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The Effect of the DOCAR Learning Model on the Problem-Solving Ability of Mathematics Students in Junior High School

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Abstract – The purpose of this study was to determine the influence of the *DOCAR* learning model on the mathematics problem-solving ability of junior high school students. The study was conducted by experimental methods. The sample was 20 students. The subjects of this study were junior high school students X Gresik in the second semester of the 2020/2021 academic year. The research instrument used is a test of mathematical problem-solving ability in the form of description questions. Data analysis uses a t-test, by first testing normality and homogeneity. Based on the data obtained, there is an influence of the *DOCAR* learning model on students' mathematical problem-solving ability. While the learning experience obtained by students is as follows: (1) knowing the problem first (understanding in advance the problem to be solved), (2) making a plan (making a series of plans that have been prepared), (3) applying the plan (carrying out a series of plans that have been prepared), and (4) checking back (checking everything done by checking one by one and checking the final results of problem solving).

Keywords – Problem Solving Ability, *DOCAR* Learning Model

I. INTRODUCTION

The development of the industrial revolution 4.0 cannot be separated from the influence of universal science, including mathematics. The important role of mathematics in various things will make the human mindset advance. It is important to teach mathematics to every educational action that is the provision for the development of abilities when implementing mathematics in explaining a situation. In our view, mathematics education should prepare students to apply mathematics in all sorts of work situations and everyday life. While the role of mathematics in life can be used to solve problems related to problems related to contextual problems both qualitatively and can develop knowledge, problem-solving skills, and self-confidence attitudes. One of the goals of mathematics in general is to be able to master abstract science, basic concepts, and mathematical principles and have the skills to develop science, which can be applied in solving contextual problems in everyday life. In essence a problem is something that needs to be solved or solved, both problems in everyday life and problems that are set forth in the form of narrative questions. Problem-solving skills are so important in mathematics that we cannot ignore how to solve problems that arise from learning (Princess & Roichan, 2021). Problem solving is an effort to find a way out of a difficulty to achieve a goal. To achieve these objectives requires a strategy or problem-solving step that involves a thought process, especially how cognitive processes in understanding the problem, planning the problem solving, implementing the plan, and re-examining the results or solutions (But et al., 2020).

Raymond in belief problem solving is an assessment consisting of one's past mathematical experiences (Tireless et al., 2021). Whereas Aydogdu and Ayaz in (Palanisamy & Nor 2021) state that problem solving contributes to mathematics itself and is central to the mathematical curriculum. problem solving requires students to think critically when deciding and developing their own strategies based on what they learned and developed in the past. According to Bingham in describing problem solving as the process of overcoming the difficulties encountered in achieving goals (Afacan & Kaya, 2022). Another opinion of Elliott and baker states that problem solving is one of the teaching and learning approaches that supports content-based learning along with a variety of other skills such as decision making, time management, and problems. The process of problem solving includes cognitive and behavioral dimensions that contain a high level of thinking such as determining, choosing, and making decisions about effective solutions (Dikmen, 2022).

The definition of problem solving is that the word problem is described as something danger or an unwanted situation or problem that needs to be addressed. it is also defined as a person's situation or thing that requires attention and needs to be addressed. the term problem in conjunction with the word solve by mathematicians is referred to as problem solving, others argue that the problem is related to their condition mentioning that the problem is a situation in achieving a goal (Wicaksono & Korom, 2022). According to Hicks in (Yilmaz & Yigit, 2020) defining problem solving is the art of finding new ways to bring together all possible solutions on a subject and therefore is a demonstration of all professional practice.

Problem-solving skills refer to a set of behavioral cognitive activity in which a person tries to find or develop effective solutions to real-life problems (Simanjuntak et al., 2021). Problem solving according to Simamora and Saragih in (Nur et al., 2020) is a necessary tool in decision making to avoid mistakes in interpreting mathematics in the constructive category a person can solve a problem if it is within the area of his thinking range. Greenstein in (Hulaikah et al., 2020) revealing that problem-solving ability is the basic process of identifying problems, considering choices, and making informed choices. Problem solving is the whole effort of the individual to achieve a goal in the absence of a solution and is one of the most important types of cognitive processes that often occur in the learning process. The problem-solving process consists of steps to be aware of the problem, gather information, go to the bottom of the problem, search for a solution, and determine the right solution (Caliskan, 2020).

Based on the above expert opinions on problem solving it can be concluded that it is a common goal in mathematics learning but being a mathematics center means that problem-solving skills are basic skills in mathematics learning. To improve problem-solving skills, it is necessary to develop problem understanding skills and making mathematical models through the process of identifying problems, considering choices, and making choices based on information, finding solutions, and determining the right solution.

The importance of solving a problem can influence solving the problem facing students. The results of observations and interviews with one of the junior high school teachers in Gresik, the average problem-solving ability of junior high school students in Gresik is still relatively low because the cause is (1) there are still many students who have difficulty in solving problems, (2) students tend to be less able to do contextual problems and lack confidence, (3) students' basic mathematics skills are still lacking, (4) the lack of activeness of student independence in the learning process so that students are dependent on their peers and the questions given by the teacher are sometimes less responded to by students. This shows that students in the process of learning mathematics so far have been carried out less confident and independent. This is in line with his research Men et al., (2020) States students experience difficulties when given non-routine questions. It has been proven that few students can complete the assigned tasks. This happens because students are not used to solving problems that require understanding, planning, solving, and making decisions about the results. In addition, most teachers still use a lecture learning model where learning activities only take place one way or only from teacher to student. This causes students to be less able to develop skills in solving problems.

Seeing the problem of the low ability of students in solving mathematical problems, it is necessary to apply the *DOCAR* learning model. The *DOCAR* learning model is a learning that aims to improve the ability to solve mathematical problems. The characteristics of the *DOCAR* learning model are: (1) it has a purpose. The objectives achieved in this *DOCAR* learning are to prioritize the active role of students in constructing knowledge, collaborating in combining knowledge; (2) have a theoretical basis. The underlying theories are the theory of constructivism, Piaget's theory, and Bruner's theory; (3) contains teaching behavior. The teaching behavior in question is contained in the components of the *DOCAR* learning model, namely: syntax, social systems, reaction principles, and support systems; (4) contains a learning environment including: orientation of presentation of learning materials through teaching materials by relating contextual problems, the availability of learning media to fulfill the experimental process in finding a material concept, setting small groups of 5-6 people heterogeneously, directing and training each individual and group in the ability to think critically and problem-solving. The *DOCAR* model is designed in five phases that include the do, observation, construction, association, and reflection stages. Where is Phase 1: Do (let's do it), Phase 2:

Observation (check what you have done), Phase 3: Construction (make planning), Phase 4: Association (connect with the knowledge you have), Phase 5: Reflection (whether you have done well).

In addition, with the *DOCAR* learning model, students can get a learning experience that teaches skills including (1) knowing the problem first (understanding in advance the problem to be solved), (2) making a plan (making a series of plans that have been prepared), (3) applying the plan (implementing a series of plans that have been prepared), and (4) checking back (checking everything that is done by checking one by one and checking the final result of troubleshooting). So that *the DOCAR* learning model can motivate students to understand the meaning of the material they are studying.

Based on the background outlined above, researchers are interested in conducting a study with the title "the influence of *the DOCAR* learning model on the problem-solving ability of junior high school students".

II. Research Method

The purpose of this study is to obtain an overview of the influence of *the DOCAR* learning model on students' mathematical problem-solving ability in mathematics learning. The results can be seen from the difference in ability between classes using *the DOCAR* learning model and classes that use the lecture learning model on the material to build a flat side room.

Research using quasi-experimental methods, there are two classes, namely the experimental class and the control class. Experimental classes are given learning using the *DOCAR* learning model, while control classes are given learning with a lecture model. Furthermore, the final test is given in each class after the learning is carried out. The study population was all students of class VIII of junior high school X Gresik with a sample of 20 students. Sampling uses simple random sampling in all classes.

The variables in this study are included in the normative variables consisting of two groups, namely experimental variables, and control variables. The experimental variable is the problem-solving ability in mathematics learning in students who obtain the *DOCAR* learning model, while the control variable is the problem-solving ability of lecture learning. The research instrument used is a test of mathematical problem-solving ability in the form of a description that has been tested for validity.

III. Research Result

To find out the influence on the results of problem-solving ability in mathematics learning using the *DOCAR* model. So before testing the hypothesis, research must first test the prerequisites for data analysis, namely the normality test and the homogeneity test. After the two tests are met, a research hypothesis test is carried out. Data processing is calculated using SPSS *software*.

Normality Test

The normality test is carried out to find out data from normally distributed populations or not, the data normality test uses the Shapiro-wilk test. Based on decision making in this normality test are as follows: (1) if sig. (significance) or probability value < 0.05, then the data is abnormally distributed, (2) if sig. (significance) or probability value > 0.05, then the data is normally distributed. The results of the normality test of the problem-solving ability of the experimental class and the control class are presented in table 1 as follows.

Table 1. Normality Test Results of Experimental Class and Control Class

Tests of Normality

	Factor	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Problem solving skill	cls. Experiment	.158	20	.200*	.936	20	.202
	cls. Control	.210	20	.021	.912	20	.069

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Based on these data, the experimental class obtained data 0.202 and the control class 0.69, so it can be concluded that the experimental class and the control class are normally distributed

Homogeneity Test

Homogeneity testing was carried out to determine the variance of data on the learning outcomes of experimental classes and homogeneous control classes. The basis for making decisions in the homogeneity test is as follows: (1) if the significance value (sig) is based on the mean > 0.05 then the variance of the learning outcomes data is homogeneous If the significance value (sig) based on mean < 0.05 then the variance of the learning outcomes data is not homogeneous. The results of the homogeneity test of the experimental class and the control class are presented in table 2 as follows.

Table 2. Homogeneity Test Results of Experimental Class and Control Class

Test of Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.
Problem solving skill	Based on Mean	8.097	1	38	.007
	Based on Median	7.694	1	38	.009
	Based on Median and with adjusted df	7.694	1	24.702	.010
	Based on trimmed mean	7.675	1	38	.009

Based on the output above, it is known that the significance value (sig) based on the mean is 0.07 > 0.05, so it can be concluded that the variance of the experimental class and the control class is homogeneous.

Test research hypotheses

After the prerequisite test data analysis normality test and homogeneity test have been met. Furthermore, test the research hypothesis using an independent test of the t-test sample. The basis for making decisions in the independent test of the t-test sample is as follows: (1) if the sig value. (2-tailed) > 0.05 then H_0 is accepted and H_1 is rejected, which means there is no influence on the average learning outcomes of problem-solving ability between the experimental class and the control class, (2) if the sig value. (2-tailed) < 0.05, then H_0 is rejected and H_1 is accepted, which means that there is an average influence of the learning outcomes of problem-solving ability between the experimental test class and the control class. The results of the independent test sample t test are shown in table 3 as follows.

Table 3. Independent Test Results of Experimental Class and Control Class t-test samples

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Problem solving skill	Equal variances assumed	8.097	.007	9.821	38	.000	11.400	1.161	9.050	13.750

	Equal variances not assumed			9.821	24.338	.000	11.400	1.161	9.006	13.794

Based on the results of the independent test sample t test the results of learning the problem-solving ability above in the equal variances assumed section, the sig value is known. (2-tailed) of 0.000 < 0.05, then as the basis for decision making in the independent test of the sample t test, it can be concluded that H_0 is rejected and H_1 is accepted. Thus, it can be concluded that there is a significant (real) influence on the average learning outcomes of problem-solving ability between experimental classes given learning using the *DOCAR* learning model and control classes given learning with a lecture model.

IV. Discussion

This research was conducted at junior high school X Gresik which involved two classes, namely the experimental class and the control class where class VIII B which consisted of 20 students as the experimental class and class VIII A which amounted to 20 students as the control class. The learning given in the experimental class used the *DOCAR* model while the control class used the lecture model. Both models are used by researchers to teach the same material to the experimental class and the control class, that is, the flat side room building material.

Based on the results of the implementation of the *DOCAR* learning model, the results of data analysis concluded that there was an increase in problem-solving capabilities with the implementation of *the DOCAR* learning model. This is in line with Amir, (2015) research stating that in addition to learning styles, it is necessary to have learning strategies that affect students' problem-solving ability. There is an increase in students' problem-solving ability due to the many problem-solving ability exercises in teaching materials. Solso et al., (2014) states problem-solving ability is a thought that is directed directly to find a solution to a specific problem based on knowledge, understanding, and skills possessed.

Based on the theory and indicators of problem-solving ability in the implementation of the *DOCAR* learning model. Students are taught to know the problem first to form an understanding in understanding a problem to be solved. Then students are taught to plan by constructing steps in solving the problem based on the information that has been reviewed and observed in identifying the problem. Then students are taught to apply the plan by collaborating in compiling the knowledge they have based on the plan made. Then students are taught to check back, which is to check back what has been done in solving the problem. The learning process was shown in the experimental class there was an increase in students' problem-solving ability from meeting to meeting, especially on the plan, apply the plan, and check back indicators, this is because students have begun to get used to the *DOCAR* learning model process from previous meetings. Therefore, the *DOCAR* learning model creates activities that stimulate students' curiosity, namely by providing problems related to students' daily lives, group work, making works or reports and presenting them. With these activities, the *DOCAR* learning model is preferred by students so that students are more motivated to follow the learning process. Meanwhile, lecture model learning is direct learning that is more dominated by the teacher which causes students to hear, listen and memorize more than to find a concept for themselves, making it difficult for students to understand the material being taught and only active in hearing the teacher's explanations and then taking notes in the book what the teacher conveys.

V. Conclusion

Based on the results of the analysis and discussion, it can be concluded in this study that there is an influence of the *DOCAR* learning model on the ability to solve mathematical problems of junior high school students. The *DOCAR* learning model is proven to improve students' mathematical problem-solving ability, this can be shown by the results of *an independent test sample* t test where the learning outcomes in table 3 can be concluded that there is a significant (real) influence on the average learning outcomes of critical thinking ability between the experimental class and the control class. Meanwhile, the learning experiences obtained by students include (1) knowing the problem first (understanding in advance the problem to be solved), (2) making a plan (making a series of plans that have been prepared), (3) applying the plan (carrying out a series of plans that have been prepared), and (4) checking back (checking everything that is done by checking one by one and checking the final results of problem solving).

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