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The Effect of Deep Dialogue/Critical Thinking Model on Students' Conceptual Understanding Ability

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Abstract: Most students in Indonesia find it difficult to understand the concepts of mathematics correctly. This is caused by the factor of teacher who doesn't master the learning method according to the class situation and the factor of the students who are less interested in learning mathematics. The DDCT is suitable in this case, the purpose of this study is to find out the effect of the DDCT and how much it affects the students' ability to understand concepts at SMPN 7 Ambon. This research is quantitative looking for the relationship between variables, with a pre-experimental design of the type of one-shot case study. The samples taken were students of class X-1 (experimental) and X-2 (control), each of which amounted to 15 people at SMPN 7 Ambon. Data were collected on concept understanding ability tests and questionnaires used for student responses during learning using DDCT. Data were analyzed through hypothesis testing and determinant coefficients using SPSS 22.0. The results showed that the average value of the experimental class was 88.67 and the control class was 60, so there was a difference in the average value of 28.67. From the results of the analysis obtained tcount = 0.862 > ttable = 0.05, it is concluded that there is an effect of DDCT on students' understanding of mathematical concepts. The findings during the research showed that DDCT: 1) can be used to train students to more easily understand a material, and 2) deep dialogue/critical thinking emphasizes attitude and mental emotional so that students learn with fun.

Keywords: deep dialogue/critical thinking (dd/ct), conceptual understanding ability

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INTRODUCTION

There are several mistakes made by students in solving mathematical problems. Errors in solving questions are mistakes made by students from things that should be true or deviate from the steps that have been previously set (Ferreti et al., 2018; Tong & Loc, 2017). In solving mathematical problems students make many mistakes such as errors in changing information, misconceptions, errors in interpreting solutions and errors in calculation operations (Herscovics, 2018; Qian & Lehman, 2017). Some types of errors made by students usually consist of 4 kinds. Among them are factual errors, namely errors in using symbols (Suyitno & Suyitno, 2015; Zhang et al., 2018), conceptual errors, namely errors in interpreting mathematical objects (Dreher & Kuntze, 2015; Rubino et al., 2017). principle errors, namely errors in connecting/associating several concepts/laws when solving problems and operating errors, namely errors in the process of deciphering calculations (Abdullah et al., 2015; Hansen et al., 2020).

In Indonesia, the cause of the failure to understand concepts in learning mathematics is that most students are unable/misunderstand mathematical concepts (Khasanah et al., 2020; Mardiah et al., 2020; Novitasari, 2016). Misconceptions of a knowledge can result in misunderstanding students' basic understanding to a higher level of education. This happens because mathematics is a learning material that is related to one another. In addition, the weak ability to understand mathematical concepts makes students unable to deal with variations in the form of problems from mathematics (Cholid et al., 2022; Pramuditya & Sulaiman, 2019; Wati & Murtiyasa, 2016).

Conceptual errors in learning mathematics can be caused by teacher and student factors. Teacher factors, including because teachers do not master the appropriate learning approaches and methods used to deliver material (Djalal, 2017; Lutvaidah, 2016; Sintawati & Indriani, 2019). In addition, what causes conceptual errors in learning mathematics is that the teacher lacks mastery of the core material provided (Tamimi & Hanum, 2018; Wulandari & Iriani, 2018). Mastery of the material must be owned by every teacher.

If the teacher does not master the concept, it is likely that he will convey the wrong concept which is then accepted by the students. Another cause is the lack of variety of teachers in choosing learning media in learning mathematics. Meanwhile, from student factors, among them are because students are less interested in learning mathematics so that students do not pay attention to the material and ultimately do not understand the concept (Amallia & Unaenah, 2018; Febriyanti & Seruni, 2015). In other cases, students only memorize formulas or concepts, not understand them. As a result, students cannot use the concept in different situations.

Recently, there are many problems faced by mathematics teachers and students in the mathematics learning process (Suraji et al., 2018; Siki et al., 2021; Gusmania & Agustyaningrum, 2020). The problems in question include students not understanding mathematical concepts because the subject matter perceived by students is too abstract and unattractive. This is very natural to happen because the method of delivering material is only centered on the teacher while students tend to be passive, on the other hand, students are also not allowed to be creative to find their ability to understand mathematical concepts. Students are afraid to express their ideas and feel reluctant to ask questions, even though the teacher often asks students to ask if there are things that are not clear or are not understood. Understanding mathematical concepts is a requirement to be able to master mathematics (Fajar et al., 2019; Ginanjar, 2019). Every lesson always begins with the introduction of concepts so that students have good basic provisions to achieve other basic abilities such as reasoning, communication, connection, and problem-solving. If the understanding of the concept is good, students do not just know or remember several concepts learned but can express them again in other forms that are easy to understand. Students can also provide data interpretation and can apply concepts that are by their cognitive structure.

Though, this comprehension ability is a very important thing (Aledya, 2019; Zebua et al., 2020; Taufik, 2019). By understanding the concept students can achieve mathematical procedural knowledge (Nasution, 2018; Mulyono & Hapizah, 2018). According to Laili et al. (2019), understanding is the level of ability that expects students to be able to understand the meaning of concepts, situations, and facts they know. The ability to understand concepts can also be interpreted as the ability to capture meanings such as being able to express a material presented in another form that can be understood, being able to provide interpretation, and being able to classify it.

The deep dialogue/critical thinking model is suitable in this case (Noviandari & Fratiwi, 2018; Rahman et al., 2018). This deep dialogue/critical thinking model can help teachers make learning meaningful for students (Kristianty, 2021) because in this learning model the learning process is focused on students as much as possible. So in this learning model students are trained to gain knowledge, experience, find concepts, and solve problems through deep dialogue and critical thinking with teachers and fellow students (Widiati et al., 2020; Alifiani & El Walida, 2019; Rianti & Iswanto, 2020). So that to continue the next material students can easily understand it.

According to Nasution (Umamah, 2016) students who master concepts can identify and work on new, more varied questions. In addition, if children understand a concept, they will be able to generalize an object in various other situations that are not used in learning situations. Wardhani (Kusumawati, 2017) states that several indicators show an understanding of the concept, namely: (1) restating a concept; (2) Classifying objects according to certain properties (according to the concept); (3) Give examples and non-examples of the concept; (4) Presenting concepts in various forms of mathematical representation; (5) Developing the necessary or sufficient conditions for a concept; (6) Using, utilizing, and selecting certain procedures or operations; (7) Apply the concept or problem-solving algorithm. From these indicators, this research takes several indicators to focus on, namely: (1) restating a concept; (2) Giving examples and non-examples; (3) Presenting concepts in various forms of mathematical representation. Based on some of the opinions above, it can be concluded that conceptual understanding is the process of individuals mastering by receiving and understanding information obtained from learning which is seen through the ability to behave, think and act shown by students in understanding the definition, understanding, special characteristics, nature, and core or the content of mathematical material and the ability to choose and use procedures efficiently and appropriately.

According to Untari (2016) that the five components contained in the deep dialogue/critical thinking model are silence, community building, core activities with concept attainment and cooperative learning strategies, reflection, and evaluation. The first is silence, which means a calm situation before the lesson, or it can be done by praying because it can bring the hearts and minds of the students and teachers to the learning at that time. Second, building a community, namely creating a positive bond as a unit by emphasizing common goals and mutual respect between members. Community building activities are also very important for a pluralistic society, therefore if in learning an attachment has been built in a small community (class) then on a macro scale, attitudes and behavior are tolerance, respect for differences, open to criticism, dare to be different, and Other commendable attitudes will be able to lead students to become democratic citizens. Third,

the activities of concept discovery and cooperative learning.

Based on the discussion presented above, this research focuses on the influence of middle school students' conceptual understanding skills on the deep dialogue/critical thinking model. Thus, the objectives of this study are: (1) To find out whether there is a significant effect between the use of the deep dialogue/critical thinking model on the ability to understand mathematical concepts of class VII SMPN 7 Ambon; (2) To find out how much influence the use of the deep dialogue critical thinking model has on the ability to understand concepts in class VII SMPN 7 Ambon.

METHODS

This type of research is quantitative. Anggito and Setiawan (2018) explains that research is based on the philosophy of positivism, which is objective phenomena and is studied quantitatively. The purpose of this quantitative research is to show the relationship between variables. This study uses two variables, namely the independent variable and the dependent variable. The independent variable is the deep dialogue learning model/critical thinking and the variable is the students' ability to understand mathematical concepts. The design used in this study is a pre-experimental design. This design is used to reveal cause-and-effect relationships only by involving one group of subjects, so there is no strict control over the variables. In the pre-experimental design, the researcher uses a one-shot case study, which is an experiment that can be applied without a comparison group and also without a pre-test. With this design, the researcher has a simple goal, namely wanting to know the effect of the treatment given to the group without regard to the influence of other factors.

The research population is the entire object under study in the form of humans, objects, events and symptoms that occur. This population is very important because it is a necessary variable to solve the problem so that research can be achieved. the population in this study were all students of class X SMPN 7 Ambon. researchers took research samples with random sampling technique, namely the sampling technique on the basis of the consideration that the selected class was a class taught by the same teacher. Because there are several classes taught by the same teacher, one class is taken randomly from among the several classes. Class X-1 consisting of 15 people was chosen as the class under study, namely the class that uses the deep dialogue critical thinking learning model and class X-2 which consists of 15 people as the class that uses the conventional model.

Data collection techniques in this study using a test that is used after the teaching and learning process. The test used to measure the students' conceptual understanding ability. This test will be given in the form of essay questions consisting of three questions that represent three indicators of concept understanding ability, namely restating a concept, providing examples and non-examples, and presenting examples in various forms that represent mathematically, then a questionnaire is used to collect responses. student data on learning using deep dialogue critical thinking. The tests given to the class that must be studied are posttest questions. The material being tested is the subject of the linear absolute value equation of one variable. While the ability to understand mathematical concepts about the linear absolute value equation variable of one variable is the score achieved by students in solving the equation problem of the value of one linear variable.

The data analysis technique in this study uses the average test to measure the posttest value in the experimental and control class, then uses a hypothesis test to determine conclusions on the initial hypothesis and performs a determinant coefficient test to measure the percentage of the influence of the model on the variable Y. The coefficient of determination is denoted where r^2, is the square of the correlation coefficient. This coefficient can be used to analyze whether the suspected variable (Y) is influenced by the variable (X) or how the independent variable affects the dependent variable. The hypothesis test in this study is the correlation "r" Product Moment by Pearson. Using spss 22.0 where for the basis for taking the hypothesis, namely if the value of sig < 0.05 or $t_{count} > t_{table}$, then there is an effect of variable x on variable Y, but if the value of sig > 0.05 or $t_{count} < t_{table}$, then there is no the effect of variable X on variable Y.

RESULT AND DISCUSSION

The purpose of this research is to find out whether there is an influence of the Deep Dialogue/Critical Thinking model on the understanding of the concept at class VII SMPN 7 Ambon. implemented in classes VII-1 and VII-2 totaling 30 people. The data in this study were obtained by several data collection techniques, namely tests and questionnaires.

Description of Experimental and Control Group Value Data

The experimental class is the group that is treated using the Deep Dialogue/Critical Thinking model. Before the researcher gave the treatment, the experimental class was given a test. The number of students in the experimental class was 15 students and 15 students took the test. While the initial scores of the

experimental class are presented in the following table:

Table 1. Pre-Test and Post-Test Data for Experiment & Control Class

Student's name	Experiment		Control	
	Pre-Test	Post-Test	Pre-Test	Post-Test
S-1	30	80	30	60
S-2	50	90	40	60
S-3	40	70	40	50
S-4	70	90	60	70
S-5	50	80	40	60
S-6	70	90	40	50
S-7	80	100	60	70
S-8	50	90	50	60
S-9	70	90	70	90
S-10	40	80	30	50
S-11	70	100	50	60
S-12	60	80	40	60
S-13	70	100	30	50
S-14	50	90	30	50
S-15	60	100	30	60
Amount	860	1330	640	900
Average	57.33	88.67	42.67	60.00

The highest value of the pre-test given to the experimental group was 80 and the lowest score was 30 with an average of 57.33. While the highest score of the post-test given to the experimental group was 100 and the lowest score was 70 with an average of 88.67. The control class is a group that is treated without using a model but using a conventional model. Before the researcher gave the treatment, the control class was given a test. The number of students in the control class was 15 students and 15 students took the test. The highest value of the pre-test given to the dick group was 70 and the lowest score was 30 with an average of 42.67. While the highest score of the post-test given to the experimental group was 90 and the lowest score was 50 with an average of 60.00.

Normality Test

The normality test using the Kolmogorov-Smirnov test was carried out on the data on the effect of the Deep Dialogue/Critical Thinking model on students ' understanding of concepts. To simplify and get accurate data calculations in the normality test in this study, researchers used SPSS 22, the interpretation of the Kolmogorov-Smirnov test using SPSS 22 is that if the significance value is more than 0.05 then the data distribution is declared to meet the assumption of normality, and if the value is less than 0.05 then interpreted as abnormal.

Table 2. Normality Test

Tests of Normality

		Kolmogorov-Smirnov [a]		
	Class	Statistics	df	Sig.
Results	Experiment Class	.211	15	.071
	Control Class	.249	15	.013

The significance value in the experimental class is 0.071, and in the control class is 0.013. So that both can be concluded to have more significance than 0.05 which means that the two variables are normally distributed.

Data Homogeneity Test

The homogeneity test between the experimental class and the control class used the F test. However, to simplify and obtain accurate calculations for the homogeneity test, the researcher used SPSS 22 for the help of the SPSS for Windows computer program with the condition that if sig. > 0.05 then the data is homogeneous. If homogeneity is met, the researcher can carry out further analysis stages.

H_0: The variance of the two homogeneous groups

H_1: The variance of the two groups is not homogeneous

By using the significance level 5% or 0.05, if the significance obtained is more than 0.05, then accept Ho, which means that the variance of each sample is the same (homogeneous). And if the significance obtained is less than 0.05, then reject Ho, which means that the variance of each sample is not the same (not homogeneous).

Table 3. Homogeneity Test

		Levene Statistics	df1	df2	Sig.
Student learning outcomes	Based on Mean	.031	1	28	.862
	Based on Median	.000	1	28	1,000
	Based on Median and with adjusted df	.000	1	26.062	1,000
	Based on trimmed mean	.001	1	28	.981

The significance value is equal to 0.981. So it can be concluded that we accept Ho, which means that the variance of the two groups is homogeneous.

Hypothesis Testing

To find out how far the influence of the Deep Dialogue/Critical Thinking model is on students' conceptual understanding, it is necessary to test its significance by using the t-test technical difference test analysis. The aim of the researcher, namely to examine the influence of the Deep Dialogue/Critical Thinking model on students' conceptual understanding. From the calculation data of student learning outcomes (post-test), it can be seen that the experimental class applied to the Deep Dialogue/Critical Thinking model has an average of 88.67. Whereas in the control class (the Deep Dialogue/Critical Thinking model is not applied) on understanding the concept of students have an average of 60.00.

To simplify and obtain accurate calculations for the t-test, the researcher used SPSS 22. T-test criteria will give the conclusion that there is an effect if the significance is less than or equal to 0.05.

Table 4. Results of T-test

Independent Samples Test

			MARK	
			Equal variances assumed	Equal variances not assumed
Levene's Test for Equality of Variances	F		.031	
	Sig.		.862	
t-test for Equality of Means	T		7.888	7.888
	Df		28	27.353
	Sig. (2-tailed)		.000	.000
	Mean Difference		28.66667	28.66667
	Std. Error Difference		3.63405	3.63405
	95% Confidence Interval of the Difference	Lower	21.22264	21.21470
		Upper	36.11069	36.11863

Significance value $0.000 < 0.05$ is, then the SPSS 22 calculation concludes that there is an influence of the Deep Dialogue/Critical Thinking model on students' conceptual understanding between students who are taught using the Deep Dialogue/Critical Thinking model and students who are taught not using the learning model. So it can be concluded that there is a positive and significant influence of the Deep Dialogue/Critical Thinking model on understanding the concept of class VII SMPN 7 Ambon.

From the analysis obtained t_{count} = 0.862, t_{table} = 0.05 it is concluded that the hypothesis is accepted. This means that there is a significant influence of using the model Deep Dialogue/Critical Thinking on students' conceptual understanding.

Determinant Coefficient

The coefficient of the determinant (R2) is a constant that shows the magnitude of the variation in YI every time there is a change in one unit of Xi. The determinant coefficient is used to determine the influence of

the Deep Dialogue/Critical Thinking model on students' understanding of concepts.

Table 5. Model Summary

Model	R	R Square	Adjusted R Square	Std. The error of the Estimate
1	.835 [a]	.698	.674	7.30297

0.698 x 100% = 0.698 or 69.8%. So the magnitude of the influence of the Deep Dialogue/Critical Thinking model on the understanding of the concept of class VII SMPN 7 Ambon is 69.8%. And 30.2% is influenced by other variables not examined.

Student Response Questionnaire

The questionnaire technique is used to measure student learning responses when students participate in learning activities using the Deep Dialogue/Critical Thinking model. To determine student learning responses after using the Deep Dialogue/Critical Thinking model:

Table 6. Student Learning Response Questionnaire

No	Question Items	Yes		Not		Amount	
		F	%	F	%	F	%
1	Do you always say hello and start the lesson by praying?	15	100	0	0	15	100
2	Did the teacher condition the class before starting the lesson?	13	87	2	13	15	100
3	I like it when the teacher explains the material using Deep Dialogue/Critical Thinking.	14	93	1	7	15	100
4	It is easier for me to understand learning when the teacher uses a variety of learning models.	14	93	1	7	15	100
5	I feel learning with Deep Dialogue/Critical Thinking always gives a lot of assignments to students.	15	100	0	0	15	100
6	With the Deep Dialogue/Critical Thinking model, my enthusiasm for learning has increased.	15	100	0	0	15	100
7	I pay less attention to subjects I don't like.	1	7	14	93	15	100
8	I am present on time when studying subjects that I consider easy.	12	80	3	20	15	100
9	I am lazy to ask the teacher if there is a lesson that I do not understand.	5	33	10	67	15	100
10	I feel I learned by using the Deep Dialogue/Critical Thinking model can improve understanding of the concept.	15	100	0	0	15	100
	Amount	119	793	31	207	150	100
	Percentage	11.9	79.3	3.1	20.7	15	100

Questionnaire of student learning responses to Deep Dialogue/Critical Thinking. The results obtained indicate that the student's learning response to the Deep Dialogue/Critical Thinking model is very high, it is known from the students' answers to the questions in the questionnaire which shows the percentage of students who answered "Yes" reached 79.3% which indicates the use of the Deep Dialogue/Critical Thinking model also triggers attractiveness of students to learn.

The initial data that became the material for discussing the Deep Dialogue/Critical Thinking model on students' conceptual understanding was the learning process of the two sample groups of the experimental class and the control class who were given different treatments. After the teacher gave the learning materials for the experimental class, the students were given treatment using the Deep Dialogue/Critical Thinking model, and the control class was treated with the conventional model. At the beginning of the treatment, students were not used to learning activities using the Deep Dialogue/Critical Thinking model, but in the learning process students were able to describe and study the material given by the teacher and solved it together. While in the control class that uses the conventional model, students are less active because they only hear explanations from the teacher and only a few students are seen to be active in learning.

The ability to understand mathematical concepts of students using the Deep Dialogue/Critical Thinking (DD/CT) Learning Model.

Posttest results after being given different treatment in learning to obtain the highest posttest score of 100, and the lowest posttest score of 70. Many students get scores between 80-90 this is because students in answering posttest questions are able to understand and answer questions properly and correctly. The average value is 88.67. The results showed that students' ability to understand mathematical concepts taught

through the Deep Dialogue/Critical Thinking (DD/CT) learning model was better than lecture learning. This is in accordance with the research results of Saifina and Tanjung (2020) which show that Deep Dialogue/Critical Thinking can improve students' conceptual understanding abilities.

The ability to understand mathematical concepts of students using the Conventional Learning Model.

The results of the posttest after being given different treatments in learning obtained the highest posttest score of 90, and the lowest posttest score of 50. Many students get scores between 50-60 so that students in answering the posttest questions have not been able to achieve the maximum value. This is because the learning process is only centered by the teacher, namely the teacher explains, gives assignments and asks questions. The average value is 60. The results show that the ability to understand mathematical concepts taught through lecture learning is less good than that taught through Deep Dialogue/Critical Thinking (DD/CT) learning.

Differences in the ability to understand mathematical concepts of students using the Deep Dialogue/Critical Thinking (DD/CT) Learning Model with the Conventional Learning Model.

The average value of the experimental class is 88.67 while the control class is 60 which means that there is a difference in the average value of 28.67. From the results of the analysis obtained tcount = 0.862 > ttable = 0.05, it is concluded that the hypothesis is accepted. This means that there is a significant effect between the use of the Deep Dialogue/Critical Thinking model on students' understanding of mathematical concepts. Thus, it can be said that students' understanding of concepts taught using the Deep Dialogue/Critical Thinking model is better than students taught using the lecture learning model and the effect of the Deep Dialogue/Critical Thinking model on students' conceptual understanding is 69.8%.

Deep Dialogue/Critical Thinking (DD/CT) explores the thinking of students to be more open so that it creates stimuli to further turn on innovative learning and have an impact on the output of students' higher posttest scores (Noviandari & Fratiwi, 2018; Priyandika, 2017; Salamah & Sumarsilah, 2018). In addition, the ability to understand concepts of students taught through lecture learning is less good than students taught through Deep Dialogue/Critical Thinking (DD/CT) learning, through lecture learning, many students only absorb learning passively so that learning will look stiff and monotonous. and the impact on the posttest of students is very low (Astuti et al., 2019; Widiati et al., 2020).

The findings during the research showed that deep dialogue/critical thinking: 1) can be used to train students to more easily understand material, use logic, analyze facts and produce imaginative local and traditional ideas. So that students can distinguish what is called good and bad thinking, (2) deep dialogue/critical thinking emphasizes values, attitudes, personality, mental emotional and spiritual so that students learn fun and passionately, (3) deep dialogue/critical thinking is an approach that can be collaborated with various methods that already exist and are used by teachers so far

Implications Theoretically, in essence the application of learning models can help teachers in carrying out teaching and learning activities in the classroom (Basal, 2015; Clark et al., 2010; Dewi, 2018). The Deep Dialogue/Critical Thinking learning model in learning mathematics positively affects students' ability to understand students' mathematical concepts. Deep Dialogue/Critical Thinking requires students to be more active by emphasizing deep dialogue and critical thinking (Anggraini & Nendra, 2020; Forijati, 2020). This is in line with the results of research showing that the Deep Dialogue/Critical Thinking learning model has succeeded in increasing students' understanding (Saifina & Tanjung, 2020; Sakban, 2015; Sanusi et al., 2013). This strengthens the theory of the Deep Dialogue/Critical Thinking learning model, and this model can be the right choice in learning activities to improve students' understanding of mathematical concepts in learning mathematics.

Implications Practically, the application of the Deep Dialogue/Critical Thinking model shows the effect on students' understanding of mathematical concepts during mathematics learning as well as on the development of student attitudes. Based on these findings, learning using the Deep Dialogue/Critical Thinking model can be an alternative for teachers and students in other places, especially those who have problems similar to those that occurred at SMPN 7 Ambon to apply them in classroom learning. The findings and implications of this study can also be an illustration that the use of learning models is one of the factors that encourage and determine the achievement of learning quality.

CONCLUSION

From the analysis obtained t_{count} = 0.862 > t_{table} = 0.05, it is concluded that the hypothesis is accepted, the conclusion is that there is an influence of the Deep Dialogue/Critical Thinking model on students' conceptual understanding between students who are taught using the Deep Dialogue/Critical Thinking model and students who are taught not using the Deep Dialogue/Critical Thinking model and the

magnitude of the influence of the Deep Dialogue/Critical Thinking model on students' understanding of concepts is 69.8% and 30.2% is influenced by other variables not examined. Based on the results of the questionnaire, the percentage of students who answered "Yes" reached 79.3% which indicates the use of the Deep Dialogue/Critical Thinking model also triggers the attractiveness of students to learn.

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