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The Effect of REACT Learning Model on Mathematics Problem Solving Ability

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Abstract: *REACT is a development model of contextual learning, to help teachers relate learning material to the real world. This study aims to determine the effect of the REACT learning model on the mathematical problem solving abilities of junior high school students. The populations of this study were all grade VII students of SMP Negeri 2 Unaaha in the academic year 2019/2020 which was distributed in 5 classes. The sample was determined using purposive sampling technique, so that two classes were selected as samples, namely class VII1 as the experimental class and class VII2 as the control class. The research design used a posttest-only control design. The research instrument used teacher and student activity observation sheets, and tests of mathematical problem solving abilities. The observation data was collected during the learning process using the REACT learning model, while the data from the problem-solving ability test was carried out during the posttest. The results showed that there was a significant effect of the REACT learning model on the mathematical solving ability of grade VII students of Junior High Schools. The REACT learning model can develop students' creative thinking so that they can construct their own concepts and knowledge*.

Keywords: *learning model; mathematical problem solving; REACT learning*.

INTRODUCTION

Mathematics as a vehicle for education plays an important role in improving education itself. Learning mathematics is a means of logical scientific thinking and has an important role in improving the quality of human resources. Problem solving is one of the abilities that students must have in learning mathematics. The importance of problem solving in learning has also been contained in the National Council of Teachers of Mathematics (NCTM). The thinking process in mathematics learning includes five main standard competencies, namely problem solving skills, reasoning skills, connection skills, communication skills and representation skills (NCTM, 2000).

The ability to solve mathematical problems in Indonesia is still lacking and needs to be improved. This can be seen from the existence of some data that shows the low ability of solving mathematical problems in Indonesia. Based on the results of the 2015 PISA (Program for International Student Assessment (PISA) study organized by the Organization for Economic Co-operation and Development (OECD) in 2016, it shows that Indonesia is ranked 62th out of 70 countries with a score of 403. Indonesia is still below the international average score of 500 (OECD, 2016).

According to (Polya, 2004) there are four stages of problem solving, namely: (a) understand the problem, students need to identify what is known, what is there, the number, relationships and values associated with what they are looking for; (b) make a plan (devise a plan), students need to identify the operations involved and the strategies needed to solve the given problem. This can be done by students in ways such as guessing, developing a model, sketching diagrams, simplifying problems, identifying patterns, making tables, experimenting and simulating, working in reverse, testing all possibilities, identifying sub objectives, making

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analogies, and sorting data / information; (c) carry out the plan, what is implemented clearly depends on what has been planned in advance and also includes the following: interpreting the information provided in mathematical form and implementing the strategy during the process and calculations that take place; and (d) looking back, the following aspects need to be considered when checking back on the steps previously involved in solving the problem, namely: checking all important information that has been identified, checking all calculations involved, considering whether the solution is logical, look at other alternative solutions and read the question again and ask yourself if the question has actually been answered.

This problem-solving ability is closely related to the components of students' understanding in mathematics. Polya stated that the first step in solving a mathematical problem understands the math problem itself. The relationship between understanding skills and problem solving can be emphasized that, if someone already has the ability to understand mathematical concepts, then he is able to use them to solve problems. Conversely, if someone can solve a problem, then that person must have the ability to understand mathematical concepts that have been studied previously (Fauziah, 2010).

The indicators of the problem solving stage according to Polya are as follows: 1) Indicators of understanding the problem, including: (a) knowing what is known and asked about the problem and (b) explaining the problem in accordance with its own sentences, 2) Indicators of making plans, including: (a) simplifying problems, (b) able to make experiments and simulations, (c) able to find sub-objectives (things that need to be looked for before solving the problem), (d) sorting information, 3) indicators of implementing plans, including: (a) interpret the problem given in the form of mathematical sentences, and (b) carry out the strategy during the process and calculation. Indicators of review include: (a) checking all information and calculations involved, (b) consider whether the solution is logical, (c) look at other alternative solutions, (d) read the question again, and (e) ask yourself if the question has been answered.

Based on the results of preliminary observations at SMP Negeri 2 Unaaha, it can be seen that the students' problem-solving abilities are still low. This is due to the lack of understanding of the concept of students so that students are less able to solve various questions and difficulty levels of difficulty. The low understanding of these students' concepts causes most students to experience difficulty in analyzing problem solving problems. The learning experience experienced by students is also one of the factors causing the low ability of mathematical problem solving at SMP Negeri 2 Unaaha. This is because the direct learning model that is applied in learning makes the process of creating an understanding of a certain concept not experienced or felt by the students themselves, so students tend to be passive in thinking about solutions to solving mathematical problems. Students are not actively involved in learning in constructing their knowledge, but only follow the steps given by the teacher.

After conducting a preliminary test of mathematical problem-solving abilities in class VII students at SMP Negeri 2 Unaaha, an average score of 15.38 was obtained. This low acquisition is due to the low ability of students to understand the problems given. Students tend to have difficulty understanding the questions given; there are even some students who do not write down their answers because they do not understand the problems given. In addition, there are several student mistakes in planning problem solving, so that the solutions given are not correct.

Overcoming these problems, it is necessary to improve mathematics learning. Of course, you will choose a learning model that can develop students' learning experiences in finding and understanding mathematical concepts. One learning model that can develop student learning experiences is the REACT (Relating, Experiencing, Applying, Cooperating, and Transfering) learning model. REACT learning model is a development of contextual learning model. According to (Siswoyuono & Susilo, 2016), the REACT learning model is the right learning model to create mathematics learning because it involves students to be more active.

The REACT model of learning is carried out by paying attention to the aspects of connecting (Relating), exploring to finding (Experiencing), Application (Applying), cooperating, and transferring knowledge (Transferring).

The REACT Learning Model (Relating, Experiencing, Applying, Cooperating, and Transferring) is one of the developments of contextual learning. According to (Cahyono et al., 2017), the essence of contextual teaching and learning is a learning concept that helps teachers link the material between what is being taught and the real world. Contextual learning is an educational process that aims to help students understand the meaning in the teaching materials they learn by connecting lessons in the context of everyday life with the context of personal, social, and cultural life. Contextual learning is a learning concept that helps teachers link the material being taught with students' real-world situations and encourages students to make connections between their knowledge and its application in everyday life.

According to (Anas & Fitriani, 2018; Helina & Ilmadi, 2022), the REACT learning model is a learning model that teachers can use in instilling students' understanding of mathematical concepts. States that REACT learning applies generative learning (constructivism), which is linking experience with knowledge and instilling meaningful learning that is built in students so that it makes it easier to learn mathematics, especially in forming concepts (Anas & Fitriani, 2018). According to (CORD, 1999), REACT is a contextual learning consisting of five strategies that must be visible, namely: (1) Relating, (2) Experiencing, (3) Applying (implementing), (4) Cooperating, (5) Transferring. Relating (linking) is learning in the context of real life experiences or previous knowledge. Experiencing (experiencing) is a learning strategy by learning through exploration, discovery and creation. Classroom experiences can include manipulative use, problem solving and laboratory activities. Applying is learning by putting concepts to use, providing realistic and relevant exercises. Cooperating is learning in the context of sharing, responding and communicating with other learners. Then Transferring (transferring) is learning by using knowledge in a new context.

The aspect of connecting (Relating), conducting searches and investigations carried out by students actively to find the meaning of the concepts being studied (Experiencing), applying mathematical understanding in problem solving (Applying), providing opportunities for students to work together and share (Cooperating), and provide The opportunity for students to transfer mathematical knowledge in solving mathematical problems and in other areas of mathematics application (Transferring) is an integral part of this REACT learning model. (Marthen, 2010).

The advantage of this REACT learning model is that it has a gradual understanding strategy, from the basic understanding that is expected to emerge at the Applying stage and deep understanding at the Transferring stage. Gradual understanding can help streamline students' thinking skills. In addition, the Experiencing stage in the REACT model is an important stage for students to build concepts. At this stage, students are expected to carry out activities to build knowledge concepts which will be applied in any problems related to the material. This activity can be in the form of manipulation, experimentation or problem solving activities (Durotulaila, Masykuri, & Mulyani, 2014). The steps of the development model according to (Lestari, 2019) are shown in table 1.

Table 1. Syntax of Learning *REACT*

Phases	Activities
Relating	Students are guided by the teacher to connect the concept of material in learning with the knowledge possessed by students
Experiencing	Students conduct research (Hands-on Activity) and the teacher provides explanations to direct students to find new knowledge.

Phases	Activities
Applying	Students apply the knowledge learned in everyday life
Cooperating	Students conduct group discussions to solve problems and develop collaborative skills with friends.
Transferring	Students demonstrate the ability to learn about knowledge and apply it in a new situation or context.

Based on the description above, the purpose of this study is to see the increase in the use of the REACT learning model on the problem-solving ability of seventh grade students of SMP 2 Unaaha.

RESEARCH METHODS

This type of research is experimental research. The populations in this study were students of class VII SMP Negeri 2 Unaaha. Determination of the sample in this study was carried out using purposive sampling technique, namely two classes that have almost the same mean and variance of test scores for mathematical problem-solving abilities. The two classes chosen were class VII1 and class VII2. The selection of the experimental class and the control class was done randomly. The result, class VII1 as the experimental class and class VII2 as the control class. The variables used in this study were the independent variable and the dependent variable. The independent variable in this study is the treatment in the form of learning using the REACT (X1) learning model for the experimental class and the control class in the form of a direct learning model (X2). The dependent variable in this study is the mathematical problem solving ability of students who are taught using the REACT (Y1) learning model and the mathematical problem solving abilities of students who are taught using the direct learning model (Y2).

The design used in this study was the Posttest-Only Control Group Design, where the two sample classes were given different treatments (Sugiyono, 2016). The design used is described in Table 2 below.

Table 2. posttest-Only Control Group Design

Group	Treatment	Posttest
Experiment (R)	X_1	O_1
Control (R)	X_2	O_2

The research instrument used in this study had two instruments including an instrument in the form of an observation sheet and an instrument in the form of a test of students' mathematical problem solving abilities. The observation sheet is used to measure the level of activity / participation of teachers and students in the mathematics learning process using the REACT learning model and direct learning. In this study, the observation sheet was made referring to the lesson plan. The format used in the observation sheet is a systematic activity in the form of filling in to find out actions during the implementation of the REACT learning model and the direct learning model.

The test of mathematical problem solving abilities in this study was used to measure students' mathematical problem solving abilities in the form of a written test in the form of a description of 4 questions on the material of equations and one variable linear inequality. This test is used to obtain quantitative data in the form of students' problem solving ability scores which are arranged based on scoring guidelines. The tests are arranged based on indicators of problem-solving abilities according to Polya, namely: 1) indicators of understanding the problem, including: (a) knowing what is known and asked about the problem and (b) explaining the problem in accordance with its own sentences; 2) Indicators of making plans, including: (a) simplifying problems, (b) being able to make experiments and simulations, (c) being able to find sub-objectives (things that need to be looked for before solving problems), (d) sorting information; 3) Indicators of implementing the plan, including: (a) interpreting the problem given in the form of mathematical sentences, and (b) implementing the strategy during the process and calculation; (4) Review indicators, including: (a) checking all the information and calculations involved, (b) considering whether the solution is logical, (c) looking at other alternative solutions, (d) reading the questions again, (e) asking oneself itself whether the question has been answered. Scoring Guidelines for Polya's problem-solving abilities (Widodo, 2015) can be seen in table 3.

Table 3. Scoring Guidelines for Polya's problem-solving abilities

Aspect	Reaction to questions/problems	Score
Understand the problem	Students do not write down anything so that students do not understand the meaning of the problem posed	0
	Students write data/concepts/knowledge that are not related to the problem posed so that students do not understand the problem posed	1
	Students only write down or express what is known or what is being asked	2
	Students are able to write or express what is known and asked about the problem posed clearly	3
Planning Problem Solving	Students do not tell/write steps to solve problems	0
	Students tell/write down the steps to solve the problem but not coherently	1
	Students write down the sufficient and necessary terms or formulas of the problem posed and use all the information that has been collected.	2
Execution of the Plan	students are not able to carry out the plans that have been made	0
	students carry out the plan that has been made, but there are procedural errors and algorithm/ calculation errors	1
	students carry out the plan that has been made, but there is a procedural error	2
	students carry out the plans that have been made, use the steps to solve the problem correctly, and there are no procedural errors, but algorithm/calculation errors	3
	Students carry out the plans that have been made, use the steps to solve the problem correctly, there are no procedural errors, and there are no algorithm/calculation errors.	4
Check again	Students do not re-check the answers	0
	Students do a re-examination of the answers.	1

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RESULTS AND DISCUSSION

Based on the results of the descriptive analysis of the posttest value of students 'mathematical problem solving abilities, the data obtained from the students' mathematical problem solving abilities in the experimental class and control class can be seen in table 4.

. Table 4. Description of Students' Mathematical Problem Solving Ability Experiment Class and Control Class

Descriptive statistics	Experiment Class	Control Class
Jumlah Sampel	27	25
Mean	81,2037	70,6
Median	82,5	72,5
Modus	77,5	70
Std. Deviation	14,38	19,77
Variance	206,91	390,77
Skewness	-2,50245	-0,60908
Kurtosis	8,5774732	0,09367
Minimum	25	25
Maximum	100	100

The frequency distribution of the posttest scores of students' mathematical problem solving abilities in the experimental class and control class can be seen in figure 1.

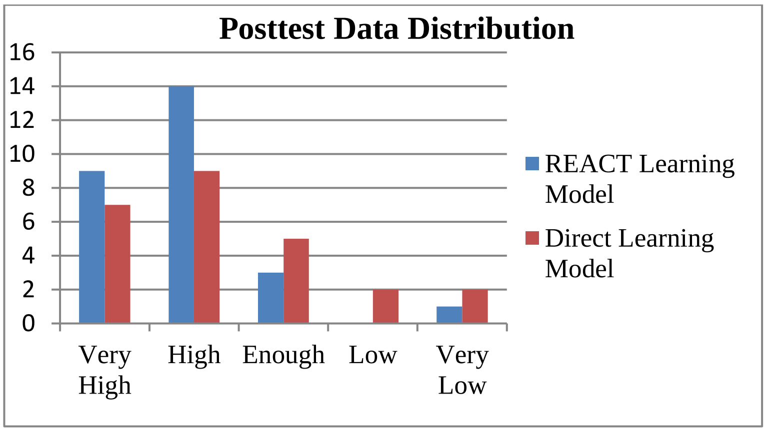

Figure 1. Posttest Data Distribution

The normality test in this study used the Kolmogorov-Smirnov test statistic. The results of the analysis can be seen in Table 5

Table 5. Results of Data Normality Test Analysis

Class	*Sig.*	Decision
Experiment	0,068	Accept H_0
Control	0,808	Accept H_0

Based on the results of the data normality test, it was concluded that the posttest data of control class students' mathematical problem solving was normally distributed. The homogeneity test was used to determine whether the variance of the two groups of posttest data on students' mathematics problem solving was homogeneous or not. Based on the results of the homogeneity test of data variance of the two sample groups with the help of IBM SPSS Statistics, the calculation results can be seen in table 6.

Table 6. Results of Posttest Data Variance Homogeneity Test Analysis

Sig.	**Decision**
0,093	Accept H_0

Based on table 6, the results of the data homogeneity test analysis obtained a significance value of 0.160. Because the significance value is 0.93> α (with α = 0.05) then H0 is accepted, this means that the distribution of posttest data for the experimental class and the control class has a homogeneous variance. The hypothesis tested in this study is "There is a significant effect of the REACT (Relating, Experiencing, Applying, Cooperating, Transferring) learning model on the mathematical problem solving ability of seventh grade students of Junior High School". The statistical hypothesis is formulated as follows $H_0 : \mu_1 = \mu_2$ versus $H_1 : \mu_1 > \mu_2$.

Based on the results of hypothesis testing with the help of IBM SPSS Statistics, the calculation results can be seen in table 7

Table 7. Hypothesis Test Results

T- count	$Sig\ (2 - tailed)$	**Decision**
2,224	0,031	Tolak H_0

The results of the t-test analysis obtained values Sig (2-tailed) is 0,031<α (α=0,05), then H0 rejected. Accept H1, means that there is a significant effect of the REACT learning model on the mathematical problem solving ability of grade VII junior high school students. This research was conducted in six meetings in the experimental and control classes, with five meetings used for the learning process and one meeting used for tests of mathematical problem solving abilities. This mathematical problem solving ability test was given to students after being given different treatments to the two sample classes in five meetings.

The learning process in the experimental class begins with preliminary activities such as the teacher opening lessons with greetings and prayers, checking student attendance, motivating students about the importance of studying one variable linear equations and inequalities, conveying learning objectives, explaining the subject matter to be studied with the flow of the model. REACT, namely Relating (connecting), Experiencing, Applying, Cooperating (working together) and Transferring.

At the Relating stage, the teacher begins learning by connecting the learning material with the context of everyday life. This is done by giving problems in everyday life, and then students with the guidance of the teacher look for solutions to these problems, where the solutions given are related to the concept of equations and one variable linear inequality. Then, the teacher provides additional information about the linear equations and inequalities material of one variable so that students can use their initial understanding in the Experiencing stage. At the Experiencing stage, the teacher prepares a teaching aid that can help students find new knowledge from the initial knowledge that has been obtained from the relating process. Next, the teacher writes some problems on the board and asks students to solve these problems with the props that have been prepared. Students with teacher guidance work on the problems given and record additional information obtained in a notebook.

At the Applying and Cooperating stage, the teacher divides students into 5-6 study groups. Then, each group was given a a Student Worksheet. Students are expected to be able to use the information obtained from the relating and experiencing stages to exchange opinions with their group members in answering the problems given. At the transferring stage, students are welcome to present the results of the discussion with their group colleagues. In this step, students can express their opinions in front of their friends. This step can motivate students that their answers are worthy of respect, as they also learn to respect other people's answers. If there is a student's answer that is wrong, the teacher provides assistance to draw conclusions about the correct answer from the results of problem solving made by each group. At the end of the learning activity, the teacher and students reflect and evaluate the learning that is being carried out and give assignments to be done at home individually. The series of stages in this learning emphasizes students to be able to solve a problem by connecting the problem with everyday life, so that the subject matter can be easily remembered by students and not easily forgotten and can train and improve students' mathematical problem solving abilities.

Based on the results of the descriptive analysis of the posttest data that has been obtained, the average value of the experimental class is higher than the average value of the control class. Based on the average value, the experimental class students 'mathematical problem solving is higher than the control class students' mathematical problem solving. This indicates that from the average score indicator, the REACT learning model is able to have a positive influence in improve students' mathematical problem solving abilities when compared to direct learning models. From the data diversity indicator (variance), the posttest data from the experimental class had a smaller variance compared to the posttest data for the control class. The variance value of the two groups shows that the control class mathematical problem solving is more diverse than the experimental class. Meanwhile, from the indicators of skewness and kurtosis, the experimental class was -2,50245 and 8,5774732, and the control class was -0.60908 and 0.09367, respectively. These results indicate that the students' mathematical problem solving abilities in the experimental class are higher than the control class. As for the indicators based on the maximum value, minimum value, mode and median, the posttest data from the experimental class students' mathematical problem solving results was higher than the posttest data from the control class students. So in general it can be said that the mathematical problem solving abilities of the experimental class students who were taught with the REACT learning model were better than the mathematical problem solving abilities of the control class students who were taught using the direct learning model.

Based on the distribution of posttest scores for the experimental class and the control class, in the experimental class, the level of mathematical problem solving ability is spread into very high, high, moderate, and very low categories. A total of 9 students are in the very high category, 14 students are in the high category, 3 students are in the enough category, and 1 student is in the very low category. This is because most students in the experimental class have fulfilled the problem solving indicators in working on the given questions, namely understanding the problem, planning problem solving, implementing problem solving plans and conducting re-examination. Whereas in the control class, there were 7 students who were in the very high category, 9 students in the high category, 5 students in the moderate category, 2 students in the low category, and 2 students in the very low category. This is because some students in the control class are still lacking in understanding the problem and planning the problem solving of the problems given. This certainly indicates that the students' mathematical problem solving abilities in the experimental class are better than the mathematical problem solving abilities of the control class. This is in accordance with Polya's opinion (Fauziah, 2010) that the first stage in solving math problems understands the math problem itself. Furthermore, Fauziah stated that the relationship between understanding ability and problem solving can be emphasized that, if someone already has the ability to understand mathematical concepts, then he is able to use it to solve problems. Conversely, if someone can solve a problem, then that person must have the ability to understand the mathematical concepts that have been studied before.

Based on the results of observations of the implementation of learning in the experimental class, the percentage of teacher activity ranged from 93.10% to 100% and the level of student participation in learning reached a percentage of 89.52% to 93.55%. Whereas in the control class the percentage of teacher activity ranged from 90.90% to 95.45% and the level of student participation in learning reached a percentage of 84.09% to 88.64%. This means that the implementation of learning in the experimental and control classes has been going well. However, students' mathematical problem solving in the experimental class was higher than the control class. This is because through REACT learning students become more active in connecting the concepts learned with real-world contexts during the learning process, compared to students who are taught using direct learning models. Learning in the experimental class is better than the control class, although there are obstacles faced during the learning process such as some students who choose to remain silent when asked or do not want to give their opinion, but because the teacher uses the REACT learning model which is not teacher-centered, so students are required to active in learning. This results in a student-centered learning process, where students can develop their creative thinking as well can construct their own concepts and knowledge. In addition, many students in the experimental class worked on student worksheets in earnest and based on what they understood. These things are the reason why students' mathematical problem solving in the experimental class is higher than students in the control class who are taught using the direct learning model. This is in accordance with the opinion of (Siswoyuono & Susilo, 2016) that the REACT learning model is right for creating mathematics learning because it involves students to be more active. Through the REACT learning model, students are invited to build or find a new concept from previously understood concepts, or from problems in the real world, and then apply them to problems of everyday life, by discussing with their friends to be able to solve them. a math problem.

Before testing the hypothesis using the t-test (Independent Sample t-test), a prerequisite test was first carried out including the data normality test for the experimental class and the control class as well as the homogeneity test of the data variance of the two sample groups. Based on the data normality test using the Kolmogorov-Smirnov test, it was obtained for data on mathematical problem solving for the experimental class and the control class with a normal distribution. Furthermore, based on the results of the variance homogeneity test of the experimental class and control class mathematical problem solving data using Fisher's test, it was found that the data on the mathematical problem solving ability of the two groups had a homogeneous variance. Based on the results of the t-test, it can be concluded that there is a significant effect of the REACT learning model on the mathematical problem solving abilities of students of class VII Junior High School.

The influence of students' mathematical problem solving abilities is caused by the application of the REACT model. This is in accordance with the theory presented by (Durotulaila, Masykuri, & Mulyani, 2014; Nurzannah et al., 2021; Nurhayati, 2021) that the REACT learning model has a gradual understanding strategy, from the basic understanding that is expected to emerge at the Applying stage and deep understanding at the Transferring stage. Gradual understanding can help streamline students' thinking skills. In addition, the Experiencing stage in the REACT model is an important stage for students to build concepts. At this stage, students are expected to carry out activities to build knowledge concepts that will be applied to any problems related to the material, so that it can have an impact on increasing students' mathematical problem solving abilities. Similarly, the results of research by (Lestari, Sahputra, & Lestari, 2021) that the REACT model can increase students' understanding of concepts by 0.42 in the medium category. In addition, based on previous research conducted by (Siswoyuono & Susilo, 2016), it was concluded that the REACT learning model was effective in developing problem solving abilities. This can be shown by student learning outcomes in the aspect of problem-solving abilities in classes that are subjected to the REACT model to achieve individual mastery and classical mastery. This shows that the application of the REACT learning model has a significant effect on the mathematical problem solving ability of seventh grade students of junior high school. Similarly, the results of research by (Karsli &

Yigit, 2017) that the REACT Strategy is effective in improving conceptual understanding and helping grade 12 students to make connections between scientific concepts and everyday life.

CONCLUSIONS AND SUGGESTIONS

Based on research and discussion, it can be concluded as follows: (1) Mathematical problem solving abilities of class VII junior high school students who are taught using the REACT learning model have an average of 81.20; median 82.5; mode 77.5; standard deviation 14.38; variance 206.91; skewness -2,50245; kurtosis 8,5774732; The maximum score is 25 and the minimum score is 100.The level of students' mathematical problem-solving abilities based on the category, it was found that 9 students were in the very high category, 14 students were in the high category, 3 students were in the sufficient category, and 1 student was in the very low category: (2) Mathematical problem solving abilities of class VII junior high school students who are taught using the direct learning model have an average of 70.6; median 72.5; mode 70; standard deviation 19.77; variance 380.77; skewness -0.60908; kurtosis 0.09367; The maximum score is 25 and the minimum score is 100.The level of students' mathematical problem-solving abilities based on the category, 7 students are in the very high category, 9 students are in the high category, 5 students are in the sufficient category, 2 students are in the low category and 2 students are in the very low category: (3) There is a significant effect of the guided inquiry learning model on the understanding of mathematical concepts of seventh grade students of junior high school: (4) The REACT learning model can develop students' creative thinking so that they can construct their own concepts and knowledge.

Based on the research results and conclusions, several things can be suggested as follows: (1) If the teacher can use the REACT learning model as an alternative learning model to improve students' mathematical problem solving skills; (2) The teacher must be able to pay attention to the situation of students in applying the REACT learning model, because not all students can easily adjust to the learning steps in the learning model. In addition, the teacher's group division must be carried out heterogeneously in order to establish good cooperation between students in the group: (3) Researchers who want to develop this research can do it on other subjects by paying attention to the transferring stage in the learning syntax, namely how students demonstrate the ability to learn about the knowledge and apply it in new situations or contexts, so that the learning process with the REACT learning model can run more optimal.

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