



Problem Solving Ability between Students Taught Using Creative Problem-solving Model Assisted by Information and Communication Technology (ICT) and Direct Instruction Model

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Abstract. This study aims to: 1) The magnitude of the effect of the *Creative Problem Solving* (CPS) learning model assisted by Information and Communication Technology media on the problem solving skills of students in Class VI of State Elementary School 1 Mantangai Hilir; 2) The magnitude of the effect of the *Direct Teaching* learning model on problem solving skills in Class VI of State Elementary School 1 Mantangai Hilir; 3) Differences in Mathematics Problem Solving Ability of Grade VI Students of State Elementary School 1 Mantangai Hilir Which is Taught Using *Creative Problem Solving* Model Assisted by Information and Communication

Technology (ICT) Media and Direct Instruction Model. The difference in problem solving ability of students whose learning uses the Creative Problem Solving model assisted by Information and Communication Technology (ICT) Media and *Direct instruction Model* in Class VI of State Elementary School 1 Mantangai Hilir; 4) Comparison of the improvement of problem solving skills through the *Creative Problem Solving model* assisted by Information and Communication Technology (ICT) Media with *Direct instruction Model* in Class VI of State Elementary School 1 Mantangai Hilir. The design form used in this research is *Quasi Experimental Design*. Data collection techniques in this study using test instruments. Data analysis in this study used quantitative.

The results of the study were: 1) This answers hypothesis 1 that there is an effect of *Creative Problem Solving* (CPS) learning model assisted by Information and Communication Technology media on the problem solving ability of Class VI students of State Elementary School 1 Mantangai Hilir; 2) This answers hypothesis 2 that there is an effect of the *Direct instruction learning model* on the problem solving ability of students in class VI of State Elementary School 1 Mantangai Hilir; 3) This answers hypothesis 3 that the increase in problem solving ability of students whose learning uses the *Creative Problem Solving model* assisted by Information and Communication Technology (ICT) media is higher than the Direct Learning Model in Class VI of State Elementary School 1 Mantangai Hilir; 4) This answers hypothesis 4 that there is a difference in the problem solving ability of students whose learning uses the *Creative Problem Solving model* assisted by Information and Communication Technology (ICT) Media and

Direct instruction Model in Class VI of State Elementary School 1 Mantangai Hilir.

Keywords: Mathematics, Creative Problem Solving, Information and Communication Technology

1 Background

Education is essentially a process of maturing students through an interaction, a two-way process between teachers and students. In the field of education, it does not necessarily only provide knowledge such as the knowledge of subjects in school, but education is also related to the character that will be taught to students. Character building is one of the goals of national education. Article 1 of the 2003 National Education System Law states that among the objectives of national education is to develop the potential of students to have intelligence, personality and noble character. This means that education does not only form intelligent Indonesians, but also personalities or characters with the hope that a generation of nations will grow and develop with characters that breathe the noble values of the nation and religion.

Learning in elementary schools includes a variety of subject content, one of which is mathematics. Mathematics is often known as a subject related to numbers or counting. Thus, mathematics can be said to be a subject that has its own characteristics.

Mathematics learning in elementary schools is given from grade I to grade VI gradually from easy to difficult material according to the stages of development. Rahmi (2013) argues that mathematics is taught since the basic education level with the aim of preparing students to be able to deal with changing circumstances in life and a world that is always developing, through practice acting on the basis of logical, rational, critical, honest, effective, and efficient thinking and preparing students to be able to use mathematics and mathematical thinking in everyday life, and in studying various educational sciences.

Problem solving is a very important part of the mathematics curriculum because in the process of learning and solving, students may gain experience using the knowledge and skills they already have to apply to solving problems that are not routine. Through this activity, aspects of important mathematical abilities such as applying rules to non-routine problems, pattern discovery, generalization, mathematical communication, and others can be better developed. To achieve the goal of developing students' problem-solving skills, math teachers need to choose the right learning model.

The ability to solve a problem, will be more fun if this ability is able to provide opportunities for students to develop proficiency in solving problems. In addition to the cognitive abilities that have been described, other things that students need to have in order to improve problem solving. Then a learning model is needed that fosters creativity and provides a stimulus for students to learn mathematics in their activities, so using the *Creative Problem Solving* (CPS) learning model.

Based on the results of research from Apino (2016) revealed that CPS can improve students' creative thinking skills. There are several reasons why CPS can improve

students' creative thinking skills, namely CPS presents open problems that require many answers and or many ways of solving, CPS provides opportunities for students to explore ideas or ideas, CPS facilitates students to analyze the advantages and disadvantages of the ideas put forward, CPS trains students to provide arguments and proof of the best solution.

Based on the results of field observations encountered by researchers in class VI of State Elementary School 1 Mantangai Hilir, it shows that most students are unable to solve mathematical problems properly, Mathematics learning at State Elementary School 1 Mantangai Hilir is not optimal because students experience difficulties and tend to get bored with mathematics subjects, most mathematics learning outcomes are still below KKM, The learning method used by the teacher uses direct learning so that it requires students to hear and memorize what is explained by the teacher, Students lack motivation to learn to answer and solve problems from the problems given. This happens because the math learning that is usually used by teachers is direct learning. The learning process starts with the teacher explaining the subject matter in front of the class, giving example problems, practicing problems and ending with giving homework (homework). With this learning model, the dominant activity of students is only listening. The learning process is dominated by the teacher. Only a few students are active, both asking and answering questions. The mathematics learning model should prioritize two-way interaction between teachers and students. In an effective learning environment, learners should be encouraged to actively participate, not only as recipients of information, but also as question makers, problem solvers, and contributors to class discussions.

Based on the background description of the existing problems, the researcher is interested in conducting research by taking the title "*Problem Solving Ability Between Learners Who Are Taught Using the Creative Problem Solving Model Assisted by Information and Communication Technology (ICT) and Direct Instruction Model*". So based on these problems, the problem formulations in this study are: 1) How much influence does the *Creative Problem Solving* (CPS) learning model assisted by Information and Communication Technology media have on problem solving skills in Class VI of State Elementary School 1 Mantangai Hilir?; 2) How much influence does the *Direct Instruction learning model* have on problem solving ability in Class VI of State Elementary School 1 Mantangai Hilir?; 3) Is there a difference in the problem solving ability of students whose learning uses the

Creative Problem Solving model assisted by Information and Communication Technology Media (ICT) and *Direct Instruction Model* in Class VI of State Elementary School 1 Mantangai Hilir?; 4) Is the mathematics problem solving ability of class VI students of State Elementary School 1 Mantangai Hilir whose learning uses the *Creative Problem Solving model* assisted by Information and Communication Technology Media (ICT) higher than the *Direct Instruction Model*?

2 Literature Review

2.1 Creative Problem Solving

According to (Harefa, 2020) *Creative Problem Solving* is a way of thinking and acting in solving a problem. *Creative* is a basic idea that is *original*, innovative, effective, and complex to produce a solution that has value and relevance. Problems are gaps between real situations and desired conditions, situations that have challenges, and confront individuals or groups to find answers.

Every learning model or method has advantages and disadvantages. Likewise with the *Creative Problem Solving* learning model (Muftukhin, 2013 in Ningsih, et al, 2022).

- Pros:
 - Train learners to design an invention
 - Facilitate learners to think and act creatively
 - Helps to solve problems realistically
 - Interpret and evaluate observation results
 - Stimulate the development of learners' thinking progress
- Disadvantages:
 - Requires a longer time allocation compared to other learning models
 - Expanding organized and thoughtful lesson planning
 - This learning model is not effective if there are some learners who tend to be passive

The steps to apply the *Creative Problem Solving* (CPS) model (Shoimin, 2014 in Sari and Noer, 2017), namely:

- Clarification of the problem
- Expression of opinion
- Evaluation and selection 4) Implementation

2.2 Information and Communication Technology

Information and Communication Technology (ICT) is a technology both *hardware* and *software* used to manage data/information and communication (Gunawan, 2015).

Various advantages of using Information and Communication Technology (Ariesto Hadi Sutopo, 2012):

- Pros:
 - Presentation of information
 - Practice and feedback
 - Access learning resources
 - Effective cost
 - Easy to use
 - Interactive
- Disadvantages:
 - Lack of visual information
 - Audio and video quality

- Lack of experience
- Breach of personal confidentiality
- Crime and fraud
- Health risks.

According to Jamun (2016:144) "The application of technology in learning activities is characterized by the presence of *e-learning* which with all its various levels has facilitated changes in learning delivered through all electronic media such as: audio/video, interactive TV, compact disc (CD), and the internet."

2.3 Direct Instruction Learning Model

Direct Instruction or direct learning is a lesson that has certain steps that can guide students in learning a procedural material (Pritandhari, 2017).

There are advantages and disadvantages of Direct Instruction:

- The advantages of the *Direct Instruction* Learning Model (Khoeriyah, 2016), namely:
 - In direct instruction learning, the teacher controls all the content of the subject matter to be learned, down to the sequence of information so as to maintain the focus of learning and the objectives to be achieved by learners.
 - It is an effective way to teach explicit concepts and skills to learners.
 - Teachers can show how a problem can be approached, analyzed, and knowledge generated.
 - The Direct Instruction model emphasizes listening and observing through demonstrations.
 - The direct instruction learning model can be applied effectively in large and small classes.
 - Learners can know the learning objectives that will be learned clearly.
 - The time used for each phase of the learning activity can be tightly controlled.
 - In this Direct Instruction learning model, there is an emphasis on academic achievement.
 - Learners' performance is closely monitored by the teacher.
 - Feedback to learners is academically oriented.
 - This model can be used to emphasize key points or difficulties that learners may encounter.
 - This model can be an effective way to teach factual and structured information and knowledge.
- Disadvantages of *Direct Instruction* Learning Model (Suprihatiningrum, 2013):
 - Not all learners have the ability to listen, observe and take notes well. Therefore, teachers still have to teach and guide learners.
 - Teachers sometimes find it difficult to overcome differences in learners' abilities, learning and comprehension levels, prior knowledge, and learning styles.

- Learners' opportunities to develop social and interpersonal skills are limited as active participation is mostly done by the teacher.
- The success of Direct Instruction learning is highly dependent on the teacher. If the teacher is prepared, knowledgeable, confident, enthusiastic and structured students can learn well.
- This learning model can have a negative impact on students' problem-solving skills, independence, and curiosity because students' ignorance will be resolved with teacher guidance.
- The direct learning model requires better communication skills from the teacher. If communication is not effective, learning will not be successful.
- It is difficult for teachers to get feedback on learners' understanding, which can result in learners' incomprehension or misunderstanding.
- This learning model will be difficult to implement for abstract and complex materials.
- If the Direct Instruction learning model does not involve learners much, learners will lose attention after 10 - 15 minutes and will only remember a little of the content of the material presented.
- Learners become irresponsible about the material they have to learn because they think the material will be taught by the teacher.

There are several steps that should be fulfilled in the application of this *Direct Instruction* model, namely (Yudaningsih, 2021):

- Preparation
- Presentation
- Correlation
- Generalization
- Application

3. Research Method

The type of research used in this study is experimental research, because researchers will test the impact of a *treatment* or intervention on research results. The form of research design uses a *quasi-experimental design*, which is a design that has a control group, but cannot function fully to control external variables that affect the implementation of the experiment. The form of design used in this research is *Quasi Experimental Design*.

This research was conducted at State Elementary School 1 Mantangai Hilir, all grade VI students totaling 57 students in the first semester of mathematics in the 2023/2024 school year. In this study, the research population was all grade VI students of Sekolah Dasar Negeri 1 Mantangai Hilir Kapuas Regency in the 2023/2024 school year, totaling 57 students. According to Sugiyono (2015): "Population is a generalization area consisting of: objects or subjects that have certain qualities and characteristics set by researchers to study and then draw conclusions". In this study, the research population was all students in grade VI of State Elementary School 1 Mantangai Hilir,

Kapuas Regency in the 2023/2024 academic year, totaling 57 students with the following class distribution:

Table 1. Grade VI Teacher at Sekolah Dasar Negeri 1 Mantangai Hilir.

No.	Group	Gender		Number of Learners
		Male	Female	
1.	A	12	14	26
2.	B	12	19	31
	Total	12	19	57

Source: Grade VI Teacher at Sekolah Dasar Negeri 1 Mantangai Hilir

The sample is part of the number and characteristics of the population (Sugiyono, 2016). Research is not possible in all, populations, therefore researchers use samples taken from the population. Homogeneous population members allow research samples to be taken with cluster sampling techniques. The cluster technique selects samples not based on individuals, but rather based on groups, regions, or groups of subjects that naturally gather together.

Based on the sampling technique, two classes were obtained, namely:

- Class VI A with a total of 29 students, as an experimental class that was given treatment in the form of a Creative Problem Solving, learning model.
- Class VI B with 28 students, as a control class using the Direct Instruction learning model.

The data collection technique in this study used a test instrument. Tests are used in this study to measure students', problem solving skills, tests that will be given to students in the form of essay questions. The test is done at the beginning of learning (pretest) and at the end of learning (posttest).

Data analysis in this study uses quantitative. The tests carried out are normality and homogeneity tests. According to Sugiyono (2015): "Data analysis technique is an activity after data from all respondents or other data sources are collected. Activities in data analysis are: grouping data based on variables and types of respondents, metabulating data based on variables from all respondents, presenting data for each variable studied, performing calculations to answer problem formulations, and performing calculations to test hypotheses that have been proposed ".

Data analysis in quantitative research is an activity after all data is collected, namely by grouping data based on variables and types of respondents, presenting data for each variable studied, performing calculations to test hypotheses. Data analysis is used to answer the formulation of problems in research or to test the hypotheses proposed through data presentation. In this study, before hypothesis testing was carried out, prerequisite analysis was carried out on all posttest data results in the form of tests of students' mathematical. problem solving abilities that had been collected. The tests carried out are normality and homogeneity tests.

- Normality Test

Normality test is used to test whether a variable have normal data or not. To test the normality of the data in this study using the Shapiro-Wilk test. The Shapiro-Wilk test is used in this study because researchers will later test a large sample of more than 50 people. The Shapiro-Wilk test can be said to be normal or not, it can be seen based on the results of looking at the probability number, with the provisions:

- If the probability value > 0.05 then H_0 is accepted the data is normally distributed.
- If the probobiltas value < 0.05 then H_0 is rejected the data is not normally distributed.
- Homogeneity Test
The homogeneity test is carried out to determine whether the data in variable X_1 and X_2 and Y are homogeneous or not. The homogeneity test was carried out using One-way Anova with the help of the *Homogeneity of Variance test*. Basis for decision making:
 - If the probability value < 0.05 , then it is said that the data is not homogeneous.
 - If the probability value > 0.05 , it is said that the data is homogeneous.
- Hypothesis Test
To determine the effect of the *Creative Problem Solving*, model on students' mathematical problem solving, skills, a hypothesis test was conducted.
 - Research Hypothesis:
 - H_0 : Mathematics Problem Solving Ability of Learners Taught Creative Problem Solving (CPS) Learning Model assisted by Information Technology and Computer media is Not Higher than Learners Taught with Direct Instruction Model.
 - H_1 : Mathematics Problem Solving Ability of Learners Taught Creative Problem Solving (CPS) Learning Model assisted by Information and Communication Technology media is Higher than Learners Taught by Direct Instruction Method. The statistical hypotheses tested in this study are as follows:

$$H_0: \mu A_1 \leq \mu A_2 \quad (1)$$

$$H_0: \mu A_1 \geq \mu A_2 \quad (2)$$

Hypothesis testing in this study was carried out using one-way Anova statistics. Data analysis in this study was carried out with the help of the spss statistics 23, program. If the sig. value < 0.05 then H_0 is rejected and H_1 is accepted.

4 Research Results and Discussion

4.1 Pre Test and Post Test Result Data

Table 2. Data Statistics.

Control Class Pre Test	Control Class Post Test	Experiment Class Pre Test	Experimental Class Post Test
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N	Valid	28	28	29	29
	Missing	1	1	0	0
Mean		38.36	70.11	37.72	77.72
Median		35.50	69.00	36.00	80.00
Std. Deviation		9.900	9.425	10.292	10.347
Variance		98.016	88.840	105.921	107.064
Range		35	35	38	42
Minimum		25	50	25	51
Maximum		60	85	63	93

Data presentation of pre and post test results of mathematical problem solving, skills of students taught with *Creative Problem Solving* Model (experimental class) and students taught with direct learning (control class).

In the experimental class there were 29 students, based on the results of the calculation of the pre-test of students' mathematical problem solving ability that the average mathematical problem solving ability of experimental class students was 37.72, standard deviation = 10.292. and variance = 105.921 The calculation of the results of the post-test of students' mathematical problem solving ability that the average mathematical problem solving ability of experimental class students was 77.72, standard deviation = 10.347 and variance = 107.064.

In the control class there are also 28 students, based on the results of the calculation of the pre-test of students' mathematical problem solving ability that the average mathematical problem solving ability of control class students is 38.36, standard deviation = 9.900 and variance = 98.016. The calculation of the results of the post test of students' mathematical problem solving ability that the average mathematical problem solving ability of control class students is 70.11, standard deviation = 9.425 and variance = 88.840.

Based on the table of research results in the experimental class and control class above, it can be seen that there is a difference in the average pre test and post test of the mathematical problem solving ability of students taught by using the *Creative Problem Solving* Learning Model with students taught by direct learning. Where the average value of the pre test and post test of the mathematical problem solving ability of students taught using the *Creative Problem Solving* Learning Model is higher than the average value of the pre test and post test of the mathematical problem solving ability of students taught with direct learning.

4.2 Pre Test and Post Test Result Data

Table 3. Normality Test.

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Control Class Pre Test	.134	28	.200*	.134	28	.056
Control Class Post Test	.091	28	.200*	.091	28	.499
Experiment Class Pre Test	.113	28	.200*	.113	28	.078

Experiment Class Post Test	.144	28	.144	.144	28	.094
*. This is a lower bound of the true significance.						
a. Lilliefors Significance Correction						

Based on the table above, it can be seen that both class sample groups both *control* and experimental classes on *pre* and *post* data given *Creative Problem Solving* treatment have a Sig. value greater than 0.05, namely the *Pre Test* value in the control class of 0.056, the *Pre Test* value in the experimental class of 0.078, the *Post Test* value in the control class of 0.499, and the *Post Test* value in the experimental class of 0.094, it can be concluded that all groups of sample data are normally distributed.

4.3 Homogeneity Test

Table 4. Homogeneity Test of Variances.

		Levene Statistic	df1	df2	Sig.
Pre Test	Based on Mean	.000	1	55	.983
	Based on Median	.007	1	55	.935
	Based on Median and with adjusted df	.007	1	54.999	.935
	Based on trimmed mean	.000	1	55	.995
Post Test	Based on Mean	.309	1	55	.581
	Based on Median	.161	1	55	.690
	Based on Median and with adjusted df	.161	1	52.850	.690
	Based on trimmed mean	.247	1	55	.621

Based on the SPSS output above in the Based on Mean section, the *pre-test* data obtained a Levene value of 0.000 with a Sig value. (0.983) and post test data obtained a Levene value of 0.309 with a Sig value. (0.581) > 0.05, it can be concluded that the data of the two groups before being given treatment have the same variance or homogeneous.

5 Discussion

Using the CPS model during the learning process is a necessity for learners. To develop learners' problem-solving skills and give them practice using problems with a straightforward framework, and several techniques are used. After that, activities that follow the procedure are given to learners to solve (Parama Kwangmuang et al, 2021).

In general, it can be stated that the CPS learning model assisted by ICT-based media is able to run well in accordance with expectations and plans. The analysis results also show the expected results. The process of strategy delivery in the application of the CPS learning model assisted by ICT-based media is able to train students to be able to solve problems with various strategies and use strategies that are found by themselves.

The *Direct Instruction* learning model is specifically designed to develop procedural and declarative knowledge. *Direct instruction* is a learning approach where the researcher provides the lesson in a simple, sequential order and steps. In applying the *Direct Instruction* learning model, the teacher must demonstrate the knowledge or skill to be trained to students step by step. In fact, the role of the teacher in learning is very dominant, so the teacher is required to be able to become an attractive model for students (Zahriani, 2014: 98). *Direct instruction* can be a solution to overcome saturating and boring learning because the *Direct Instruction* learning model is a teaching approach that can help students learn basic skills and obtain information that can be taught step by step. The learning process of *Direct Instruction learning model* can take the form of lectures, demonstrations, training or practice and group work. In using the *Direct Instruction* learning model, a teacher can also link it with class discussions and cooperative learning. As stated by Kardi that a teacher can use direct instruction to teach new material or skills with group discussions (Renny, 2020: 2). This aims to train students to think, apply newly acquired skills, and build their own understanding of the learning material.

This ICT-based media-assisted CPS learning model has a huge contribution in guiding students to think more creatively and with the help of learning media greatly helps students in understanding the concepts given, so that students are easier in solving the problems given. In general, it can be stated that the CPS learning model assisted by ICT-based media is able to run well in accordance with expectations and plans. The analysis results also show the expected results. The process of strategy delivery in the application of the CPS learning model assisted by ICT-based media is able to train students to be able to solve problems with various strategies and use strategies that are found by themselves. While learning by using *Direct Instruction* makes students bring up their ideas and results in their thinking skills so that problem solving skills do not develop. In addition, there are some students who take notes and pay attention but some are busy chatting, causing less effective learning.

Learners who are given treatment with the *Creative Problem Solving* model assisted by ICT media with high learning interest have better problem-solving abilities compared to students who have moderate and low learning interest. Learners who are given learning with the *Creative Problem Solving* model with high learning interest have better problem solving skills than students who have high, medium, low learning interest in the *Direct Instruction* model. This is because students with high learning interest have an interest in learning. So that students will explore a lesson in detail, then it will be easy to master and understand the lesson. So that students with high learning interest are superior in having an understanding of concepts in problem solving.

Learners who are given treatment with the *Direct Instruction* model with moderate learning interest have better problem solving skills than learners who have low learning interest but not better with learners who have high learning interest. Students who are

given learning with the Direct Instruction model with moderate learning interest have better problem solving skills than students who have low learning interest in the *Creative Problem Solving* model but not better at high and moderate learning interest. This is a material consideration that the learning model in stimulating students in the process of forming interest, but it can also be used as material in grouping high, medium and low learning interests.

6 Conclusions and Suggestions

Based on the results of the research and discussion in the previous chapter, the following conclusions can be drawn in this study: 1) This answers hypothesis 1 that there is an effect of the *Creative Problem Solving* (CPS) learning model assisted by Information and Communication Technology media on problem solving skills in Class VI of State Elementary School 1 Mantangai Hilir; 2) This answers hypothesis 2 that there is an effect of the *Direct Instruction learning model* on problem solving ability in Class VI of State Elementary School 1 Mantangai Hilir; 3) This answers hypothesis 3 that the increase in problem solving ability of students whose learning uses the *Creative Problem Solving* model assisted by Information and Communication Technology (ICT) media is higher than the Direct Instruction Model in Class VI of State Elementary School 1 Mantangai Hilir; 4) This answers hypothesis 4 that there is a difference in the problem solving ability of students whose learning uses the *Creative Problem Solving model* assisted by Information and Communication Technology (ICT) Media and Direct Instruction Model in Class VI of State Elementary School 1 Mantangai Hilir.

7 Advice

The suggestions in this study are as follows:

- To educational practitioners, especially those involved in learning mathematics, it is recommended to use the CPS learning model assisted by ICT-based media as an alternative to classroom learning.
- This research was conducted on limited samples and learning materials. Other interested researchers are advised to conduct research on the Differences in Problem Solving Ability Between Learners Taught Using the *Creative Problem Solving*.

Method Assisted by Information and Communication Technology Media and the Direct Instruction Method with a larger sample and broader learning materials to determine the effect of the application of this learning model in mathematics learning more deeply.

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