The Effect of REACE (Relating, Exploring, Applying, Cooperating and Evaluating) Learning Model Toward the Understanding of Mathematics Concept

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Abstract. The observation shows that the average students who still have mistakes in solving the mathematic problems as the students have not yet understood the concept of the lesson well. One way to solve the problem of students' concept understanding is to apply the REACE learning model (Relating, Exploring, Applying, Cooperating and Evaluating) oriented towards creating an independent learning environment, liveliness, cooperation elements and the ability to help teachers create concepts. This research is a quantitative research quasi experimental type research with nonequivalent control group design, specifically to see the effect of REACE on students' mathematical concept understanding. The analysis results show that the average of experimental class (77.36) with the gain test 0.48 (medium category) is higher than the control class (55.78) with the gain test 0.48 (weak category). The test t count ($t\text{ }\text{count}>t\text{ }\text{table}$ ($4.192>2.005$) means that the applying of REACE affected the students’ mathematical concept understanding.

1. Introduction
One of the missions of education in Indonesia is to expand and realize the noble ideals of the nation in quality education for all the people of Indonesia. On the one side, Indonesia's education problems are still low quality of education, this is based on the results of the Trend in International Mathematics and Science Study (TIMSS) survey that the students 'ability in terms of cognitive is still very low because the learning leads to the memorization that causes the students so that less understanding of the subject matter [1]-[5]. Mathematical reasoning allows learners, including teachers to understand mathematics and actively build mathematical ideas, communicate thinking and problem solving with appropriate strategies [6]. One of the foundations in improving mathematical achievement is the cognitive ability that connects knowledge by understanding the subject matter in solving mathematical problems [7]-[9].
Based on the observations conducted in the class VII of SMP Negeri 1 Kahu obtained information that the lack of the students understanding in solving mathematical problems that has not yet reached the value of criteria of minimum completeness of mastery learning (KKM) that is 70. The Table of the observation results based on the value of the task as follows.

| Class | VII A | VII B | VII C | VII D | VII E | VII F | VII G | VII H | VII I | VII J |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Average score of task value | 71 | 70 | 70 | 68 | 68 | 67 | 67 | 64 | 63 | 60 |

(Source: SMP Negeri 1 Kahu)

From the table seen the value task of class VII is there are still many students who have not yet reached the value of mastery. In general, this happens when the students in solving the task experienced mistakes, only a few students who can finish the task precisely and correctly. This happens because the students do not understand the concept of problem solving well and correctly. The low concepts of understanding is also seen when the teachers change the form of task, the students have difficulties in solving them, whereas the concept of problem solving is the same as the example given before.

The solution to solve the problem required a development of a model to obtain theory, which corresponds to the material. The process and the quality of learning needs creativity in developing the concept of education and new learning thoroughly. This can be done by updating the model to be more flexible, with the placement of students on educational objects. The concept of education also needs to be designed to foster the development of learning models [10,11].

Increased students understanding is a complex concept because it is influenced by aspects of teaching, learning context, learning materials and approaches in learning [12]. Therefore, it takes creative efforts from teacher in making learning becomes more interesting. One of the creative steps that can be done by teachers is to develop variation of learning in the way of elaborating learning model that aims to assist students in the process of learning mathematics, therefore REACT model learning (Relating, Experiencing, Applying, Cooperating and Transferring) elaborated with LC learning model (Learning Cycle 5E) to form a learning model. The result of the elaboration of the learning model is then formed REACE (Relating, Exploring, Applying, Cooperating and Evaluating) which is a model of learning that can help teachers to embed concepts in students by connecting the material and students’ real life context, it is expected that students are more motivated to learn based on the knowledge and experiences that have been owned, learning to orient by creating conditions or atmosphere of independent learning, active and cooperation in the learning process.

2. Basis theories

The REACE learning model is formed from the elaboration of REACT learning model (Relating, Experiencing, Applying, Cooperating and Transferring) with LC learning model (Learning Cycle 5E). The REACT learning model is a contextual learning model based on how students learn to gain understanding and how teachers teach to provide understanding [13]. LC learning model (Learning Cycle 5E) is a learning model that consists of five stages: Engage, Explore, Explain, Elaborate and Evaluate. The LC model is a model that provides new concepts or deep understandings that emphasize on students [14][15].

The objectives of the REACE learning model are as follows: 1) Students must be able to think critically in learning and able to make their own decisions well, 2) Have tolerant attitude toward different problem solving process and creativity and 3) Show attitude of happiness, confidence, internal motivation, critical attitude, cooperative, honest and confident in solving real problems.
The steps of learning model of REACE (Relating, Exploring, Applying, Cooperating and Evaluating) are:

1) Relating is learning by relating the material being studied to the context of real-life experiences or prior knowledge.
2) Exploring is students are given an opportunity to work together in small groups without direct instruction from teachers to test predictions, perform and record observations and ideas as well.
3) Applying is learning by applying the concepts that have been learned to be used, by providing realistic and relevant exercises.
4) Cooperating is learning by conditioning students to cooperate, share, respond, and communicate with other students.
5) Evaluating is teacher assesses whether the learning is going well by giving a test to measure students’ ability after receiving the subject matter.

3. Research methods
This study aims to determine whether there is influences of the implementation of REACE learning model to understanding the concept of mathematics on the subject of triangle. This research design uses quantitative research, with the type of quasi experimental research with "Nonequivalent Control Group Design". In this study, before the beginning of the treatment both the experimental and the control class are given a pre-test to know the initial condition of each class. The following is the experimental class, given a treatment using REACE learning model assisted props. While in the control class using the learning model commonly used every day by teachers in teaching mathematics. After completion of the treatment, then both classes are given a post-test. The form of the research design can be seen as follows.

Note:
X = treatment (treatment of REACE learning model)
- = No treatment (treatment)
O1 and O3 = Score of pre-test of the experimental class and the control class group
O2 and O4 = Score of pos-test of the experimental class and the control class group.
The sampling technique of this research is non-random sampling technique, with purposive sampling type that the sample is determined directly through the consideration of both samples that have homogeneous characteristics and can represent the population [16].

The subject of this study is the students of grade VII of SMP Negeri 1 Kahu with the population is 276 students of all class VII, the sampling technique of this study is non-random sampling, with purposive sampling type that is the sample is determined directly through the first sample consideration of students class VIID that is 28 as the experiment class and class VIIB is 28 as the control class. Collecting the data is done using a description test as a result of the learning and the observation.

The variables in this study are: Independent variables are variables that affect, so the independent variables in this study is REACE learning model and dependent variable is the variable that is influenced, in this study the dependent variable is the Understanding of Mathematical Concepts (Variable Y).

The assessment rubric of concept understanding is used as a reference in providing an assessment of the understanding mathematical concepts through tests. This assessment rubric contains the criteria for assessing students' concepts which is given a score ranged of 1 - 5 in accordance with students’ predetermined concept indicators [17].

| Aspect                  | Score | Explanation                                      |
|-------------------------|-------|--------------------------------------------------|
| Question understanding  | 1     | No effort to understand the problem              |
|                         | 2     | Misinterpretation of the whole question          |
|                         | 3     | Misinterpretation of the question on most questions |
|                         | 4     | Misinterpretation of the question in a small part of the question. |
|                         | 5     | The interpretation of the whole questions are true |
| Question completion     | 1     | No effort                                       |
|                         | 2     | Unsuitable planning of completion                |
|                         | 3     | Some procedures are correct, but most are wrong  |
|                         | 4     | The substantial procedure is correct, but there is still an error. |
|                         | 5     | The completion procedure is correct, without any errors |
| Answering Questions     | 1     | No answer or wrong answer due to incorrect completion procedure. |
|                         | 3     | Incorrect computing, no statement of answers, wrong labeling |
|                         | 5     | The completion is correct                       |

This research uses quantitative analysis that is an analytical technique where the analysis is done by calculation, as it is related to the numbers, the instrument test given is the test of the result of mathematic learning. The analyzing is done by the use of REACE learning model) through the understanding of mathematic concepts. From the data that has been obtained, then done with statistical calculations. The statistical calculation used is: Normality test, Homogeneity test, Gain-test, Group achievement test and Mean Independent Paired Test.

4. Research results and discussion

4.1. Description of the research result
The development of students' understanding of mathematical concepts becomes a benchmark in research that can be used as learning outcomes. Learning results obtained through the test. The test is
given at the first and last meeting. The first test in this study is the pretest test aimed to get the initial score and the following test is the posttest where the students given after the treatment, the treatment is the application of REACE learning model and final test (posttest) aims at knowing whether after application of the model, the students’ value increases. Increased understanding of students can be seen from the evaluation results provided at the end of the meeting.

The description of the test results of students' concept understanding shows that the highest value achieved by the two classes has no too distant difference, where the highest value in the experimental class is 94 and the highest value in the control class is 80. However, the lowest values achieved by the two classes looks quite far, that is 54 for the experimental class and 26 for the control class. When it is viewed from an average value, the experiment's average value is higher than the average of the control class. This means that the application of REACE learning model can influence the students’ concept of understanding, which is seen in the improving students' learning outcomes in experimental class. The result of the calculation based on the completion of question, the comprehension of the question, and the answering question obtained the average of the pretest in the control is 17.10 and the score of experiment class is 18.10, while the average of the post-test score in the control class is 18.60 compared to the experiment class, there is a significant increase with average score is 25.79. The description of the test results of students' concept understanding can also be seen in the following table.

| Table 3. The value of the results of the ability to comprehend the concepts of mathematics
|------------------------------------------|
| **Statistic** | **Group** | **Experiment** | **Control** |
|----------------|------------|----------------|-------------|
| Number of students | 28 | 28 |
| Ideal score | 100 | 100 |
| Highest score | 94 | 80 |
| Lowest score | 54 | 0 |
| average score | 77.36 | 55.78 |
| Criteria of Minimum completion | 2.50 | 2.50 |

4.2. Discussion of Research Results
Based on the result of the observation obtained shows that a lack of the students understanding in solving problems causes average of the students have not yet achieved the value of criteria of minimum completeness of mastery learning (KKM) in mathematic subjects that is 70. In general, this occurs when students experience mistakes in solving the problem well and correctly. One of the strategies to solve that problem is by applying the learning model of REACE to the experiment class.

The results of data analysis can be seen that in general, from the development of understanding of mathematical concepts of the experimental class students have increased during the implementation of learning model of REACE. Each student is given the opportunity to cooperate and exchange opinions in groups to test their initial knowledge and ideas. The number of ideas that arise during the discussion adds to students' knowledge and understanding so as to influence the conceptual understanding of the subject matter. The average increase in the test result shows the difference in the experiment class compared to the control class, which can visually be seen in the following figure.
Figure 3. Bar Chart of The Comparison of Normality Test Results of The Experimental Class and The Control Class

Based on the picture above shows that the average value of the post-test of the experimental class (77.36) is higher than the average value of the control class (55.78). The final test result of the experimental class also shows that the highest score of students is 94, it is caused by the learning process; The students are required to be able to understand and able to think independently in finding general principles based on the material or data provided by the teacher. The lowest score is 54, this is due to the students’ inactivity in the learning process so that it becomes an obstacle in understanding the problem so that the learning achievement is not maximal, but this result is better than the control class which shows the students’ lowest score is 26 and the students’ highest score is 80.

In the normality test, the data is normally distributed by using Kolmogorov Smirnov formula. Then the homogeneity value is searched by using Fisher test, obtained F Count as worth of 1.042 with n = 28 at significant level 95% (α = 0.05) obtained F Table equals to 1.90. Both groups meet the criteria F Count < F Table then both groups of the data are homogeneity.

Figure 4. Comparison Diagram of The Students' Concept Understanding of The Experimental Class and The Control Class

Based on the picture above shows that after doing the research by applying REACE learning model that aims to find out a change in understanding the concept of mathematics on the subject of triangle
obtained the average value of pre-test of the experiment class 56.6. After performing the initial test the treatment was conducted or a learning of using the model learning of REACE with assisted instructional media (props) provided particularly for each group.

In the learning process, students were divided into 4 groups with consideration of the highest initial test score of the students as group leaders with the aid of triangle props consisting of four (4) forms. After the treatment was done, the final test (posttest) was applied where the result answer of the students of the experimental class reached the average score of the posttest was 77.36 compared with the average score of the pretest was 56.50, it showed that there was an increase of 21% after applying the REACE learning model. The average score of pre-test of the control class was 51.29 and the average of the post-test value was 55.79 or there was only an increase as worth of 4.50%. The low score of the students in the control class occurs due to the lack of the students understanding in analyzing the questions and one of the most influential factors is the lack of the teacher’s control in the learning process. The score of students' concept understanding that consists of aspects of understanding questions, solving questions and answering questions can be seen in the following figure.

![Average Score of The Students’ Concept Understanding](image)

Figure 5. The Average Score of Students’ Concept Understanding

From the results of the comparison scores of both classes, the average increase in the average score of the experimental class increased as much of 6.95 points compared to the control class which only increased 1.5 points. This indicates that the application of REACE learning model influences the average value of the students' concept understanding. Based on the calculation of the hypothesis test analysis by using t test independent test obtained t count value 4.192. The significance level is 95% (α = 0.05) with the number of samples (n) is 28, then the value of the t on the student distribution (t) obtained t table 2.005, which means that the value of t arithmetic> t table, then H0 was rejected. So it can be concluded that there is an influence in the implementation of REACE learning model to the students’ understanding of mathematical concepts with the evaluation result shows that the experiment class was higher than the control class, then it means that the model used was successful because it can improve the students' understanding. Furthermore, Gain-Test is done to know the improvement of the students learning outcomes. In the learning process shows that the experimental class included in the medium category because 0.48> 0, 30. While for the control class included in the weak category because 0.09 <g <0, 30. In addition, to find out the group’s activeness in the learning process then GPA test was conducted. The GPA Test of the experimental class in the pretest obtained 1.13 which means that the students’ activeness was still very low, whereas in the post-test obtained result of GPA 1.55 which means that the students’ activeness in the learning process have increased significantly. Based on the description above it can be concluded that the students understanding of mathematical concepts in the experimental class is better than the control class. This is achieved because students
are able to build their own knowledge and able to cooperate well in groups during the learning process.

5. Conclusion

5.1. Conclusion
Based on the result of the research, it can be concluded that there is influences in the implementation of REACE learning model. The result of the students’ learning on triangle subject that is: The average value of the post-test of the experimental class (77,36), the control class (55,78) after applying REACE learning model. This is based on the results of the hypothesis test analysis or t test of the independent test obtained t value 4.192. The significant level is 95% (α = 0, 05) with the sample number (n) is 28, then the value of the t on the student distribution (t) obtained table 2,005, which means that the value of t arithmetic > t table, then H0 is rejected. So it can be concluded that there is influence in the implementation of REACE learning model to the students’ understanding of mathematical concepts. The evaluation result of students' concept understanding shows that the experimental class is higher than the control class, the model used is successful in improving the students’ understanding of mathematical concepts.

5.2. Suggestion
Based on the result of the research it should be suggested to teachers, especially junior high school mathematic teachers to apply REACE learning model as one of the efforts to help improve students' mathematic learning outcomes. The application of REACE learning model takes long time. It is expected to use strategy plays in the learning process so that the learning will not become monotonous.

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