The effect of the REACT CBA strategy on the material of reaction rate on student achievement at SMA Kristen 1 Tomohon

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Abstract. The purpose of this study was to determine whether there was an effect of the REACT CBA strategy on the material reaction rate on student achievement at SMA Kristen 1 Tomohon. The REACT CBA strategy was applied in the experimental class with 33 student’s in number, and conventional learning in the control class with 33 student’s. Student achievement scores are obtained from the pretest and posttest scores. The results showed that there was no significant difference in the pretest scores of the experimental and control class, namely U = 543.5; p = 0.990 (p > 0.05). While for the posttest scores there is a significant difference between the experimental and control classes where U = 151.0; p = 0.000 (p = < 0.05). So that the conclusion is that H0 is rejected and H1 is accepted, it means that there is an effect of the material reaction rate on student achievement.

1. Introduction
Reaction rate is a material that is senior in high school (SMA) and can be found in everyday life. For example, the process of demolishing an old building with the help of explosives, which is a very fast process, otherwise the rusting process that occurs in iron is very slow, so that the reaction rate material is a very interesting subject when taught to students [1]. Based on observations made at SMA Kristen 1 Tomohon while carrying out Field Experience Program (PPL) activities in March - May 2019, it was found that the material on the rate of reaction was taught using the discovery learning method, students hesitate to express opinions and questions during the learning process, and the learning process does not take place as expected. The average level of student achievement in the reaction rate material is very low (55) or Minimum Completeness Criteria (75) which has not been achieved by the school. Besides that, according to students chemistry is the most boring subject, as well as material related to daily activities is still limited, hence resulting in a lack of understanding of the concept of chemistry. In accordance with the above, a learning approach is needed that teaches students the context of chemistry that occurs in everyday life, can improve student achievement and allow students to consider the material that has been given using the point of view of the students themselves [2].

The context used in the Context Based Approach (CBA) very important that is must involve the material used in the community environment it between family environment, social, and cultural environment with the aim that students are more active in achieving efficient learning [3]. In particular, the Context Based Approach (CBA) is required so that students are able to connect subject matter with everyday life [4].

REACT strategy is part of the Context Based Approach (CBA). Where the REACT strategy itself consists of 5 learning stages, that is: Relating, Experiencing, Applying, Cooperating, and Transfering [5]. The purpose of this study was to determine the effect of the REACT CBA strategy on the material reaction rate on student achievement at SMA Kristen 1 Tomohon.
2. Methods

The method used in this research is a quasi experimental design with a pretest-posttest control group design research design. In this research design, there are 2 classes chosen randomly in implementing this research design, next to find out the initial state whether there is a difference between the experimental class and the control class, a pretest is given.

| R_0 | O_1 | X | O_2 |
|-----|-----|---|-----|
| R_0 | O_1 | X | O_4 |

Figure 1. Pretest-posttest control group design.

The population in this study were students of class XI MIPA at SMA Kristen 1 Tomohon academic year 2019/2020 with a total of 175 students. After using random sampling technique, the selected sample is class XI MIPA 1 as the control class with a total of 33 students, and class XI MIPA 5 as an experimental class with a total of 33 students.

The research procedures carried out include: a). Approaching chemistry teachers and school principals to convey goals and objectives so that they can be allowed to carry out the intended research; b). Determine the learning material; c). Develop research instruments (RPP, pretest questions, and posttest questions); d). Validating research instruments; e). Carry out research; f). The experimental class and the control class were given pretest questions; g). Carry out the learning process on the reaction rate material using the REACT CBA strategy in the experimental class, and conventional learning in the control class; h). The experimental class and the control class were given posttest questions; i). Collecting research data; j). Analyze and compile research data.

The data analysis method consisted of instrument testing in the form of validation tests conducted by 2 expert team lecturers and reliability testing. The data analysis technique for normality test used the Shapiro Wilk test, Students’ answers to pretest and posttest questions were analyzed using content analysis, and hypothesis testing using the Mann-Whitney U.

3. Results and discussion

3.1. Research instrument testing

3.1.1. Team of experts. Before being tested on real samples, the research instrument was tested first on 2 expert team lecturers to see whether the instrument used was valid. Then if the instrument used is valid then proceed to the research sample.

Based on the results of instrument validation through 2 expert team lecturers, the instruments used in this study were suitable for use after revisions.

3.1.2. Reliability test. Reliability test results using the KR-20 formula for the pretest data obtained $r_{count} = 0.83 > r_{table} = 0.77$ with very high reliability criteria. Next the posttest data obtained that is $r_{count} = 1.27 > r_{table} = 0.70$ with very high reliability criteria. In accordance with the data acquisition value above, the pretest and posttest data are reliable or accurate to the measured data.

4. Data analysis

4.1. Normality test

The results of the normality test used the Shapiro Wilk test for a significant value < 0.05 with the support of the SPSS software application, the results obtained from the pretest data test using the REACT CBA strategy with n = 33 in the experimental class were not normally distributed because the significant value obtained was 0.010 < 0.05. While the control class with n = 33 using conventional learning was not normally distributed because the significant value obtained was 0.015 < 0.05. Then the results of the posttest question data test in the experimental class were not normally distributed, because the significant value obtained is 0.003 < 0.05. The control class is also not normally distributed because the significant value obtained is 0.000 < 0.05.
4.2. Students’ answers to the pretest and posttest questions used content analysis

The results of the content analysis of the pretest and posttest questions in the experimental class and the control class in the form of frequency and percentage of student answers.

Table 1. The results of the content analysis of students’ answers to the experimental class pretest questions.

| Category | Questions | CU | % | PU | % | PUSM | % | SM | % | I | % |
|----------|-----------|----|----|----|----|------|----|----|----|----|----|
| Questions |           |    |    |    |    |      |    |    |    |    |    |
| **Experimental Class (n = 33)** |           |    |    |    |    |      |    |    |    |    |    |
| 1         | 28        | 84.8 | 5  | 15.1 | 0 | 0   | 0 | 0 | 0 | 0 | 0 |
| 2         | 26        | 78.7 | 6  | 18.1 | 1 | 3.0 | 0 | 0 | 0 | 0 | 0 |
| 3         | 2         | 6.0  | 0  | 0   | 0 | 0   | 0 | 0 | 0 | 31 | 3.9 |
| 4         | 0         | 0.0  | 0  | 0   | 0 | 3.0 | 1 | 3.0 | 31 | 3.9 |
| 5         | 3         | 9.0  | 6  | 18.1 | 3 | 9.0 | 0 | 0 | 0 | 21 | 6.3 |
| 6         | 10        | 30.0 | 7  | 21.2 | 1 | 3.0 | 0 | 0 | 0 | 15 | 5.4 |
| 7         | 16        | 48.4 | 14 | 42.4 | 1 | 3.0 | 0 | 0 | 2 | 6.0 |
| 8         | 17        | 51.5 | 7  | 21.2 | 2 | 6.0 | 0 | 0 | 7 | 21.2 |
| 9         | 0         | 0.0  | 0  | 0   | 0 | 0   | 0 | 0 | 0 | 33 | 100 |
| 10        | 0         | 0.0  | 0  | 0   | 0 | 0   | 0 | 0 | 0 | 33 | 100 |
| **Total** | **102**   |     |   |     |   |     |   |    |    |    | **173** |
| **Average** |        | 30.8 |   | 13.6 |   | 2.7 |   | 0.3 |   | 52.4 |   |

Information: CU = Clear Understanding; PU = Partial Understanding; PUSM = Partial Understanding with Specific Misconception; SM = Specific Misconception; I = Incomprehension/pointless; f = Frequency; % = Percentage

Table 2. The results of the content analysis of the students' answers to the control class pretest questions.

| Category | Questions | CU | % | PU | % | PUSM | % | SM | % | I | % |
|----------|-----------|----|----|----|----|------|----|----|----|----|----|
| Questions |           |    |    |    |    |      |    |    |    |    |    |
| **Control Class (n = 33)** |           |    |    |    |    |      |    |    |    |    |    |
| 1         | 28        | 84.8 | 5  | 15.1 | 0 | 0   | 0 | 0 | 0 | 0 | 0 |
| 2         | 19        | 57.5 | 14 | 42.4 | 0 | 0   | 0 | 0 | 0 | 0 | 0 |
| 3         | 0         | 0.0  | 1  | 3.0 | 2 | 6.0 | 0 | 0 | 30 | 90.9 |
| 4         | 0         | 0.0  | 0  | 0   | 0 | 0   | 0 | 0 | 0 | 33 | 100 |
| 5         | 7         | 21.2 | 9  | 27.2 | 2 | 6.0 | 0 | 0 | 15 | 45.4 |
| 6         | 5         | 15.1 | 11 | 33.3 | 2 | 6.0 | 0 | 0 | 15 | 45.4 |
| 7         | 14        | 42.4 | 15 | 45.4 | 3 | 9.0 | 0 | 0 | 1 | 3.0 |
| 8         | 13        | 39.3 | 12 | 36.3 | 3 | 9.0 | 2 | 6.0 | 3 | 9.0 |
| 9         | 0         | 0.0  | 0  | 0   | 0 | 0   | 0 | 0 | 33 | 100 |
| 10        | 0         | 0.0  | 0  | 0   | 0 | 0   | 0 | 0 | 33 | 100 |
| **Total** | **86**    |     |   |     |   |     |   |    |    |    | **163** |
| **Average** |        | 26.0 |   | 20.2 |   | 3.6 |   | 0.6 |   | 49.3 |   |

Information: CU = Clear Understanding; PU = Partial Understanding; PUSM = Partial Understanding with Specific Misconception; SM = Specific Misconception; I = Incomprehension/pointless; f = Frequency; % = Percentage

Based on the results of the analysis of the contents of the students answers to the pretest questions in table 1 and table 2 which were applied to the experimental class and the control class, then the frequency of answers in category I is higher than in other categories (CU, PU, PUSM, SM) for the majority of students in the experimental and control classes (category I for each experimental and control class, f:173, 52.4%; f:163, 49.3%). These results indicate that neither the students in the experimental class nor the control class know or understand the material about reaction rates.
Table 3. The results of the content analysis of the students' answers to the experimental class posttest questions.

| Category Questions | CU  | PU  | PUSM | SM  | I   |
|--------------------|-----|-----|------|-----|-----|
| Experimental Class (n = 33) | f  | %  | f  | %  | f  | %  | f  | %  | f  | %  |
| 1                  | 33  | 100 | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| 2                  | 33  | 100 | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| 3                  | 26  | 78,7| 7   | 21,2| 0   | 0   | 0   | 0   | 0   | 0   |
| 4                  | 11  | 33,3| 10  | 30,3| 11  | 33,3| 0   | 0   | 1   | 3,0 |
| 5                  | 31  | 93,9| 2   | 6,0 | 0   | 0   | 0   | 0   | 0   | 0   |
| 6                  | 22  | 66,6| 9   | 27,2| 2   | 6,0 | 0   | 0   | 0   | 0   |
| 7                  | 24  | 72,7| 4   | 12,1| 5   | 15,1| 0   | 0   | 0   | 0   |
| 8                  | 24  | 72,7| 9   | 27,2| 0   | 0   | 0   | 0   | 0   | 0   |
| 9                  | 33  | 100 | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| 10                 | 17  | 51,5| 7   | 21,2| 9   | 27,2| 0   | 0   | 0   | 0   |
| Total              | 254 |      | 48  | 14,5| 27  | 0   | 1   |     |     |     |
| Average            | 76,9| 14,5| 8,1 | 0   | 0,3 |     |     |     |     |     |

Information: CU = Clear Understanding; PU = Partial Understanding; PUSM = Partial Understanding with Specific Misconception; I = Incomprehension/pointless; f = Frequency; % = Percentage

Table 4. The results of the content analysis of students' answers to the control class posttest questions.

| Category Questions | CU  | PU  | PUSM | SM  | I   |
|--------------------|-----|-----|------|-----|-----|
| Control Class (n = 33) | f  | %  | f  | %  | f  | %  | f  | %  | f  | %  |
| 1                  | 33  | 100 | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| 2                  | 33  | 100 | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| 3                  | 18  | 54,5| 15  | 45,4| 0   | 0   | 0   | 0   | 0   | 0   |
| 4                  | 2   | 6,0 | 29  | 87,8| 2   | 6,0 | 0   | 0   | 0   | 0   |
| 5                  | 33  | 100 | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| 6                  | 17  | 51,5| 5   | 15,1| 10  | 30,3| 1   | 3,0 | 0   | 0   |
| 7                  | 4   | 12,1| 0   | 0   | 15  | 45,4| 0   | 0   | 14  | 42,4|
| 8                  | 31  | 93,9| 2   | 6,0 | 0   | 0   | 0   | 0   | 0   | 0   |
| 9                  | 16  | 48,4| 15  | 45,4| 2   | 6,0 | 0   | 0   | 0   | 0   |
| 10                 | 15  | 45,4| 1   | 3,0 | 17  | 51,5| 0   | 0   | 0   | 0   |
| Total              | 202 |      | 67  | 20,2| 46  | 13,9| 0   | 0,3 | 14  |
| Average            | 61,1| 20,2| 13,9| 0,3 | 4,2 |     |     |     |     |     |

Information: CU = Clear Understanding; PU = Partial Understanding; PUSM = Partial Understanding with Specific Misconception; SM = Specific Misconception; I = Incomprehension/pointless; f = Frequency; % = Percentage

Based on the results of the analysis of the contents of the students answers to the posttest questions in table 3 and table 4 which were applied to the experimental and control classes, the frequency of answers in the CU category was higher for students in the experimental class (f:254, 76.9%) than students in the control class (f:202, 61.1%), while the frequency of students' answers in the experimental class was in another category (PU, PUSM, SM, I) lower than the control class.

In accordance with the results above, it shows that the REACT CBA strategy can improve students' understanding of the reaction rate material. Besides that, for most students in the experimental class had a higher frequency of answers to all questions in the CU category than the other categories, that is: category PU, PUSM, SM, and I. However, it is different from the control class which provides answers to the CU category for question numbers 1, 2, 3, 5, 6, 8, 9, and 10. The next is answers in the PU category for question number 4, and the answer in category I for question number 7. These results indicate that some students in the control class understand how to determine reaction rates, but do not
understand reaction order and rate equations.

In line with the data obtained in table 3 and table 4 in the experimental class and control class for the results of the content analysis of the posttest questions, it can be seen that the frequency of answers in the PUSM and SM categories in the experimental class is lower (PUSM, f: 27, 8.1%; f: 0, 0%) compared to the control class (PUSM, f: 46, 13.9%; SM, f: 1, 0.3%). These results indicate that the REACT CBA strategy can reduce students' misconceptions about reaction rates. The answers of the experimental and control class students in the PUSM category were found in questions number 4, 6, 7, 9, and 10.

4.3. Hypothesis testing (Mann-Whitney U Test)
The Mann-Whitney U hypothesis test was used with the help of the SPSS application software, with the aim of knowing the significant difference in the experimental class and the control class from student achievement based on the pretest and posttest scores.

**Table 5.** Summary of comparison of the results of the Mann-Whitney U test pretest and posttest experimental class and control class.

|                    | Experimental Class (n = 33) | Control Class (n = 33) |
|--------------------|----------------------------|------------------------|
|                    | Median                     | Median                 | U     | p      |
| Pretest            | 47.0                       | 40.0                   | 543.5 | 0.990  |
| Posttest           | 92.0                       | 85.0                   | 151.0 | 0.000  |

In accordance with the results of the U-Mann Whitney test in table 5, it can be seen that the experimental class and control class have no significant difference according to the learning achievement obtained by the results at the pretest (U = 543.5; p = 0.990 > 0.05). Whereas in the experimental class and the control class it can be seen that the student achievement scores on the posttest questions have a significant difference where the learning achievement results obtained at the posttest (U = 151.0; p = 0.000 < 0.05). Because the comparison of the p value (sig = 0.05) was obtained based on the Mann Whitney U test for the posttest questions, it can be concluded that H<sub>0</sub> is rejected and H<sub>1</sub> is accepted, so that the formulation of the problem in the study can also be answered, namely that there is an effect of the REACT CBA strategy on the reaction rate material on student learning achievement.

5. Discussion
This research was conducted in two classes which were used as research targets after random sampling was carried out in the selection of research samples at SMA Kristen 1 Tomohon for the academic year 2019/2020. Conventional learning is carried out in Class XI MIPA 1 as a control class with 33 students, among them there are 12 male students and 21 female students. Meanwhile, learning using the REACT CBA strategy was carried out in class XI MIPA 5 as an experimental class, with a total of 33 students, including 9 male students and 24 female students. This study aims to see whether there is an effect of the REACT CBA strategy on the reaction rate material on student achievement obtained from the pretest and posttest scores related to the material reaction rate.

The results showed that there was an effect of the REACT CBA strategy on the material reaction rate on student achievement. This is due to the direct involvement of students during the learning process. Learning uses the REACT CBA strategy in the experimental class starting from the first stage of Relating where students are given a context to encourage students curiosity about the material being taught because it relates to everyday life. Next in the Experiencing stage, students are involved in an activity listed in the student worksheet. Applying is the stage where activities that students have carried out in the experiencing stage are implemented in group work. Then the Cooperating stage is the stage where students can work together with their group friends and communicate with each other between their group friends. The last is the Transferring stage, students apply or link the concepts they got in the previous stages. At this stage the students mastery of the concept of the material being taught is very influential. The conceptual findings of each group were explained in their own words.

In conventional learning in the control class, after students have finished participating in learning activities, they directly work on the questions given by the teacher. While learning activities are ongoing students are less active in understanding the material.

The results of learning achievement were obtained from the pretest and posttest value data. The
pretest value is obtained from the results of the initial test given before the learning activity (treatment) takes place in the experimental and control classes. Another case with posttest scores, obtained after the learning activity ends when the sample has been given treatment.

The results of learning achievement obtained through each sample can be seen through the comparison of the pretest and posttest scores. In accordance with the results of the hypothesis test using the U-Mann Whitney test by comparing the U value at the significant level α = 0.05, the pretest value (U = 543.5; p = 0.990) and the posttest value (U = 151.0; p = 0.000). With a comparison of the p value obtained from the pretest and posttest questions obtained by the pretest U, p > 0.05, which means that in the experimental and control class there is no significant difference., while U is posttest, p < 0.05, which means that the experimental and control classes have a significant difference. This is due to the different treatment applied to the experimental class and control class. The experimental class applied the REACT CBA strategy, whereas in the control class using conventional learning where the learning process that takes place is only teacher centered.

6. Conclusion
Based on the results of research that researchers have conducted at SMA Kristen 1 Tomohon, there is an effect of the REACT CBA strategy on the material reaction rate on student achievement, because the material taught is easy to understand, have a relationship with everyday life, interesting, and students become more active in following lessons. With a significant difference in posttest results between the experimental class and the control class (U posttest = 151.0; p = 0.000 < 0.05).

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