants to create a mixed circuit. He has 5 lights, and 2 batteries, 2 switches, and wires. He wants to create a circuit where L1, L2, and L3 are connected in series. Students are asked to narrate the problem and draw the circuit.
3.	The teacher provides a series drawing circuit. Students are asked to determine the type of circuit, explain its advantages and disadvantages.
4.	The teacher provides a picture of a mixed circuit. Students are asked to determine which lights are arranged in series and parallel. Students are also asked to determine which lights turn on if a certain switch is turned on.
5.	A person makes a circuit (in this case parallel). He faces a problem, which is that the lights of both lamps are dim. Students are asked to solve this problem, determine the type of circuit, what are the properties of the circuit (wiring costs, and if one lamp is broken will the other lamp be broken).

Source: Processed Data by Researcher

The final step of classroom action research is reflection. Based on the results of the problem-solving test, the teacher analyzes the learning deficiencies to improve or enhance learning in the next cycle. Reflection at the end of the second cycle was used to draw conclusions about the research.

RESULT AND DISCUSSION

The teacher identified a problem with the large number of students who scored low on the midterm exam in science subjects. The minimum standard of completeness for all subjects at Al-Irsyad Elementary School Banyuwangi is 75. While for science subjects, the evaluation results in the midterm exam can be seen in Diagram 1.

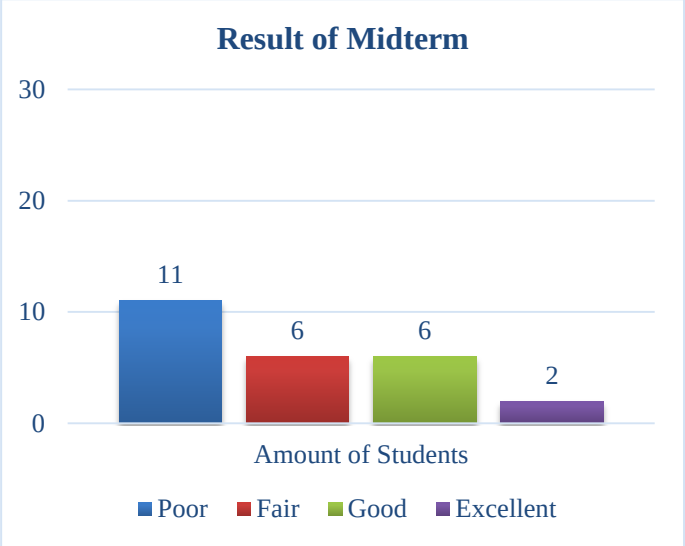

Diagram 1. Evaluation Results of Science Subjects in Midterm Test Outputs
Source: Processed Data by Researcher

The evaluation results of science subjects in the midterm exam indicated that students' problem solving skills were still low (deficient). There were 11 students at the poor level; 6 students at the fair level; 6 students at the good level; and 2 students at the excellent level. Almost at least half of the 25 grade VI students in the class have low problem solving skills even though the questions provided are still of the LOTS type. One of the factors causing this phenomenon is low interest in learning. On the other hand, teachers realize that student competencies in the 21st century are getting more complex. School education must develop students' potential and equip graduates to continue their studies to a higher level and survive in the real life (Ratumanan & Ayal, 2020).

Based on the midterm test results, it is understandable that students' problem solving skills still need to be improved. In order to overcome this problem, the teacher has developed a lesson plan that incorporates the IDEAL problem-solving model as one of the strategies to improve students' problem-solving ability. The IDEAL model consists of five steps, such as identifying the problem, defining the goal, exploring possible strategies, anticipating the outcome and acting, and looking back and learning (Islamiah et al., 2022).

The teacher gives two tasks. The first is the problem of "What are the components of electricity?" From this problem, the teacher and the team collaborate to set learning objectives. The teacher gives teams the opportunity to brainstorm and discuss potential solutions. After brainstorming, each team identifies the electrical components, as illustrated in Figure 3.

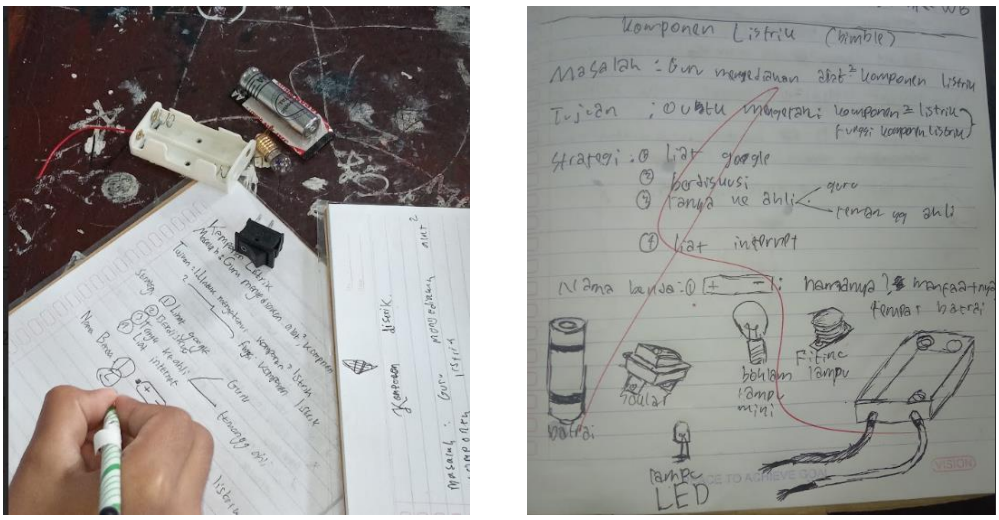

Figure 3. Brainstorming to Identify Electrical Components
Source: Processed Data by Researcher

The second problem in the second meeting, the teacher gave a problem about "How do you turn on a light bulb with the electrical components in front of you?" After they knew the name and function of each component, students and their groups discussed again how to make a simple circuit to turn on the light bulb. The teacher becomes a facilitator and assessor of students' activities, rather than an information provider. All groups can make some simple electrical circuits and they are satisfied with their work. In the end of the lesson, the teacher evaluates the students and asks the students to share their discoveries and successes, as illustrated in Figure 4.

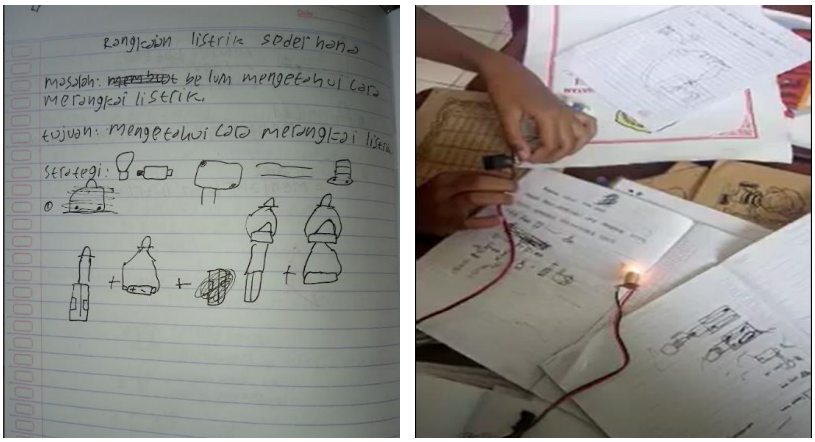

Figure 4. Brainstorming to Create A Simple Circuit and Implement It
Source: Processed Data by Researcher

Learning in the first cycle indicated that students were excited, satisfied, and challenged by the problems or case studies given by the teacher. The students made a list of problem solving. The first task given to the students was to identify the names and functions of the electrical components in front of them. Internet browsing, discussions, asking experts and reading books are the ways they use to solve the problem. It is meaningful learning and they are really trained to encounter real problems. They learn to think about problem solving and the execution of those solutions. The first test consisted of 3 HOTS questions. Each problem asked students to identify a problem and provide the right solution steps for the problem. The first problem is identifying the names and functions of electrical components, the second problem is about creating a simple electrical circuit, and the last problem is about how to turn on a light bulb without a battery holder and light fittings.

The results of this first test measuring problem solving ability are presented in Diagram 2. There were 5 students at the poor level, 8 students at the fair level, 2 students at the good level, and 10 students at the excellent level. The lowest score was 60 and the highest score was 100. The class average was 85.28. It indicates that the IDEAL problem solving model provides meaningful learning which has an impact on student learning outcomes. Brainstorming applied in the classroom can provide positive results. Peer interaction and small group discussion can improve problem solving skills in IDEAL problem solving teaching and learning.

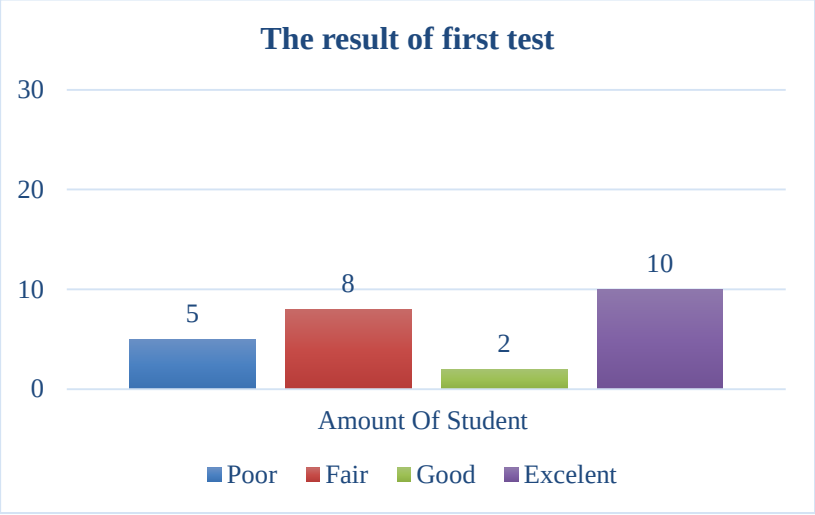

Diagram 2. Science Subject Evaluation Results in the First Test of the First Cycle
Source: Processed Data by Researcher

The reflection step involved the teacher reviewing the deficiencies identified in the first cycle. The observation results from the first cycle indicated that some students were less disciplined when working together. Teachers realize that

brainstorming or peer interaction in small groups has a positive impact. Therefore, teachers should encourage students to be more active in working together.

The meeting in the second cycle was about making series and parallel circuits and finding the advantages and disadvantages of the circuits. The students were given the problem of how to make a series circuit. It was a challenge for them. The groups searched in the book and discussed with their group members to solve the problem. They had to draw in the book first before executing, as illustrated in Figure 5.

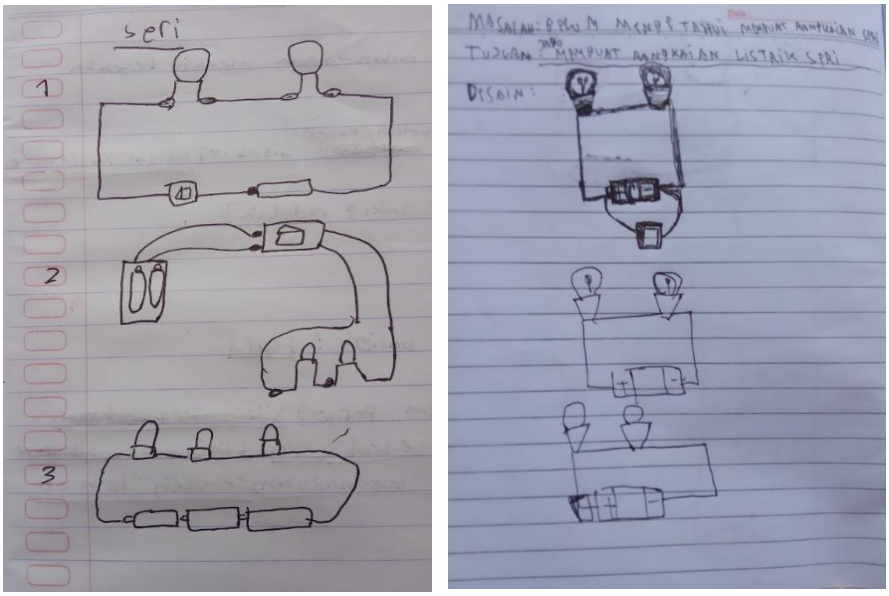

Figure 5. Brainstorming to Create A Serries Circuit
Source: Processed Data by Researcher

Then, they execute the drawing and see if their design works or not. It took time to solve this problem. The whole group was very enthusiastic and excited about their success. The teacher and the group together made a conclusion about the series circuit design and listed the advantages and disadvantages of their findings (Figure 6).

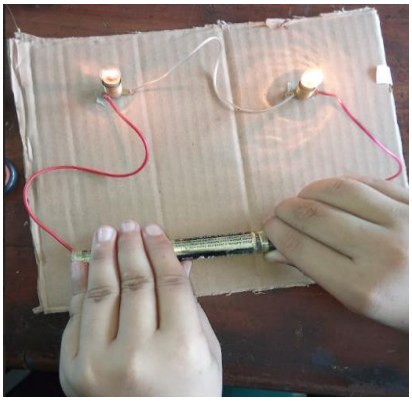

Figure 6. The Groups created Serries Circuit
Source: Processed Data by Researcher

In the fourth meeting of the second cycle, teams were given the challenge of creating a parallel circuit. The students were given the problem of how to make a set of parallel circuits. this was a challenge for them. Teams searched the book and discussed with their team members to solve the problem. They had to draw in the book first before executing it, as illustrated in Figure 7.

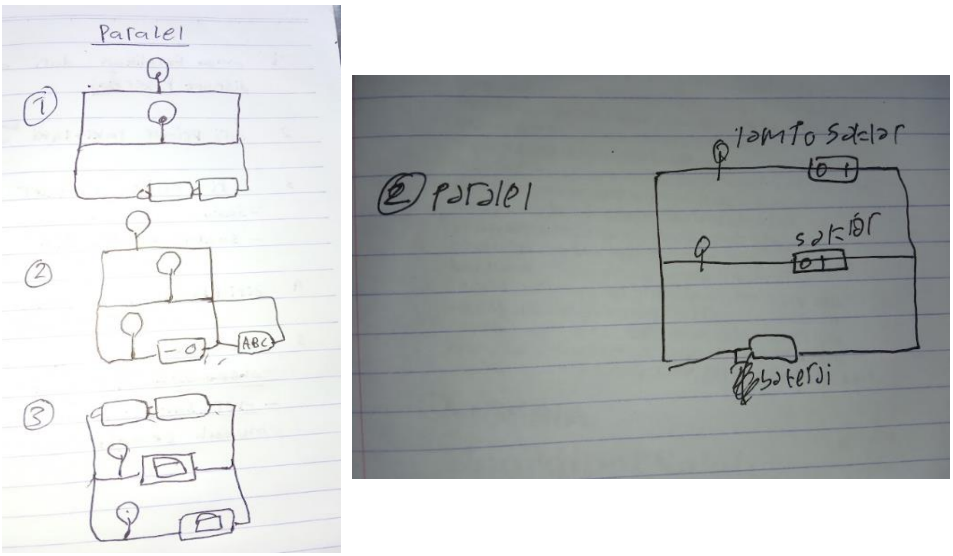

Figure 7. Brainstorming to Create A Parallel Circuit
Source: Processed Data by Researcher

This was challenging for them because we know that making a parallel circuit is more difficult than a series circuit. The groups worked hard to solve this problem. During this session, the teacher contributed more to help them. The teacher was often involved in making the circuit with them. However, the students were excited and very satisfied with their success in solving this problem. They felt that they had worked hard. In the closing session, the teacher and the team made a conclusion about the design, advantages, and disadvantages of parallel circuits (Figure 8).

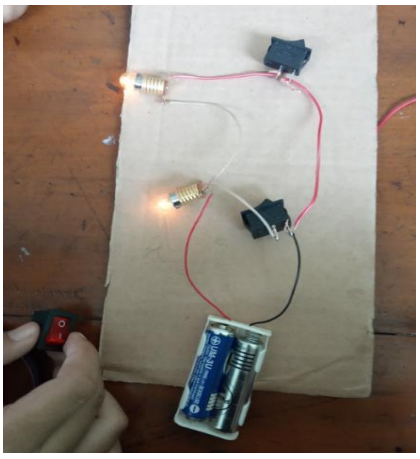

Figure 8. The Groups created Parallel Circuit
Source: Processed Data by Researcher

The results of the second test measuring problem solving ability are presented in Diagram 3. There were 5 students at the poor level, 5 students at the fair level, 2 students at the good level, and 13 students at the excellent level. The lowest score was 43 and the highest score was 100. The class average was 85.36. The lowest score in the first cycle was 60 and in the second cycle was 43. This was due to the difficulty level of the questions in the second cycle. In the first cycle, the problems given were about simple circuits, but in the second cycle, the problems given were about series and parallel circuits which had a higher level of difficulty than the first cycle. The class average was 85.36 and was better than the first cycle by about 0.6.

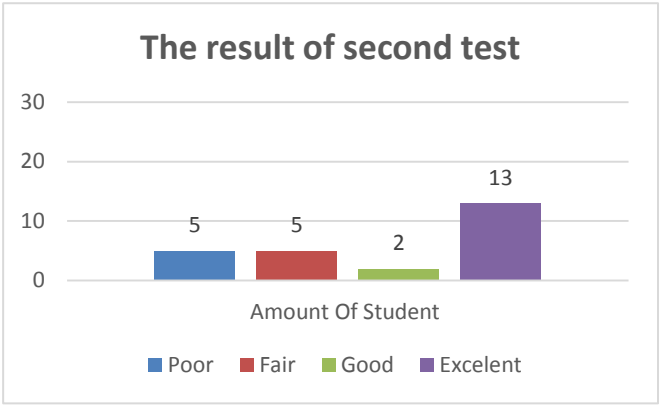

Diagram 3. Science Subject Evaluation Results in the Second Test of the Second Cycle
Source: Processed Data by Researcher

The result of this research indicates that the IDEAL problem-solving model is effective to improve students' problem-solving skills. The learning outcomes of electricity in elementary school students were satisfactory through this model. The class average shows that students are at a good level in electrical materials.

CONCLUSION

Based on the research results and discussion at all stages of the research conducted in class VI B Al-Irsyad Elementary School Banyuwangi, it is concluded that students' problem solving skills in electrical subjects have increased after participating in learning with the IDEAL problem solving model. It can be concluded that students' problem solving ability in electrical subjects has increased after participating in learning by applying the IDEAL model, the average value of student learning outcomes was 85.28 and increased to 85.36 in cycle II. The IDEAL model is proven to contribute to the improvement of students' problem solving skills. Problem solving skills must be trained continuously in learning. Maximizing brainstorming sessions is a very important stage in improving problem solving skills.

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