The REACT strategy and discovery learning to improve mathematical problem solving ability

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Abstract. The purposes was to examine the comparison of problem solving abilities and critical thinking abilities for students who are taught with the REACT learning strategies and conventional learning. A quasi-experimental study with non-equivalent pretest-posttest design was applied in this study. The sample of this study was 64 students of Senior High School Kota Bengkulu. This research instrument is a test of problem solving skills and a critical thinking ability test. The result of the research was the ability of students taught with REACT strategies was higher than students taught with traditional learning. Also, the ability of students taught with guided discovery models was higher than students taught with traditional learning.

1. Introduction
Mathematics is often seen by students as a frightening subject. Students have difficulty solving math problems. Also, his motivation for learning mathematics is low. As a result, students' mathematics learning achievements are less encouraging [1].

Therefore, the right mathematics learning strategy is needed. According to Ismaya the Relating, Experiencing, Applying, Cooperating, and Transferring (REACT) learning strategies effectively increasing learning motivation and student learning outcomes [2].

The REACT strategy can be positive, and encourage students to learn more actively. As a result, the results of the study [3], show that there are differences in mathematics learning outcomes between students who follow REACT strategies with students who follow direct learning strategies. The average score of students 'mathematics learning outcomes that were taught with REACT strategies was higher than the average scores of students' mathematics learning outcomes that were taught with direct learning strategies. Thus, the REACT strategy is feasible to be implemented in mathematics learning.

Rahayu W state that both student’s groups having high initial capability and low initial ability will have higher mathematical belief compared with lecture with conventional method [4]. The descriptively, it was found that mathematical belief on students was categorized as low. The REACT strategy is carried out by connecting classroom learning material with the context of everyday life (relating) [5], actively searching and investigating students to get the meaning of the concept being studied [6]. Also, presenting learning in applying, providing opportunities for students to learn through collaboration (cooperating), as well as utilizing knowledge in solving problems in everyday life (transferring) [7]. To make it easier for students to reach the planned cognitive level, mathematics learning scenarios are needed through guided discovery [8, 9].
According to Shieh that students with integrated information technology Guided discovery instructions defeat them with traditional instructions on learning achievement [10, 11]. Students find it easier to understand mathematics, when given teaching materials that are close to their minds. Students learn and practice social skills, to facilitate the application of learning with REACT strategies and apply guided discovery learning. Based on the previous description, this paper discusses the influence of REACT strategies and guided discovery learning models based on mathematical abilities. Based on the previous description, this paper discusses the influence of REACT strategies and guided discovery learning models based on mathematical abilities.

2. Methods
This research applies experimental design. That is applying the non-equivalent pretest and posttest. The population was the all students in SMA N 2 Kota Bengkulu. The sample of this study is 48 students. The random sampling technique is applied to select the sample. It was divided into three groups. The first group was applied to the REACT strategy, the second group was taught through guided discovery and the last was traditional learning. The research instrument was the test of mathematical problem solving skills. The each of group was given a pretest and after treatment students were tested of the problem solving abilities. The data were analyzed by covariate analysis.

3. Results and discussions
The data of pretest and posttest about problem solving abilities were analyzed using statistics, namely covariance analysis. It was controlling the initial ability of students in mathematical representations. The results are presented table 1.

| Source         | Type III Sum of Squares | df  | Mean Square | F     | Sig.  |
|----------------|-------------------------|-----|-------------|-------|-------|
| Corrected Model| 110.734                 | 3   | 36.911      | 111.407 | 0.000 |
| Intercept      | 10.545                  | 1   | 10.545      | 31.826 | 0.000 |
| A              | 20.072                  | 2   | 10.036      | 30.291 | 0.000 |
| X              | 63.140                  | 1   | 63.140      | 190.572 | 0.000 |
| Error          | 14.578                  | 44  | 0.331       |       |       |
| Total          | 23530.000               | 48  |             |       |       |
| Corrected Total| 125.313                 | 47  |             |       |       |

Table 1. Levene's test of equality of error variances.

| F  | df1 | df2 | Sig. |
|----|-----|-----|------|
| 0.870 | 2  | 45  | 0.426 |

Table 1 presents the Levene test which aims to determine the level of homogeneity of variance from the four sample groups. We test the following Ho hypothesis.

- Ho: \(\sigma^2_1 = \sigma^2_2 = \sigma^2_3\)
- Ha: besides Ho

Based on Table 1, the Levene's test of error variance was F = 0.870 with df (2, 45) and p-value = 0.426 > 0.05. This means that Ho was accepted. Therefore, the average parameter of the three groups of sample data was to have the same variances (homogeneous).

Thus, we continue the analysis of covariance, namely the test of between-subject effects, the results of which are listed in table 2.

| Source         | Type III Sum of Squares | df  | Mean Square | F       | Sig.  |
|----------------|-------------------------|-----|-------------|---------|-------|
| Corrected Model| 110.734                 | 3   | 36.911      | 111.407 | 0.000 |
| Intercept      | 10.545                  | 1   | 10.545      | 31.826  | 0.000 |
| A              | 20.072                  | 2   | 10.036      | 30.291  | 0.000 |
| X              | 63.140                  | 1   | 63.140      | 190.572 | 0.000 |
| Error          | 14.578                  | 44  | 0.331       |         |       |
| Total          | 23530.000               | 48  |             |         |       |
| Corrected Total| 125.313                 | 47  |             |         |       |

See Colom A in table 2, obtained Fcount = Fo (A) = 30.291, df (2, 44) and p-value = 0.001 < 0.005. It was mean, there were differences of mathematical problem-solving abilities between those taught with REACT strategies, guided findings and traditional learning controlled by the initial ability covariates.
(pretest scores). The next, we were compare the problem-solving ability between groups of students taught with REACT strategies and conventional learning. The results are listed in table 3.

Table 3. Parameter estimates.

| Parameter | B    | Std. Error | t   | Sig. | 95% Confidence Interval |
|-----------|------|------------|-----|------|-------------------------|
| Intercept | 1.237| 0.341      | 3.628| 0.001| 0.550 – 1.924           |
| [A=1.00]  | 1.611| 0.207      | 7.765| 0.000| 1.193 – 2.029           |
| [A=2.00]  | 0.755| 0.213      | 3.546| 0.001| 0.326 – 1.184           |
| [A=3.00]  | 0.00*| 0.000      | 0.000| 0.000| 0.000 – 0.000           |
| X         | 0.829| 0.060      | 13.805| 0.000| 0.708 – 0.950          |

Table 3 shows that $t_{(A1A3)} = 7.765$, df = 44 p-value = 0.000 <0.05. This means that Ho is rejected. Thus, the problem-solving ability of students taught with REACT strategies is higher than students taught with traditional learning.

The next, $t_{(A2A3)} = 3.546$, df = 44 p-value = 0.001 <0.05. It means that Ho is rejected. So, the problem solving ability of students who are taught with guided discovery models is higher than students taught with traditional learning after controlling the initial ability covariate.

The results of the study explicitly conclude that the REACT strategy, and discovery learning are superior to traditional learning. Therefore, there is influence of discovery learning method toward the mathematics learning result of students. This is seen from the results of the students’ learning taught by discovery learning method is better than the results of students’ learning taught by expository [12, 13].

According to discovery method is a component of educational practice that covers teaching methods that promote the way of active learning, process oriented, self-directed [10]. One of the methods that have been widely used in advanced schools is discovery method.

On the other hand, the application of the REACT strategy in the school mathematics curriculum helps develop students' intellectual [14], increasing motivation and learning mathematics outcomes [10].

According to Kluge students require time to experiment with models to use them as resources, and that experimentation needs some structure elements to be productive [14]. The interactive models need to invite action and allow for different kinds of use.

4. Conclusion
This study concluded that the problem solving ability of taught students with REACT strategies is higher than students taught with traditional learning. Also, the problem solving of students who are taught with guided discovery models is higher than students taught with traditional learning.

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