# The Impact of Collaborative Learning on Learner Performance When Teaching Rate of Chemical Reactions: A Case of Mukuba Secondary School in Kitwe District

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***Abstract:-*****This study was conducted to show the impact of Collaborative Learning Approach on learner performance when teaching the topic Rate of Chemical Reactions to the Grade 11 pupils of Mukuba Secondary in Kitwe District. The problem of poor performance of the Grade 12 pupils in Chemistry, especially on Rate of Chemical Reactions has been a matter of concern. To try and alleviate this problem a study was conducted on grade 11 pupils of Mukuba Secondary School in Kitwe District. The study population involved 60 pupils from Mukuba. The study was based on three research questions and two hypotheses. The research method used was a mixed approach. The sample size was 60 boys from two intact classes which were purposively selected. The Shapiro-Wilks test was conducted to test the normality of the data because of the small sample size used. While, the design used for the study was a pre-test post-test quasi- experimental one.The two intact classes were randomly assigned into an experimental and a control group. This was done by tossing a coin; the head was for experimental group while the tail was for a control group. The two intact classes constituted 30 students for control and experimental Group. The two groups were subjected to a pre-test before implementation of the intervention on the experimental group. The experimental group was then taught using Collaborative Learning Approach while the control group was taught using Lecture and Discussion Approaches. The initial analysis of data used SPSS, considering two descriptive parameters of the mean and standard deviation. Then the Independent sample t-test was conducted at alpha level of 0.05 to compare the results of the pre-test and post-test scores. The study showed that there was a statistically significant difference in the post-test scores for Experimental group (Mean = 62.1, standard deviation = 11.3) and the control group (Mean = 41.5, standard deviation = 11.3).Therefore, using Collaborative Learning Approach when teaching Rate of Chemical Reaction was found to have a positive impact on learner's performance and a change in attitude on Rate of Chemical Reaction was observed. The chemistry attitude questionnaire results showed a significant difference before and after the intervention that is from 20 to 45 students out of 60 showed positive attitudes towards Rate of Chemical Reaction after the intervention. The study also revealed that learners had challenges in plotting graphs of volume of the gas collected against time especially on coming up with correct scales for each axis and labelling of the graph which are ECZ standards followed when marking questions involving graphs.**

## I. INTRODUCTION

In Zambia, the education system has been characterized by poor results, in particular, Chemistry Grade twelve (12) national examinations especially on the topic, Rates of Chemical Reactions. This evidenced by the 2013, 2014, 2015 and 2017 Examinations Council of Zambia Chief Examiners Reports for the aforesaid years. Highlighted in these reports is the learners' inability to apply the concept of rates of chemical reactions in practical terms. This challenge was attributed to traditional teaching methods by the research. This was because traditional teaching and learning methods forbid much active participation by pupils in the development of what is taught. Learning here meant acquisition of what already was incorporated in books and in the heads of the teachers. Moreover, that which was taught, was taught as a finished product, with little regard either to the ways in which it was originally built up or to changes that would occur in the future. Therefore, the research sought to find out what effect collaborative teaching approach would have on the learner performance if used to teach the topic Rates of chemical reactions.Collaborative learning was taken to be a process that involves students working together to solve a problem, complete a task, or create a product. This approach to teaching and learning is an active process whereby students assimilate the information and relate this new knowledge to a framework of prior knowledge; it requires a challenge that opens the door for the learner to actively engage his/her peers, and to process and synthesize information rather than simply memorize and regurgitate it; gives learners benefit when exposed to diverse viewpoints from people with varied backgrounds; flourishes in a social environment where conversation between learners takes place.

## II. RESEARCH METHODOLOGY

### *2.1 Introduction*

This chapter reviews the methods used to collect and analyze the data in the study. It discusses the description of study area, research design, study population and participants, access to participants and confidentiality, data collection methods and

techniques, instrument reliability and validity and data analysis technique.

*2.2 Description of study area*

Mukuba Secondary School is a boys School which was recently given the status of school of excellence. The School is located 4 Kilometers away from Kitwe City business district along Chibuluma road opposite Road view Hotel in the Copperbelt Province of Zambia.. The School has a population of about 1400 pupils and target sample was 60 pupils.

*2.3 Research Design*

According to Kerlinger (1973), research design is "the plan, structure and strategy for investigation conceived so as to obtain answers to research questions and to control variable". A mixed method approach was used in this research. In this study both the qualitative and quantitative data was considered in order to maximize the strengths and minimize the limitations of each model within a single study (Wisdom and Mihas, 2009). Other researchers, however, are not in favor of this type of research design. Using both qualitative and quantitative paradigms in the same study had resulted into debate from some researchers arguing that the two paradigms differ epistemologically and ontologically (Hussein, 2009). In his article Hussein defends the use of mixed method by stating that when combined there is a great possibility of neutralizing the flaws of one method and strengthening the benefits of the other for the better research results. Typically, quantitative research methods are used within the positivist research paradigm and qualitative methods are used in the interpretivist paradigm(Cavana, Delahaye and Sekaran, 2000). One of the greatest strengths of the qualitative approach is the richness and depth of explorations and descriptions by sheer volume of data and the detailed level of analysis that results even when research is confined to a small number of subjects (Myers, 2002).However, both qualitative and quantitative approaches have their strengths and weaknesses, and advantages and disadvantages and neither one is markedly superior to the other in all respects (Kumar, 2005). According to Best (1992) defines experimental design as the blueprint of a procedures that enable the researcher to test the hypothesis by reaching valid conclusions about relationships between independent and dependent variables.

A pre-test and post-test experimental design was employed in this study. Thus, it provides the researcher an opportunity for the comparison as required in the hypotheses of the experiment and enables him to make a meaningful interpretation of the study. The two classes were purposively picked because they were doing the topic of interest. The two classes were randomly assigned into experimental and control groups. This gave the study internal validity.

| | Pretest | Treatment | Posttest |
|---|---|---|---|
| R (experimental) | $O_1$ | x | $O_3$ |
| R (control group) | $O_2$ | | $O_4$ |

R = Randomized, that is subjects are randomly selected and randomly assigned to the treatment Group and control group.

O = Observation or testing X = the treatment

The researcher opted to use this research design method due to the controlled environment of experimental research, better results are often achieved. Secondly, since there is such a high level of control, and only one specific variable is being tested at a time, the results are much more relevant than some other forms of research. You can clearly see the success, failure, of effects when analyzing the data collected. In fact, this research design is repeatable and therefore, results can be checked and verified and still maintaining the validity of the design.

*2.4 Pre-test measurements*

The pre-test was administered to the two pairs of groups. This test was given before the intervention was administered. This test helped to establish the homogeneity of the experimental and control groups. The experimental group received treatment using the Collaborative Learning approach while the control group uses the Conventional methods. The control group was taught using conventional method such as question and answer, Discussion method. During the two weeks session, pupils were presenting solutions and explanations on the board for tasks. Any member of the class was free to ask a question and make contributions whenever someone was presenting on the board. Additionally, during the intervention pupils were given individual tasks or class exercise and the researcher acted as a facilitator when the pupils were doing group and individual tasks. The experimental group was taught using Collaborative Learning Approach. Members of the class were divided into small groups to perform experiments on the factors that affect the Rate of Chemical Reaction for example Surface area , Concentration, Temperature and discuss concepts within the groups and later ask questions in order to consolidate their understanding on the concepts and later make contributions. They were also writing the class exercises and their books marked. The researcher was the facilitator in this case too.

*2.5 Post-test measurements*

A post-test was finally administered to the control and experimental groups after the intervention. The results were compared. The comparison was done between the experimental group and the control groups post test scores. This was done in order to determine the group which achieved higher than the other. Achievement of students in this test was the dependent variable while the independent variable was the teaching approach used. A questionnaire was administered first to the experimental group immediately after a post test. The control group after a post- test they were also taught using Collaborative Learning Approach and thereafter a questionnaire was administered.

*2.6 Study population and participants*

A population is a group of individuals, objects or items from which samples are taken for measurement (Kombo and Tromp, 2006). Capturing the variability in population allows for more reliability of the study. In this case the respondents were the pupils from the two pure classes who were in grade 11S and 11P. The sample size was 60 that is 30 pupils from each class. All the participants were boys.

*2.7 Access to participants and confidentiality*

The following section focuses on the presentation of how the researcher accessed the participants and upheld the principle of confidentiality:

*2.8 Access to participants*

The researcher accessed the participants by obtaining permission before conducting the research from the Head Teacher of Mukuba Secondary School. This was to ensure that the Natural Science Department and the students were protected and aware of the overt research.

*2.9 Confidentiality*

The participants were assured of confidentiality by not writing their names or identity on the tests and the questionnaires. The participants were assured of confidentiality as the information was used strictly for academic purposes only.

*2.10 Data collection instrument methods and techniques*

The following section discusses how data were collected and the techniques that were used in the collection of data.

*2.11 Data collection instrument*

To collect data, the researcher used two types of Student Chemistry Achievement Test (SCAT) in form of pretest and posttest for the pupils. After the tests, the Chemistry attitude questionnaires were administered to the pupils and this was concluded by teacher interviews The use of different data collection procedures provided part of the basis for triangulation defined by (Best and Kahn, 2009) as "the process by which data are verified by agreement with other data obtained from other sources or different procedures of collecting the data."

*2.12 Data collection methods and techniques*

Data was collected between January 2018and April 2019. The researcher sought permission from the Mukuba Secondary School, Head Teacher to gain access to the pupils. Thereafter, the researcher conducted his research in the institution. A purposive sampling method was used because the two grade 11 pure classes were doing rates of chemical reactionduring that period. This is so, because the researcher wanted to work with a predetermined group of pupils from Mukuba Secondary School. In data collection the researcher must have a clear understanding of what he hopes to obtain and how to obtain it (Kombo and Tromp, 2006).

*2.13 Instrument reliability and validity*

In order to determine the suitability of the questionnaire for the sample, three weeks was allocated for pilot testing of the questionnaire. This was done so as to check if there are some errors that neededto be corrected and to help improve on the response rate. The pilot testing was done randomly to the pupils who were not part of the sample and the responses from some of the questions resulted in the redesigning of the instrument. The questionnaires were pre-tested through a pilot study to ascertain their reliability in soliciting information regarding theeffect of pupil's performance on Rates of Chemical Reaction when taught using collaborative learning. The researcher used grade 12 pupils from a class which was not part of the sample of interests who were selected for this purpose. Questionnaires were administered to 18 pupils and 5 teachers out of 16 Science teachers in the Science department. Simple random sampling technique was used to select the students and the lecturers. This was done by random assignment which was in form of a lottery. Students were asked to pick one piece of paper from a box. The box had a total of twenty small rolled up pieces of papers. The papers were labeled one up to eighteen and each student draws a number out of this box.The following Pearson's product moment correlation (r) coefficient was used to compute the correlation coefficient between the two scores.

$$r = \frac{n \sum xy - \sum x \sum y}{\sqrt{[n \sum x^2 - (\sum x)^2][n \sum y^2 - (\sum y)^2]}}$$

Where, n = Total number of subjects. $x$ = rated value of one half.

$y$ = rated value of the other half. $\sum$ = Summation.

The calculated Pearson product moment correlation coefficient yielded a reliability coefficient of 0.86 and 0.90 for students and lecturers respectively. This was considered as high enough to justify the instrument was reliable to be used in the study (Orodho, 2005).

*2.14 Validity of data collection instruments*

The questionnaires for the study were given to my supervisor to determine their workability. The corrections, suggested changes and advice given were taken into consideration by the researcher to improve the questionnaires and interview items.

*2.15 Data Analysis*

Data analysis refers to the treatment of data so that they become summarized or reduced to a point they can be meaningfully interpreted. Data analysis implies extracting the required information which will serve to answer the research questions and test the hypotheses from the data that were collected. The data that were collected were reduced, arranged and presented in an organized form for easy analysis, using suitable statistical techniques. Descriptive and inferential statistics were computed for both pre-test and post-test. Data collected were entered into statistical package for social sciences (SPSS) version 16. Percentages, mean, standard

deviation and frequencies where generated under descriptive statistics. Both quantitative and qualitative methods of data analysis and interpretation of data was done. Descriptive statistics provides simple summaries about the sample (Trochim, 2006).Quantitative data were analyzed using simple descriptive statistics which was facilitated by Statistical Package for Social Sciences (SPSS) to obtain percentages, mean, standard deviation, frequency tablesand inferential statistics, and using independent group t-test. A significant level of 0.05 margin of error was selected in advance to avoid rationalizing the results after data collection. Qualitative data was analyzed through thematic analysis that is coding and categorization of emerging themes from the data. These statistics helped in making a decision about the effectiveness of the interventions.

### *2.16 Shapiro-Wilk test*

Before a t-test was performed the data was first tested to determine if it was normally distributed. The normality check was necessary. If not checked, the interpretations and inferences of results based on the data may not be reliable. There are several methods that can be used to assess whether a set of data is normally distributed or not. Some common techniques used to check for normality by researchers are Jarque-Bera test, Shapiro- Wilk test, Kolmogorov- Smirnov test and D'Agostino test. The Shapiro- Wilk test and Kolmogorov-Smirnov are applied in almost similar situations. The Shapiro-Wilk test was, however, chosen because of the sample size. Kolmogorov-Smirnov test is used for large samples while the Shapiro-Wilk test is applied to smaller samples of say 40 or less. Boyer (2013) suggested that the Shapiro-Wilk test of normality is valid only for a small number of observations of say between 5 and 38. The null hypothesis of this test is that the scores are normally distributed. Moreover, if the p-value is less than the chosen alpha level, then the null hypothesis is rejected. This would imply that the data is not normally distributed. The analysis of data was done with the help of SPSS. Shapiro-Wilk normality test was then carried out for the control and the experimental group. Thus, on the output the column labeled "sig" which is the p-value was checked. If the column displayed a number above 0.05, then the data was considered to be normally distributed. In other words, the significance level for two-tailed was set to 0.05. This alpha level of 0.05 was used as opposed to 0.01 because, the more stringent a test is, and the more unlikely it is to find a statistically significant result (Kumar, 2011). For the Shapiro-Wilk test, the closer the "sig" value is to 1, the more normal the sample is.

### *2.17 Independent sample t-tests*

According to IDRE (2014) an independent t-test is designed to compare means of same variable between two groups. Independent sample t-test was carried out on the pre-test scores for both the control and experimental group. This procedure was to compare the mean score of both the control and experimental groups. Independent sample t-test was also carried out on the post-test scores for both the control and experimental group. This procedure was meant to compare the mean scores of both the control and experimental groups. The SPSS output columns also show the columns labeled df for degrees of freedom and t for t-statistic. For independent sample t-test statistics, IDRE (2014) explained that the degrees of freedom when we assume equal variances is simply the sum of the two sampled sized minus 2 and when we assume unequal variances, it is calculated using the scatter Waite formula. It further defined t-statistic under two distinctive assumptions: equal variances and unequal variances as the ratios of the mean of the differences to the standard errors of the difference under the two assumptions. The questionnaires were also administered in this study after the post test. Data collected through the questionnaires were analyzed qualitatively. The analysis was approached as described by Rallis and Rossman (2003) in the following words, "Qualitative data analysis requires that the researcher approach the texts with an open mind, accepting the meanings and structures that emerge from it" (p.62). Data included some important illustrations. Hannan (2007) supports this approach by suggesting that qualitative analysis may include illustrations drawn from data of particularly significant.

### *2.18 Conclusion*

This chapter has outlined the methodologies that were used in this study. It has also outlined the research design, data collection methods and instruments. The purpose of a research design was used in this study was to maximize valid answers to all the three research questions. The main concern of the chapter was to map out how the research instruments was managed and administered.

## III. DATA PRESENTATION, ANALYSIS AND INTERPRETATION

### *3.1 Introduction*

The chapter discusses the findings of the research from the pre-test, post-test and the questionnaires which were administered to the pupils in order to find out the impact of Collaborative Learning on the attitude and performance in Rates of chemical Reaction by pupils of Mukuba Secondary School and in Kitwe District of the Copperbelt province. This chapter presents data analysis and interpretation ofempirical findings of this study. The results were presented using tables and each result was preceded by a brief analysis. Analysis of data is a process of inspecting, cleaning, transporting, and modeling data with the goals of discovering useful information, suggesting conclusions and supporting decision-making.

### *3.2 General information about the sample.*

The information presented in this section represents the questionnaire responses from 60 pupils fromMukuba Secondary in Kitwe district. This information was collected with a view todetermining the impact of Collaborative Learning strategy on learner performance on rate of chemical

reaction. The questionnaire inquired more about pupil's attitudes towards Rate of chemical reaction after the post tests. Results indicate that the majority of the respondents, 45 representing 75% had positive attitude towards rates of chemical reactions.

Table 3.3: Descriptive statistics for the Pre-test for experimental and control groups.

| Test | Group name | N | Mean | Std. Deviation |
|---|---|---|---|---|
| Pre-test | Experimental | 30 | 29.1 | 10.1 |
| | Control | 30 | 27.8 | 9.2 |

Table 3.3 shows the descriptive statistics and the difference in the pre-test mean scores between the experimental and control group is 1.3. This very small difference in mean score indicated that the two groups started off at a comparatively same level. The mean for the experimental group pre-test scores was 29.1, Standard deviation was 10.1 and the mean for the control group was 27.8, standard deviation was 9.2 .This difference is statistically insignificant showing that the results could not happen by chance.

Table 3.4: Shapiro-Wilk normality test for experimental and control groups

| | Shapiro-Wilk | | |
|---|---|---|---|
| | Statistic | Df | Sig. |
| Pretest Score | .953 | 60 | .023 |
| Posttest score | .973 | 60 | .213 |

The assumption which was observed before the t-test was that the data collected was normally distributed. The first step was, therefore, to use the Shapiro-Wilk procedure to test for normality. The procedure was carried out to check out that the assumption was not violated. A t-test could only be used effectively if the data under investigation is normally distributed. Table 3.3 and 3.4 shows the results generated using statistical package for the social sciences (SPSS) software.

Table 3.5: Independent sample t-test for the experimental and control group of pre-test

| Type of test | t-test for Equality of Means | | | | | | |
|---|---|---|---|---|---|---|---|
| | T | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference | |
| | | | | | | Lower | Upper |
| Pre-test equal Variances Assumed | .-510 | 58 | .612 | -1.26667 | 2.48413 | -6.25918 | 3.70585 |

Table 3.5 presents the independent sample t-test for the experimental and control group of pre-test. An independent sample t-test was also used to analyse whether there was a significant difference between the mean scores of the experimental group and the control group for the pre-test before administration of the treatment to the experimental group.There was no significant difference in the pre-test scores for experimental and control group (p-value = $0.612 > \alpha = 0.05, t = -0.510$)and(p-value = $0.612 > \alpha = 0.05, t = -0.510$)indicating that the difference in the mean score were not significant. These results illustrated that both the pupils in the control and experimental group were similar in abilities before the treatment was administered. Hence, the two groups are equivalent.

Table 3.6: Descriptive statistics for the Post-test

| Test | Group name | N | Mean | Std. Deviation |
|---|---|---|---|---|
| Post-test | Experimental | 30 | 62.1 | 11.3 |
| | Control | 30 | 41.5 | 12.4 |

Table 3.6 shows the descriptive statistics and the difference in the post-test mean scores between the experimental and control group is 20.6. This is a very big difference in mean score indicated that the two groups were at a comparatively different level after the intervention. The mean for the experimental group post-test scores was 62.1, Standard deviation was 11.3 and the mean for the control group was 41.5, standard deviation was 12.4 .This difference is statistically significant showing that the results could not happen by chance.

Table 3.7: Independent sample t-test for the experimental group for post-tests

| Type of test | t-test for Equality of Means | | | | | | |
|---|---|---|---|---|---|---|---|
| | T | Df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference | |
| | | | | | | Lower | Upper |
| Post-test equal Variances Assumed | -6.710 | 58 | .000 | -20.56667 | 3.06507 | -26.70208 | -14.43126 |

Table 3.7 presents the independent sample t-test for the experimental and control group of post-tests. An independent sample t-test was also used to analyse whether there was a significant difference between the mean scores of the experimental group and the control group for the post-test after administration of the treatment.There was a significant difference in the post-test scores (p-value = $0.00 < \alpha = 0.05, t = -6.710$). These results illustrated that both the pupils in the control and experimental group were different in abilities. This conclusion is supported by Field (2009), when the P-value is less than the alpha level of significance, set by the researcher, the null hypothesis is rejected and the conclusion is that the two means differ significantly. It is also possible to determine the magnitude of the effect caused by the treatment.

*3.3. Effect size*

According to Pallant (2005: 208) effect size statistics provide an indication of the magnitude of the differences between the control and experimental groups, and not just whether the difference could have occurred by chance. One way to obtain effect size is to manually calculate eta squared since SPSS does not provide eta squared values for t-tests. Eta squared represents the proportion of variance in the dependent variable that is explained by the independent variable.

$$Eta\ squared = \frac{t^2}{t^2 + (N_1 + N_2 - 2)}$$

Replacing the appropriate values from the post-test independent t-test output we have;

$$Eta\ squared = \frac{(-6.710)^2}{(-6.710)^2 + (30 + 30 - 2)}$$

$Eta\ squared$ =0.437 .

The guidelines proposed by Cohen (1988) for interpreting Eta squared values are: 0.01 = small effect, 0.06 = moderate effect, 0.14 = large effect. For our post-test results we can see that the effect size has large effect on the two groups. In line with these guidelines, it is clear that the obtained $Eta\ squared\ value$ 0.437 showed a large effect which could have not occurred by chance.

The independent samples t- test was conducted to compare post-test for control and experimental groups after administration of the treatment to the experimental group. There was a statistically significant difference in the post-test scores for control (M =42.5, SD = 11.3) and experimental (M = 62.1, SD = 12.4) groups; t (78) = 3.684, p = 0.000. The magnitude of the differences in the means was large (eta squared = 0.437) .These results suggest that Collaborative Learning approach when teaching Rate of Chemical Reactions does have an effect on pupil's performance. These results suggest that when Collaborative Learning approach is incorporated in Rates of Chemical Reaction lesson, students understanding of concepts being learnt are enhanced and this led to high performance.

*3.4 Frequency and percentage of each responses*

Table 3.8.1: Pupils responses on the perceived reasons on the interest of Collaborative Learning approach in understanding Rates of chemical reaction

| | | Strongly Agree | Agree | Undecided | Disagree | Strongly Disagree |
|---|---|---|---|---|---|---|
| **1** | Frequency | 35 | 10 | 8 | 5 | 2 |
| | Percentage (%) | 58.3 | 16.7 | 13.3 | 8.3 | 3.3 |
| **2** | Frequency | 0 | 0 | 2 | 30 | 28 |
| | Percentage (%) | 0 | 0 | 3.3 | 50 | 46.7 |
| **5** | Frequency | 23 | 28 | 7 | 2 | 0 |
| | Percentage (%) | 38.3 | 46.7 | 11.7 | 3.3 | 0 |
| **7** | Frequency | 20 | 30 | 6 | 2 | 2 |
| | Percentage (%) | 33.3 | 50 | 10 | 2.5 | 2.5 |
| **10** | Frequency | 5 | 5 | 4 | 22 | 24 |
| | Percentage (%) | 8.3 | 8.3 | 6.7 | 36.7 | 40 |
| **11** | Frequency | 24 | 24 | 0 | 6 | 6 |
| | Percentage (%) | 40 | 40 | 0 | 10 | 10 |
| | Frequency | 18 | 24 | 6 | 6 | 6 |
| | Percentage (%) | 30 | 40 | 10 | 10 | 10 |

**Item 1** investigated whether pupils had interest in Rates of chemical reaction. The results revealed that 35(58.3%) strongly agreed, 10(16.7%) agreed, 8(13-3%) was Undecided, 5(8.4%) disagreed and 2(3.3%) strongly disagreed. After

carrying out the conversions, the results reveal that 45(75%) students agreed and 7(11.7%) disagreed.

**Item 2** investigated whether pupils had no interest in Rates of chemical reaction**.** The results showed that 0(0%) strongly agreed, 0(0%) agreed, 2(3.3%) was Undecided, 30(50%) disagreed and 28(46.7%) strongly disagreed. Using the conversions, the results reveal that 0(0%) agreed and 39(97.5%) disagreed.

**Item 5** investigated whether pupils had interest in Rates of chemical reaction. The results revealed that 23(38.3%) strongly agreed, 28(46.7%) agreed, 7(11.7%) was not sure, 2(3.3%) disagreed and 0(0%) strongly disagreed. After carrying out the conversions, the results reveal that 51(85%) students agreed and 2(3.3%) disagreed.

**Item 7** investigated whether pupils had interest in Rates of chemical reaction. The results showed that 20(33.3%) strongly agreed, 30(50%) agreed, 6(10%) were not sure, 2(5%) strongly disagreed and 2(5%) disagreed. After carrying out the conversions, the results reveal that (83.3%) students agreed and 4(10%) disagreed.

**Item 10** investigated whether pupils had no interest in rates of chemical reaction. The results revealed that 5(8.3%) strongly agreed, 5(8.3%) agreed, 4(6.7%) was Undecided, 22(36.7%) disagreed and 24(40%) strongly disagreed. After carrying out the conversions, the results reveal that 10(16.6%) pupils agreed and 46(76.7%) disagreed.

**Item 11** investigated whether pupils had interest in Rates of chemical reaction. The results showed that 24(40%) students strongly agreed and 24(40%) agreed, 0(0%) was Undecided, 6(10%) disagreed and 6(10%) strongly disagreed. Converting the responses of strongly agreed or agree into agree and those for strongly disagree or disagree into disagree, the outcome suggested that 48(80%) pupils agreed and 12(20%) disagreed.

**Item 15** was used to investigate whether pupils had interest in Rates of chemical reaction. The results showed that 18(30%) strongly agreed, 24(40%) agreed, 6(10%) were Undecided and 6(10%) disagreed and 6(10%) strongly disagreed. After carrying out the conversions, the results reveal that 42(80%) students agreed and 12(20%) disagreed.

Table 3.8.2 Pupils responses on difficulties and challenges of Rates of chemical reaction after using Collaborative Learning method in understanding of Rates of chemical reaction

| | | Strongly Agree | Agree | Undecided | Disagree | Strongly Disagree |
|---|---|---|---|---|---|---|
| **4** | Frequency | 24 | 20 | 8 | 4 | 4 |
| | Percentage (%) | 40 | 33.3 | 13.3 | 6.7 | 6.7 |
| **18** | Frequency | 0 | 2 | 4 | 18 | 36 |
| | Percentage (%) | 0 | 3.3 | 6.7 | 30 | 60 |

**Item 4** investigated whether pupils had no difficulties and challenges in Rates of chemical reaction. The results revealed that 24(40%) strongly agreed, 20(33.3%) agreed, 8(13.3%) was Undecided, 4(6.7%) disagreed and 4(6.7%) strongly disagreed. After carrying out the conversions, the results reveal that 44(73.3%) pupils agreed and 8(13.4%) disagreed.

**Item 18** investigated whether pupils had difficulties and challenge in Rates of chemical reaction**.** The results showed that 10(16.7%) strongly agreed, 5(8.3%) agreed, 5(8.3%) was Undecided, 24(40%) disagreed and 16(27%) disagreed. Using the conversions, the results reveal that 15(25%) agreed and 35(67%) disagreed.

Table 3.8.3: Pupils responses on the application of Rates of chemical reaction after using Collaborative Learning method in understanding Rates of chemical reaction

| | | Strongly Agree | Agree | Undecided | Disagree | Strongly Disagree |
|---|---|---|---|---|---|---|
| **3** | Frequency | 2 | 2 | 4 | 28 | 24 |
| | Percentage (%) | 3.3 | 3.3 | 6.7 | 46.7 | 40 |
| **9** | Frequency | 22 | 28 | 5 | 3 | 2 |
| | Percentage (%) | 36.7 | 46.7 | 8.3 | 5 | 3.3 |
| **12** | Frequency | 0 | 2 | 8 | 30 | 20 |
| | Percentage (%) | 0 | 3.3 | 13.3 | 50 | 33.3 |
| **13** | Frequency | 17 | 28 | 0 | 10 | 5 |
| | Percentage (%) | 28.3 | 46.7 | | 16.7 | 8.3 |
| **14** | Frequency | 2 | 4 | 4 | 24 | 26 |
| | Percentage (%) | 3.3 | 6.7 | 6.7 | 30 | 43.3 |
| **16** | Frequency | 26 | 24 | 10 | 0 | 0 |
| | Percentage (%) | 43.3 | 40 | 16.7 | 0 | 0 |

**Item 3** investigated whether pupils could not apply Rates of chemical reaction in today's world. The results revealed that 4(6.7%) strongly agreed, 4(6.6%) agreed, 12(20%) was Undecided, 16(42.5%) disagreed and 24(40%) strongly disagreed. After carrying out the conversions, the results reveal that 4(10%) students agreed and 32(80%) disagreed.

**Item 9** investigated whether pupils could apply Rates of chemical reaction in other topics**.** The results showed that 30(50%) strongly agreed, 15(25%) agreed, 10(16.7%) was Undecided, 3(5%) disagreed and 2(3.3%) strongly disagreed. Using the conversions, the results reveal that 45(75%) agreed and 5(8.3%) disagreed.

**Item 12** investigated whether pupils could not apply Rates of chemical reaction in other topics and courses. The results showed that 0(0%) strongly agreed, 6(10%) agreed, 10(16.7%) were not sure, 20(33.3%) strongly disagreed and 24(40%) disagreed. After carrying out the conversions, the results reveal that 6(10%) students agreed and 44(73.3%) disagreed.

**Item 13** investigated whether pupils could apply Rates of chemical reaction in today's world. The results revealed that 12(20%) strongly agreed, 24(40%) agreed, 6(10%) was Undecided, 6(10%) disagreed and 0(0%) strongly disagreed. After carrying out the conversions, the results reveal that 36(60%) pupils agreed and 6(10%) disagreed.

**Item 14** investigated whether pupils could not apply Rates of chemical reaction in other topics. The results showed that 3(5%) students strongly agreed and 6(10%) agreed, 6(10%) was Undecided, 15(25%) disagreed and 20(50%) strongly disagreed. Converting the responses of strongly agreed or agree into agree and those for strongly disagree or disagree into disagree, the outcome suggested that 9(15%) pupils agreed and 45(75%) disagreed.

**Item 16** was used to investigate whether pupils could apply Rates of chemical reaction. The results showed that 24(40%) strongly agreed, 26(43.3%) agreed, 6(10%) were Undecided and 4(6.7%) disagreed. After carrying out the conversions, the results reveal that 50(83.3%) students agreed and 4(6.7%) disagreed.

## IV. DISCUSSIONS AND CONCLUSION

Finally, the mean for the experimental group post-test score (M = 62.1, SD = 11.3) and the mean for the control group post-test score was (M = 41.5, SD = 12.4). This difference was statistically significant (p-value = $0.01<\alpha = 0.05, t = 2.80$). According to Field (2009), when the P-value is less than the level of significance, set by the researcher, the null hypothesis is rejected and the conclusion is that the two means do indeed differ significantly.The magnitude of the difference in the means was large (eta squared = 0.437). These results suggest that using collaborative learning method when teaching Rate of Chemical Reaction does have an effect in understanding Rate of Chemical Reaction by grade 11 pupils. In this regard, the results of the present study are in line with the observation made by (Cakmakc& et al, 2005)they suggested that Collaborative Learning Approach enhances learners understanding on the difficulties on Rates of Chemical Reaction. The researcher also suggested that hands on activities done collaboratively enhances high retention on the learners this is also in line with Research and Practice in Chemistry who provided evidence of the positive influence of Collaborative Learning of learners (peers) to the cognition and development of thinking( Farrell ,Moog , & Spencer 1999). We can conclude that leaners must be taught using learner centered methods by actively engaging the leaners in the learning process. Lessons must involve hands on activity which results in high retention and also bridges the gap between macroscopic and microscopic concepts.

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